The Bulletin

Vol. 41 no. 3 Autumn 2016 www.bvws.org.uk **BVWS 40th Anniversary**

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Bulletin of the British Vintage Wireless Society
Incorporating 405 Alive
Volume 41 No.3 Autumn 2016

www.bvws.org.uk

Printed by Pureprint

Front and rear cover: various red-cased transistor sets

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Edited by Carl Glover. Sub-Edited by Ian Higginbottom
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Contents

From the Chair

Those who attended the NVCF back in May will hopefully have had the chance to take a good look at the large display of radios, TVs and other equipment that showed the diversity of our members collecting interests. An interesting display of working 405 line TV's with period programmes ran throughout the day courtesy of Russell Atkinson. A most interesting and rarely seen German Tefifon display was operated by Bryan McAlly. You can liken the Tefifon cartridge to a traditional record but instead of being on a disc it is on a long plastic tape within the cartridge. The sound quality was extremely good. A great number of interesting items could be seen including one of the only known 'Horophone' crystal sets to exist. Many 1920's and 1930's items were also on display. We think we hold the record of having one of every known model and version of the circular Ekco receiver in one place at one time on display complete with their correct stands. We would like to thank everyone who loaned items and helped with the display. The Committee and I would like to thank Jeremy Day for the many hours he gave to organising the display and making it a fitting celebration of our Society.

Due to various circumstances beyond our control we have changed our printers. Although at first this looked like it would require a great deal of work, it has actually turned out to be a very easy process. A bonus of doing this is to actually reduce the overall cost of printing and mailing by more than £900 for exactly the same service of the same quality. This is the first Bulletin produced by the new printers and I should like to thank Richard Vidler at PurePrint for his help in this matter.

It is with a real feeling of regret that I have accepted Carl Glover's resignation from the post of BVWS Editor. Carl has given the most incredible service to the Society since 1994. He has designed and edited the Bulletin making it the high quality publication that is the envy of many other various organisations. We would all like to thank Carl for the 22 years outstanding service that he has given the Society and its members. Thank You Carl!

I would like to welcome Alex Hewitt to the position of BVWS Bulletin Designer. Alex will be starting with the Winter 2016 Bulletin and I am sure he will find his feet quickly. He is experienced in graphic design, publication and also film and animation work. Some of you will have already seen Alex at the NVCF taking pictures for the Bulletin as well as producing the NVCF promotional film on Youtube.

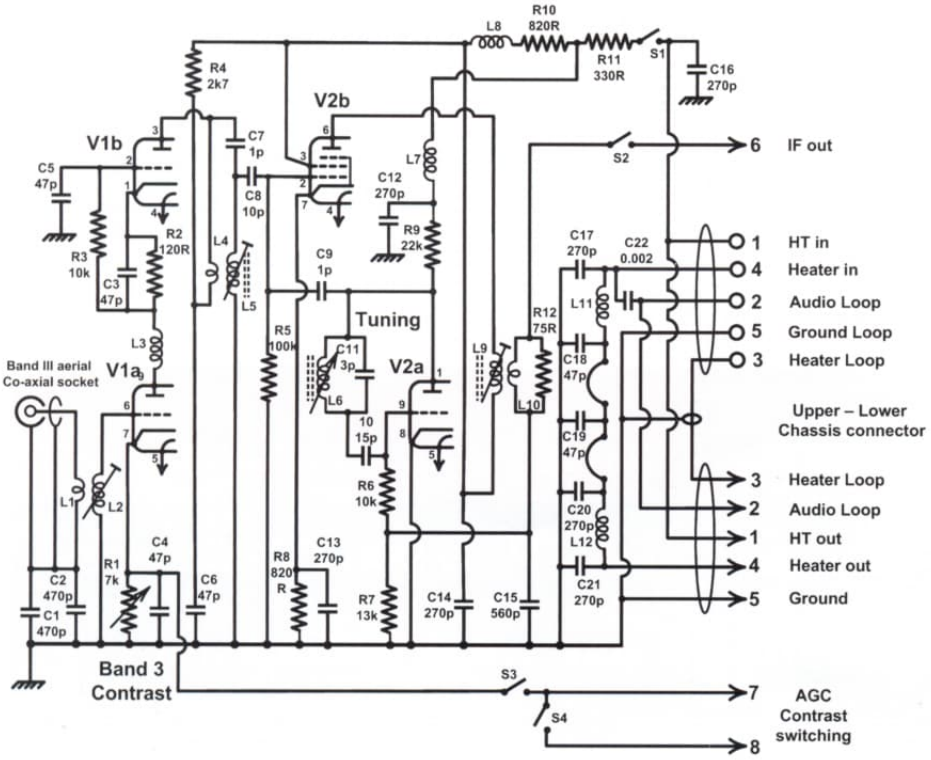
Due to the very large amount of stock we currently have for auction, we have arranged two more Special Auctions to be held at Royal Wootton Bassett. The first will take place on the 9th October and the second will be on the 5th February 2017. Apart from the main store being full, we also have two shipping containers full as well as many thousands of valves in another storage unit and more in the pipeline to come. The auction on the 9th October will feature many EMI radios and TV's and will include a rare 1937 HMV 900 combined radio/TV. This has been hidden away since the 1970s and is in a very original condition. I hope to see many of you there and at our other events.

To complete our 40 years Celebrations we will be holding an event at the Writtle Hut at Sandford Mill Museum on the 13th November (see inside back page for details). We hope to re-create the historic photo of the BVWS 1977 first AGM which was held at the Writtle hut with as many people who appeared in the original (you know who you are) as well as current members. Do please come along for a very interesting afternoon.

Mike...

Fixing my Bush TV22 by Roger Grant

During the 1977 Queen Elizabeth II Silver Jubilee celebrations I rigged up my Bush Bakelite TV22, built around the time of the coronation (the smoothing block says Apr 1952) in one of my friend John's TV shops next to a modern set of the day. 405 line TV transmissions were still available at this time and the set worked very well for the duration of the celebrations, which was the last time it was used.



With the ending of 405 line transmissions I lost my signal source and with plenty of wireless projects to keep me busy, this set and the other TV's in my collection had became very much neglected.

It wasn't until recent times when I had built myself a Test card C generator for the "Inexpensive television" project (in the Spring 2016 bulletin), and re-gained a 405 line signal source that I removed the TV22 to the workshop for a run-up and a re-visit.

The television had its last run-up nearly forty years ago, it was only 25 years old then and is now clocking up nearly sixty five years, a pensioner in its own right.

This project is not a restoration – as the title of this article suggests, it's a repair to get the set working, keeping it in its original state with only replacing what's necessary to get it working. There's no evidence of any work ever being done to this set, everything appears to be original.

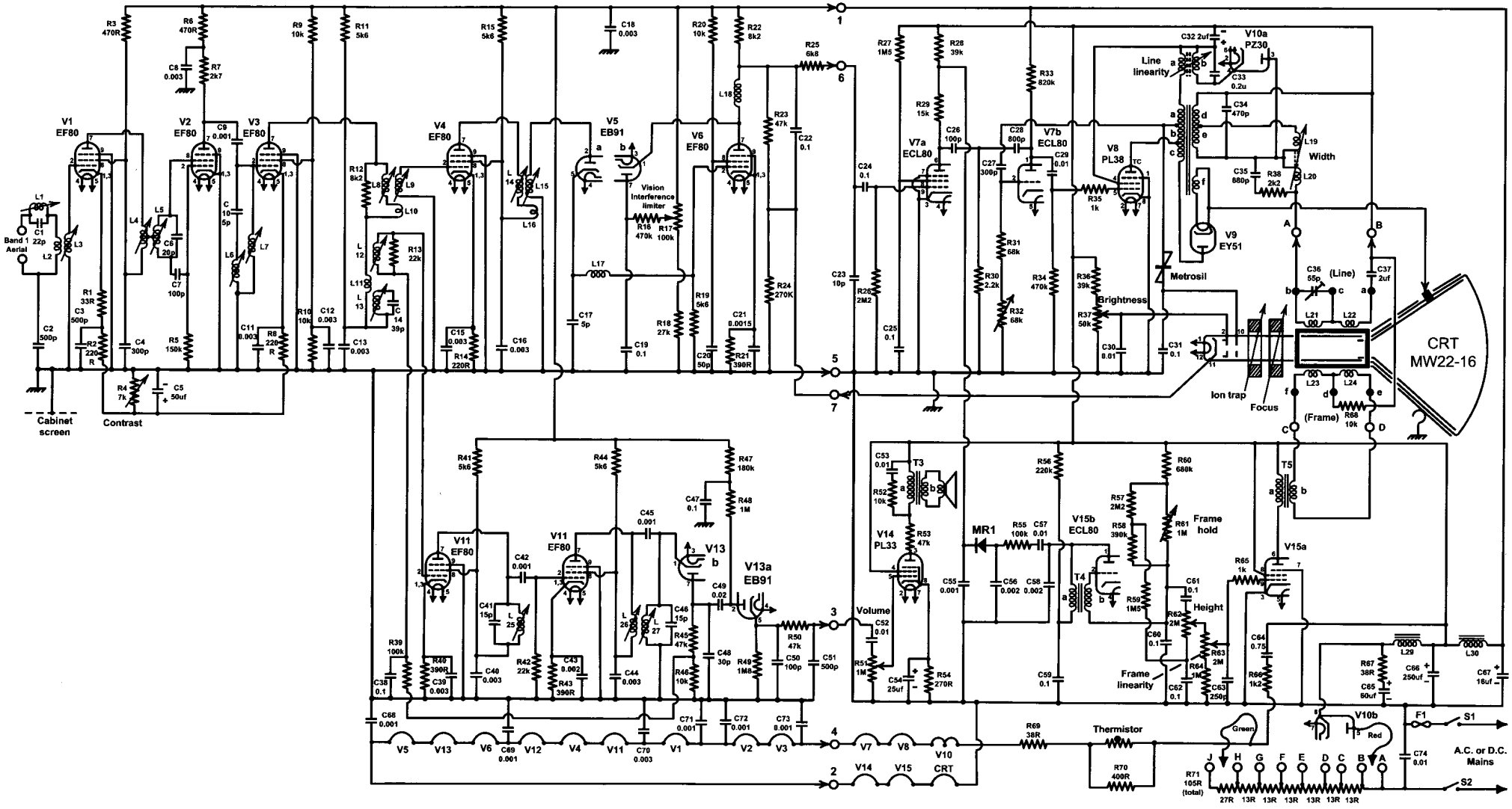
I ran all the usual cold checks. There was no sign of any bulging of the electrolytics and the smoothing block only read 1.2 meg leakage. This an acceptable amount and it was probably not much better than this when it was new. No obvious shorts on rails and the series heater chain was intact, I had a quick check of the tube on my tube tester and it appeared to have plenty of emission, I vaguely remember the picture being reasonably good in 1977.

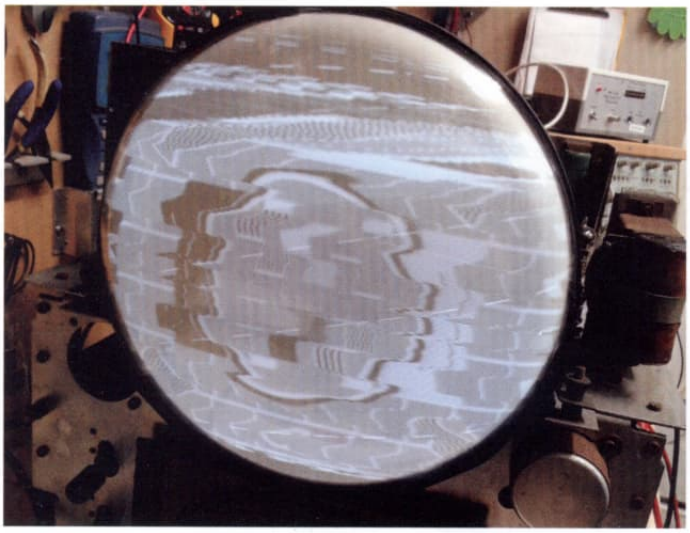
I gently powered it up from my Variac whilst monitoring various points and watched the HT rise slowly, bringing it up to full mains over a ten minute slow warm up period, and constantly checking for anything getting too warm. The ceramic wire wound resistors ponged a little as they warmed up releasing the atmosphere they had absorbed over the years but were not abnormally warm and I expected it would take a couple of hours running time before the pong completely disappears.

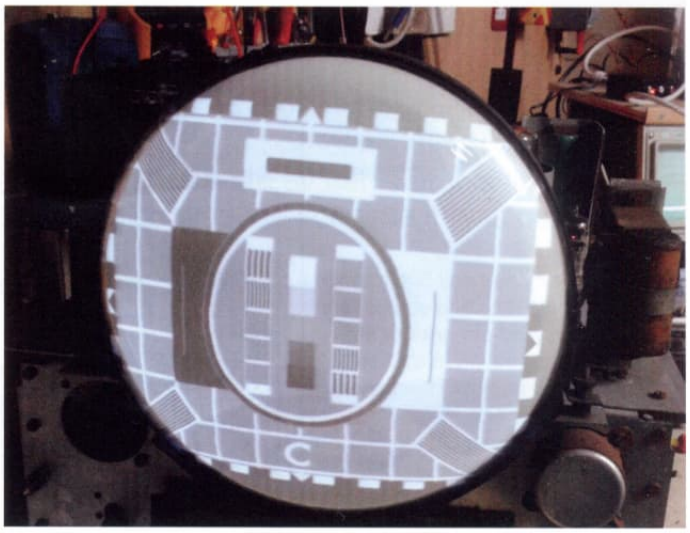
The sound output stage crackled into life but not much else. There was HT on the line output valve anode but no line output. At this point I scoped the frame circuit, this was generating a nice saw tooth waveform. I thought I'd better check this before I get the line stage working as I didn't want to risk burning the tube phosphor with a frame collapse.

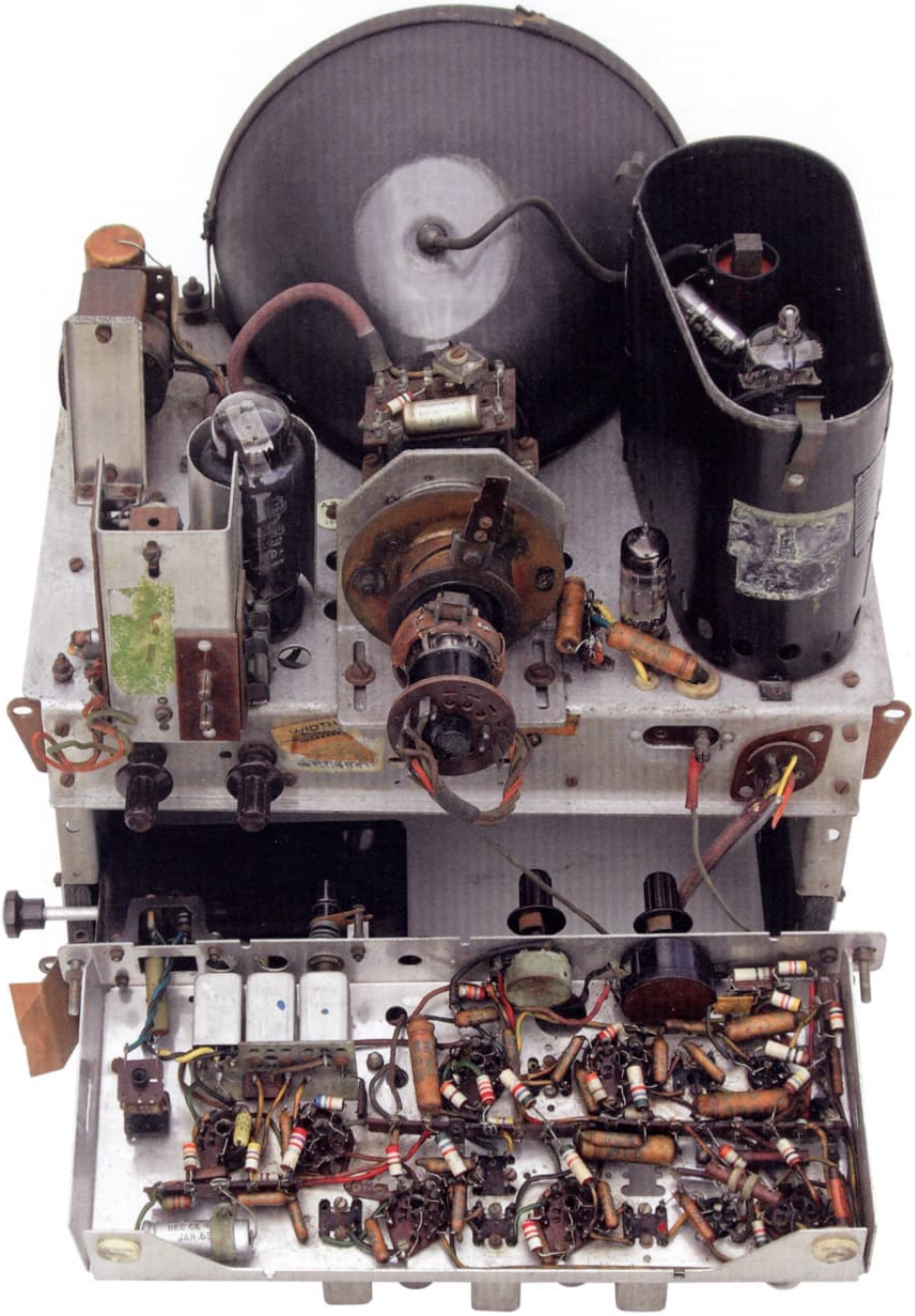
The line oscillator was not running – this uses an ECL80, the pentode section of this valve being the sync separator and the triode being half of the line oscillator multivibrator. The other half of the line multivibrator is the line output valve itself, a PL38. As the triode appeared to be drawing current (a volts drop across R33 its anode load resistor) I suspected the line output valve. On the valve tester the

Bush TV22 Mk II Chassis









heaters lit up ok and it wasn't down to air but the valve was very dead, no emission at all. The top cap had been glued back on sometime during its long life and was now loose again. On removal I found it was only the blob of glue around the pinch holding it in place and the piece of fuse wire that was connected to the stub of the lead out wire had corroded through. The stub (about 3mm) was cleaned and a new piece of jumper wire was wrapped around about three turns and soldered to the stub and the top cap firmly re-glued in place with some Araldite original (this goes off very hard and adheres well to glass). The valve now reads full emission on the tester and the line stage sprang into life the next time the set was powered up.

The next problem was the lack of a raster. The EHT was up to the required 8000 volts and the tube heater ok, the voltage checks on the tube base showed the A1 (or G2 if you prefer) at 100 volts and not the 300 volts as rated in the Trader sheet. This proved to be the 0.1 decoupling capacitor having a 150k leak pulling down the voltage out of the A1 metrosil. On re-stuffing the original with a new replacement I now had half a raster with the usual stretched out top and folded over bottom, this may have been partly due to a lack of syncs so the next step was to feed it with a signal.

This set is fitted with a band III converter box attached to the rear of the RF chassis, its operation was not obvious so I found the Trader sheet (No 1212) for this add-on unit. The knob on a shaft protruding from the side of the box is pulled out for band III operation and rotated for fine tuning, pushed in for band 1 and band 1 fine tuned using the original sets RF stage. This RF stage becomes the first IF on band III with the band 1 local oscillator muted due to the low impedance (75 Ohms) output of the tuner unit now switched across its grid.

On tuning through band 1 I got a picture and sound, the frame hold locked ok but the line hold was a bit critical and when locked, the verticals in the picture were very stepped and distorted. This was traced to the sync-separator coupling capacitors both having around a 100k leak. These two capacitors are to the rear and on top

of the upper chassis and very visible so a very neat job was made of re-stuffing these card tube type capacitors with new capacitors, this fixed the line sync problems and I now had a very nice picture.

All of the setting up controls, width, line linearity, height and frame linearity, functioned very well.

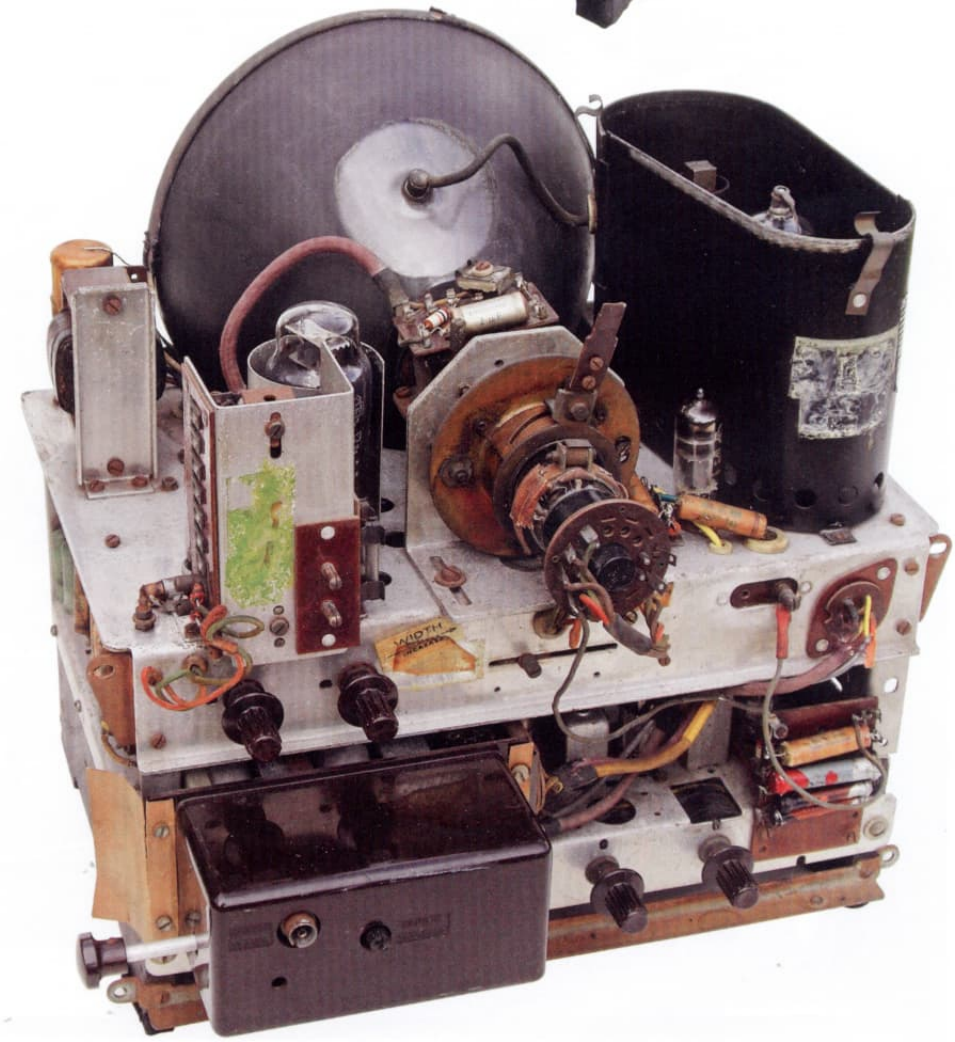
As a matter of course I checked the other 0.1's and to my surprise they were all well over a meg of leakage some over 3 megs. As there were no other problems with this set they can stay as original and I'll keep a eye on them.

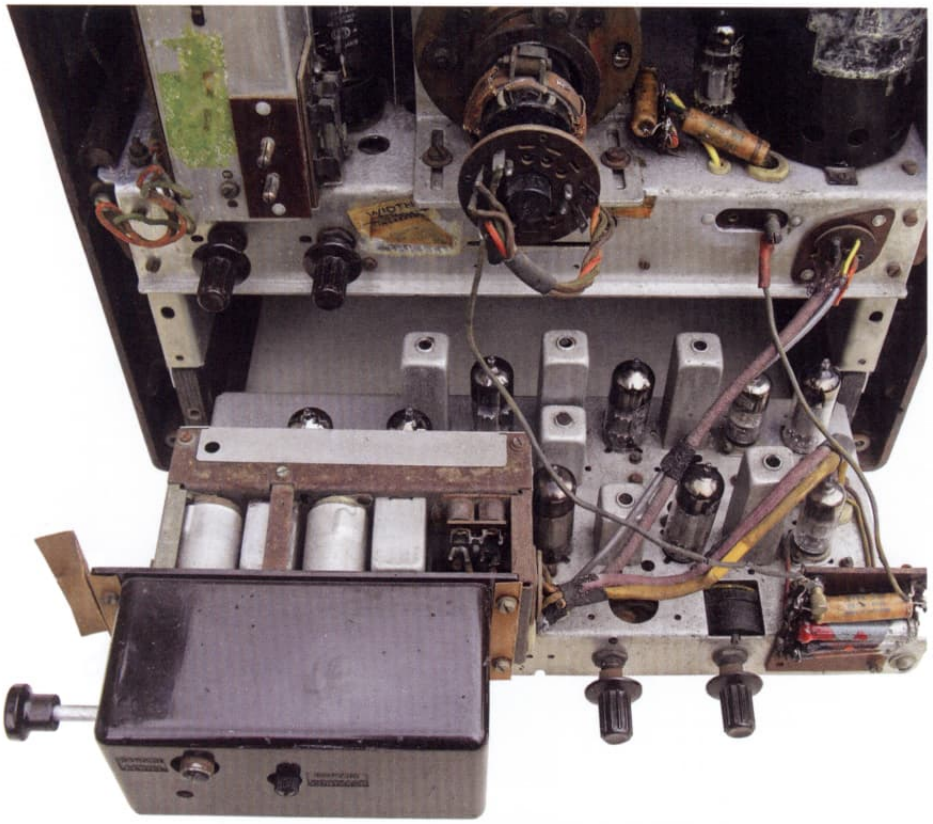
Most of the pots were a bit scratchy and required a touch of Deoxit, the top surface of the very sticky waxy capacitors had absorbed the usual grime from the atmosphere, nicotine and the fine black dust generated by the coal fires much used during this sets early life. This was easily wiped off with a cloth dampened with solvent, lighter fuel, the petrol type, as this completely evaporates.

The aluminium chassis was cleaned with a paint brush and soapy water. This removed the beginnings of the chalky oxide on the surface of the aluminium which is a little pitted but not enough to warrant any treatment. Some of the metal parts had become a little rusty and this was scrubbed off with a brass wired suede brush and lightly dusted with some clear lacquer to halt any further ingress.

The Bakelite cabinet had remained in very nice condition after its good clean and polish nearly forty years ago and just got a touch of the usual furniture polish. The very pale blue paint on the CRT mask had started to flake, as it's sprayed onto rubber this might be a bit of a problem so I think I'll leave it be for now rather than risk making it worse. The set was reassembled in its cabinet and now works as well as it did when it was in service, and only needed three 0.1 capacitors replacing, not bad for a set that's 65 years old. Fine sets these Bush's (Oh no that was Ferguson wasn't it). Never mind, I'll look out for one of those for a future project.

The story doesn't end here, it appears that I spoke too soon, Having left the set running for an hour or so, the phone rang and when I had finished the call I noticed that the picture had disappeared. A quick check proved that there was HT on the line output valve anode but no EHT. Back on the bench the line oscillator was still running, the boost volts were the same as the HT and it appeared that the boost diode (half of the PZ30) was short circuit. On removing the valve the short was still there, this proved to be a short between the two halves of the primary winding (a/b and d/e) of the line output transformer (LOPTX), these two windings are separated by the boost diode. Whoops! it looks like my nice Bush TV22 is now in serious trouble, first appearances of the LOPTX do not look good, a heavily pitch caked mess. Even worse, the outside winding is the EHT over wind and wave wound. Not giving up all hope I removed the LOPTX from the set for a thorough bench check.



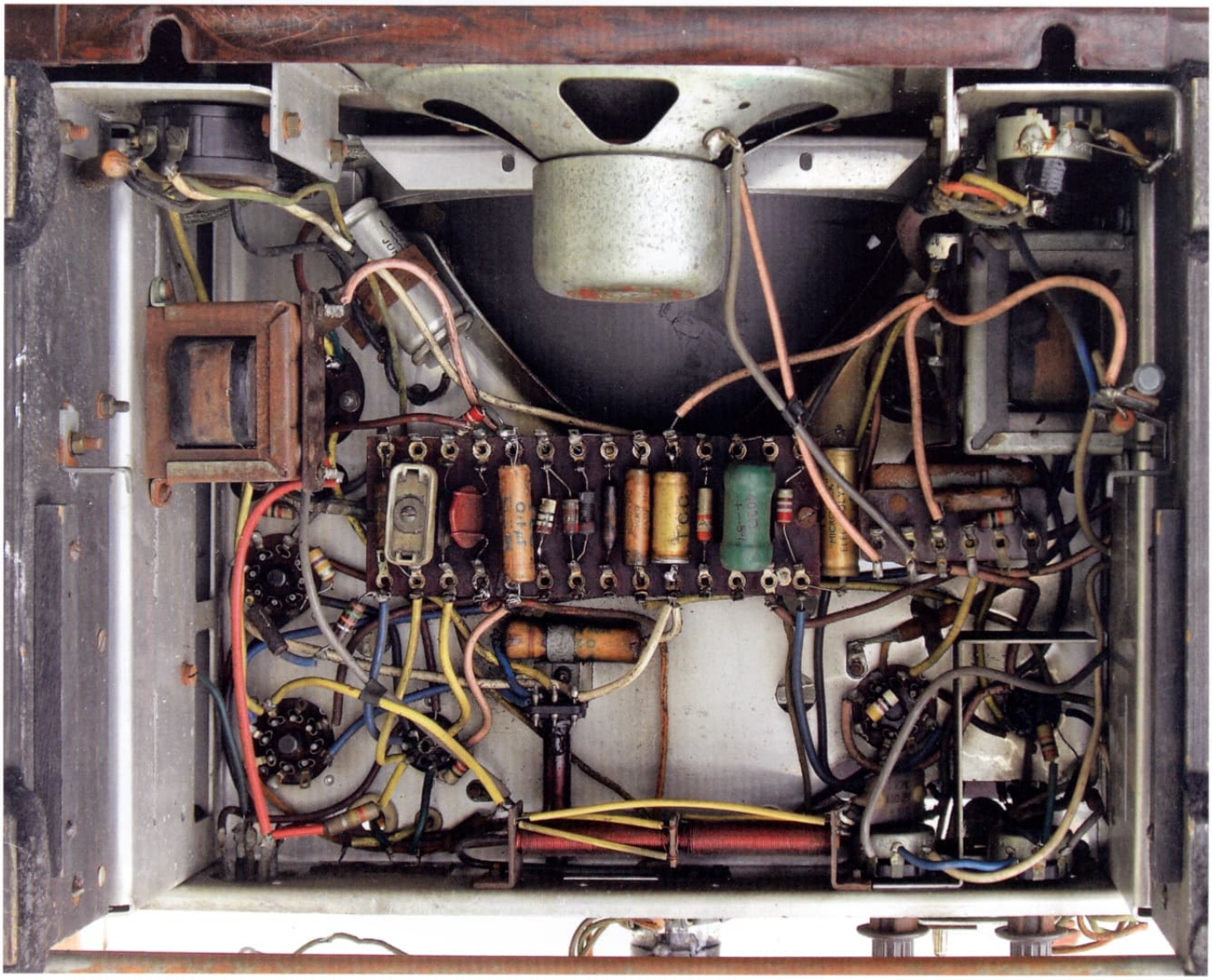


You never know your luck, but this just confirmed my original diagnosis as correct.

On closer inspection it appears that the EHT overwind and rectifier filament winding are on the outside of a paxolin tube about an inch in diameter and the primaries wound round an "I" core in the centre of this paxolin tube. Whew! it looks like I might be able to pull the centre core from the tube leaving the overwind intact. After isolating and very carefully unsoldering the cold end lead out wire of the over wind I then de-soldered the rest of the lead out wires from the tags. I then removed the core retaining screw and LOPTX mounting studs for an obstruction free removal.

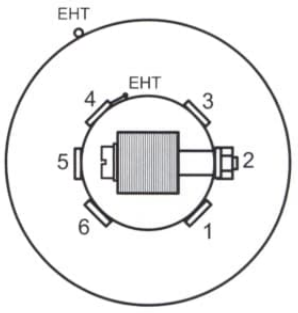
I gripped the end of the core laminations with a pair of pliers and gently gave it a bit of a wiggle, and it appeared to be loose and only the cores outer coating of pitch holding it in, with a bit more wiggling it then pulled free.

The next job was to make copious notes on the wiring and winding locations before I carefully unwound it counting off the turns as I went, the rest of the set and LOPTX put aside leaving the bench clear for this delicate operation. I counted off the turns making notes on the lead out wire positions, number of layers, spacing and coil separation

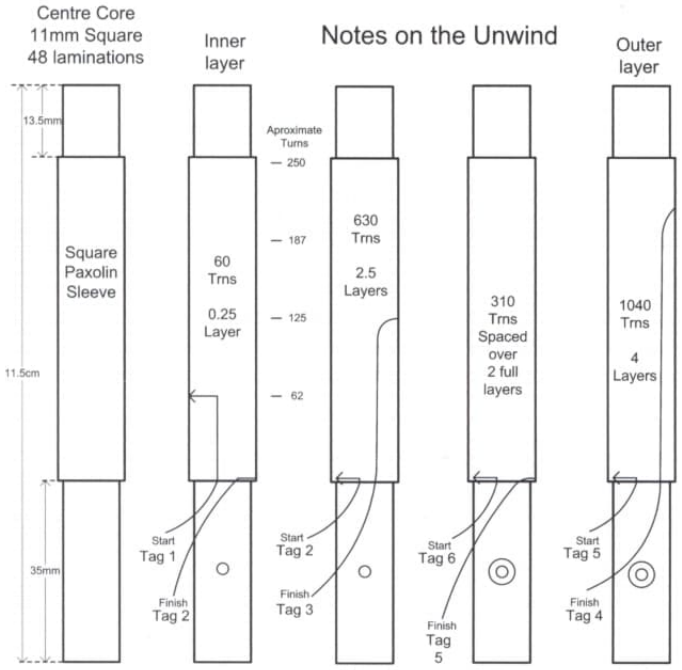


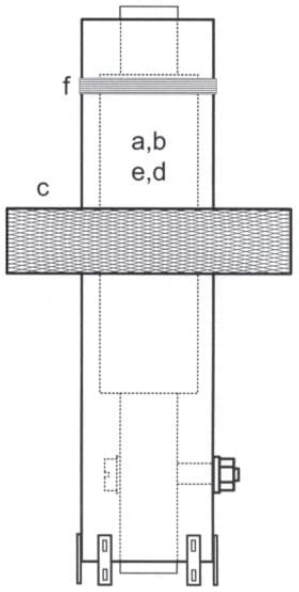
LOTPX Winding Layer:-
1 - 2 = Inner 60 trns
2 - 3 = 630 trns
6 - 5 = 310 trns
5 - 4 = Outer 1040 trns
0.24mm wire .009" 34swg

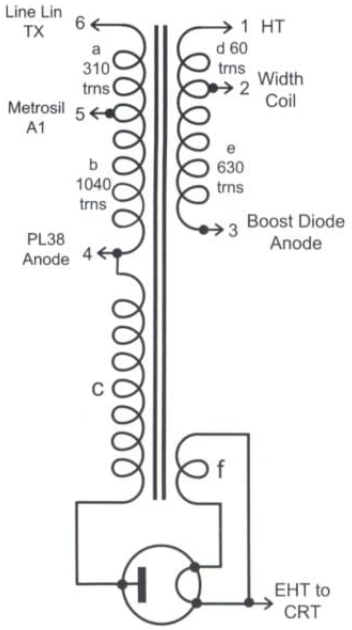
Bush TV22 LOPTX Rewind Details

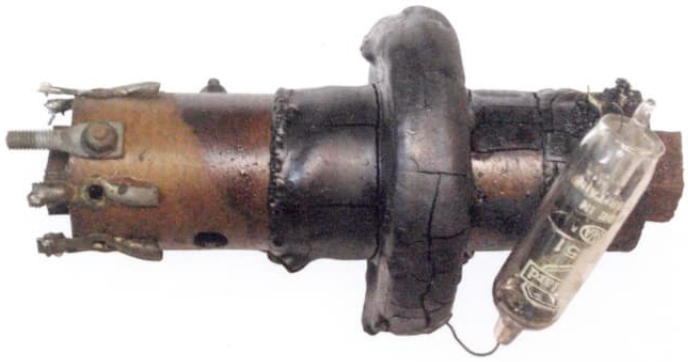


EHT Winding on 1" dia Paxolin Tube

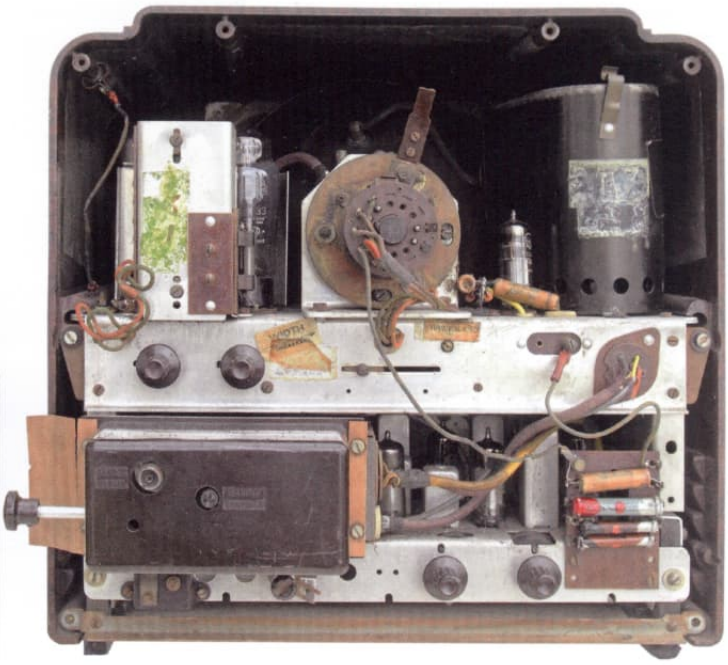


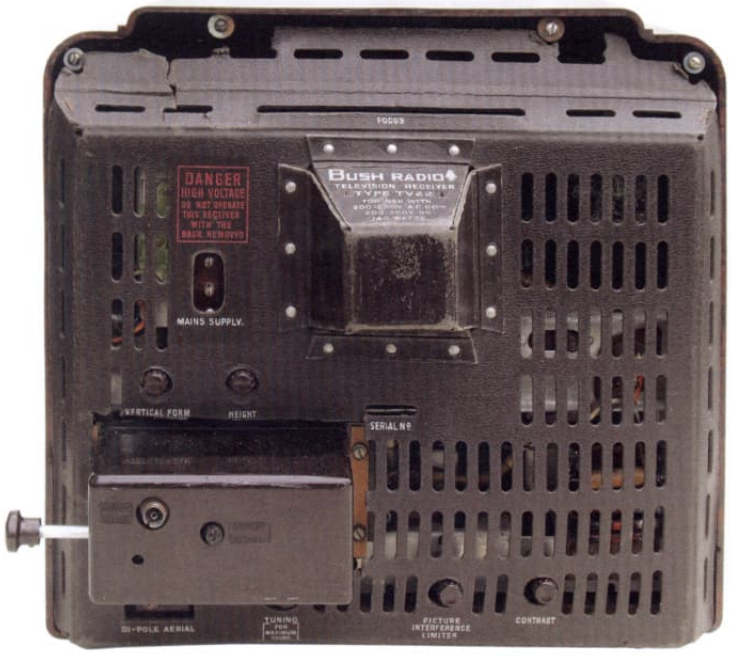






and insulation. During this operation I found a hot spot burnt through the paper separating the winding layers where the two windings had shorted and a good reason for this happening, as I counted off the turns I found the composition of the enamel had broken down and was falling off the wire leaving it bare, I was surprised the set had run for so long before failing.
At the bottom of the windings I found a square paxolin tube the coils were wound on, this made the rewind a bit easier.
The ends of the laminations are a bit flared with rust, rescuing the paxolin tube would be handy. I placed the lamination assembly loosely in the vice with the paxolin tube resting on the jaws. A few gentle taps with a small toffee hammer and the laminations moved, the flared ends stopped the laminations pulling through the tube so they had to be removed individually. Straddling the end of the laminations across the jaws of my small bench vice and using a flat bladed screwdriver as a drift I tapped a few laminations in the middle of the pack. Luckily they moved protruding through the other end by a few millimetres. This was enough to grip with pliers and pull them out completely. The rest of the laminations just fell out in the usual way.
Only the outer ends were rusty, the middle section ok, the rust wire brushed off ok and the wax impregnation cleaned off with solvent. There are 48 laminations, these were given a light dusting of lacquer





to prevent any further rusting then clamped together with tie wraps and sprayed with lacquer to hold them all together. When the lacquer had dried I removed the tie wraps and re-inserted the laminations back into the square paxolin tube, so far, so good. At this point I decided to manufacture some end cheeks for the ease of the rewind, these were made from 1mm paxolin sheet and glued in position at the ends of the square paxolin tube with super glue.

I measured the old winding wire at around 0.2mm 0.009" or 34 SWG, a very common size, probably why I haven't got any. New wire was easily obtained from RS components. The original layers of the windings were separated by fine insulation paper impregnated with wax. Fortunately while looking for some new wire I found a salvaged mains energised speaker field coil with exactly the right paper between its layers, very handy as I want to get the rewind as close as possible to the original avoiding any changes in separation or capacity. This insulation paper was quite dry and un-impregnated and after removing the top winding layer a layer of paper was removed complete and in one piece, with plenty of layers. There's enough paper in this field coil to rewind several of these transformers and I also salvaged the 32 SWG wire wound on it for future use. I diluted some of the wax off of some old waxy capacitors with solvent and painted this onto the paper separators. This became very sticky when dry and held the paper and windings in place very nicely during the rewind.

I don't have a coil winder so the rewind was done by hand, very laborious and took most of the afternoon. I colour coded the six lead out wires with plastic sleeve stripped from wire and covered the new coil with heat shrink sleeve to protect it. I re-fitted this centre core assembly back into the main paxolin tube, refitted its retaining screw and mounting furniture and re-connected the lead-out wires to their tags.

Placed back in the chassis and re-connected, the LOPTX doesn't look any different as the re-wind is mostly hidden inside the paxolin tube. I was going to paint the visible end of the laminations and paxolin end cheek with some bitumastic roofing felt adhesive but resisted until I had fired it up and checked all was well.

Next the moment of truth. I hadn't touched any of the controls since the set failed so if it works any difference in the re-wind will be instantly apparent. I connected up the test card generator and powered up the set. After few minutes the 400c/s tone from the test card generator ramped in, shortly followed by the picture, the only difference I could

see was that the width was slightly low. This was soon corrected by about a 5% increase on the width control slider, other than that the set performed just as it did before the LOPTX failed.

Job done!

While the set was out of its cabinet for the LOPTX rewind, I took a closer look at the CRT shroud. The pale blue paint on this rubber shroud seemed to have reticulated rather than flaked off as there was no evidence of any flakes. This left some of the yellowish rubber showing through the cracks in the paint. This was quite unsightly, this very thin coat of matt paint appeared to be stuck fast and would make a good surface for a re-spray. The colour seemed familiar, it reminded me of the 'duck egg blue' I used on Airfix model aeroplane kits I used to make in my youth, so it's off to the model shop to see what's available and to my surprise it's still around, duck egg blue matt in the Humbrol range and this really was quite a good colour match. A couple of coats through an air bush and the shroud is as good as new and finishes off the set very nicely. (Humbrol duck egg blue matt paint available from Hobbycraft).

Over the next few weeks while playing with this set and my newly acquired Aurora standards converter, the set developed a few more problems. The frame had become progressively non linear with the frame linearity pot now bottomed out at one end. This proved to be caused by the increasing leakage of the four 0.1uf paper capacitors in the frame linearity circuit which I then re-stuffed (C60 - C63. This was shortly followed by a heater chain problem, during a run-up the sound and picture disappeared, a look in the back showed half the valves heaters not lit and the other half frighteningly bright. This proved to be caused by one of the two RF bypass capacitors between V1 and V2 halfway down the heater chain going completely short circuit, (C71) a 0.001 paper capacitor. Fortunately the set had only been running a few minutes in this fault condition and no damage was done. A good reminder never to leave vintage technology running un-attended. Perhaps it would have been a good idea to re-stuff all of them at the beginning. I can see the rest of these paper capacitors failing one at a time but at least this gives me an interesting set to tinker with as I replace them.

This set is ideal to repair or restore, everything is easy to get at and the set is completely self contained on the bench with the cabinet off.

Extending the RF chassis connecting wire with a jumper, a paxolin B5 plug and socket and about 6" of wire made bench working on the set even easier.

The set stands on wooden feet forming part of the chassis, the Bakelite cabinet has grooves about half way up on the inside that slide onto aluminium rails that are extensions of the top deck and side panels of the chassis, so the cabinet sits on the chassis making removal and refitting much easier than sets where the chassis fits inside the cabinet.

BVWS members display historic apparatus at Chelmsford

BVWS members Bob Smallbone and John Chapman recently exhibited early Marconi wireless apparatus at Marconi's first Wireless factory. The picture shows (left to right) a Marconi coherer receiver, galvanometer, morse inker, grasshopper morse key and 10" spark coil, most of which was originally made at the Hall Street works.

The organisers were delighted to have the apparatus on show to mark the final day of a 3 month exhibition at Marconi's Hall Street factory in Chelmsford. The exhibition 'Building the Wireless Age' featured several events including guest speakers and activities. It was organised by Chelmsford Science and Engineering Society and Chelmsford Civic Society, to raise awareness of Marconi's work in Chelmsford. Money was raised by crowd-funding to run the exhibition for 3 months, and the organisers are now aiming to raise £375,000 for their longer-term aim to create a permanent heritage centre at the Hall Street factory.

The Hall Street works was Marconi's first factory from 1899 to 1912, before the company moved to purpose-built premises in New Street.

Repairing record autochangers by Graham Dawson

With a recent revival in sales of vinyl long playing records, many people are digging out old record players, or re-instating a long–forgotten radiogram, on which to play these records. This could be an opportune moment to look at some of the problems most likely encountered when overhauling an automatic record changer from the 1950s or 1960s. A note of caution however is important. These changers were quite hard on records and I for one would be reluctant to play an expensive new LP on a 50 year old deck with an arm tracking weight of typically 6 grams or more, and a cartridge not really designed to play modern stereo records. Such records should only be entrusted to a modern music centre or high quality turntable.

BSR UA8 autochanger

So these notes are aimed at anyone who wants to revive an old player to listen to old records that do not come in the high fidelity category and have probably seen better days.

There were many different makes and models of record players sold in the period 1950 to 1970 but most fitted one of the three makes of decks I shall describe. Other decks were fitted and there will be similarities, but I am not so familiar with them and they will be a small percentage of the players sold during this period. These British made decks were solidly built and designed to last, which is proven by the fact that so many are still in working order 60 years later. However certain parts may have deteriorated, and these will be described in this review.

The most common makes of autochanger were by BSR. Collaro and Garrard. I have chosen a representative sample of each make, namely the BSR UA8, the Collaro Conquest, and the Garrard AT6. Variations on these models will exhibit similar problems and details of any particular model can usually be found on the internet, where a host of information and videos of how to overhaul the deck can frequently be found.

The BSR UA8 autochanger

This was one of the most popular decks of the 1950s era and many millions must have been sold worldwide. Fitted originally with a mono only LP/45 and 78 turnover crystal cartridge of their own make, styli for the TC8M or X5M and similar are still available should you find either stylus are worn or damaged. However many of these early cartridges will have now failed and give a low, distorted, or possibly no output at all, and are not repairable. If that is the case an alternative type needs to be sourced, and as the head of the arm is quite large, a variety of different makes can be fitted, such as Acos or Sonotone, provided you can obtain the mounting bracket. Replacement or working examples are often advertised on Ebay. Fitting is straight forward and stylus pressure can be adjusted by selecting the appropriate hole for the spring at the pivot end of the arm. A sensitive weighing scale is the best way of setting this spring position at about 6 grams, but trial and error using an old 45 record so it tracks without jumping will also work. The connecting clips that plug onto the back of the cartridge are hard to source now if the replacement unit has different size pins, but sometimes opening or squeezing the old ones with fine pliers works.

I recommend removing the circlip on the turntable and lifting it out of the deck before powering up the motor, which may well be stiff or even seized after years of non use. A stiff motor shaft may succumb to some light oil lubrication, but a seized motor is best removed from the deck and dismantled to see if the shaft is rusty or the bronze bearings damaged. Very few motors have open circuit windings in my experience, unless it is one with a valve heater tap for the amplifier and the valve heater is short circuit. The one part that has to be replaced on most turntables of this vintage, whether auto or manual, is the rubber idler-wheel that takes the drive from the motor pulley to the inside edge of the turntable rim. The rubber hardens with age and a smooth face forms on the driving edge, so it no longer provides enough friction to transmit the motion. Sometimes this smooth edge can be roughened with emery paper and there is enough "give" in the rubber to bite, but the best solution is to fit a new wheel if you can source one. Without adequate friction the drive chain will not work the auto-changer mechanism and it will stall part way through a cycle. Supplies of this part, which varies from model to model and make to make are now quite hard to come by, but well worth fitting if possible. There are companies in America offering re-built wheels, but they are expensive and it is worth checking the internet in the UK in case somebody is selling a working deck or wheel for this model.

Hardened grease or oil impregnated with dust is the next problem on all old changers. The solution is to clean off all this "mess" with a de-greasing agent on an old paint brush and dry the surfaces thoroughly afterwards. Once rid of the drag of this gluey grease, most mechanisms will function again, provided the metalwork is not pitted or rusty. If the whole underside of the deck is covered in rust because of storage in a cold damp atmosphere, then it is probably not worth trying to repair it. Old used and working decks are still available at swapmeets or on Ebay, so take that route as the better alternative, since the BSR models are not in short supply at reasonable prices.

Once you have cleaned all moving parts and checked to see all springs are present and working, it is time to see if the assembly still works by revolving the large gear wheel by hand and observing the various operations sequence through the cycle. Provided it works now is the time to

apply a small amount of a light grease on the bearing surfaces. Check also the ball bearing assembly at the base of the turntable centre spindle and make sure the turntable revolves freely at the end of a loading cycle. Finally try the speed change mechanism to ensure the inter-wheel moves freely up and down the stepped motor pulley, and does not foul the adjacent larger diameter step. With 78rpm records the change cycle is very fast and from end of play of one record to start of play on the next can be as quick as 4 seconds depending on the run out and run in grooves. With 45 and 33 rpm records the time is increased in proportion to the difference of speed as compared to 78, since the mechanism is driven off the turntable centre gear wheel.

In my experience most changers respond to the above procedure and can be adjusted for arm height and set down position once the deck is re assembled and working smoothly. The screws to do this are at the pivot end of the arm. I do not consider it is worth trying to repair a badly rusted unit as it will never perform satisfactorily.

The Collaro Conquest autochanger

Another very popular deck of the 50s was this model by Collaro. It was unique in being able to sense the size of non standard records from 12" TO 6" diameter provided the larger sizes were loaded first. This was done by using the pick up arm to measure the edge of the record and "remember" this position in a clutch fitted below the arm pivot. At the end of every load cycle the clutch was re-set to the next record size or if there were no more records loaded, the arm swung right in to a position that ended the load cycle and returned the arm to its rest position and switched the motor off. All this was done by means of a clever tracked cam and clutch assembly which actually contained very few moving parts. It was also very easy to remove this complete unit for servicing, which was not the case with most other decks, which had levers and springs mounted all over the base plate. Another novel feature was driving the changer mechanism from a separate rubber wheel that was independantly connected to the turntable speed change pulley, and so loading cycle time was constant and not affected by the record speed. Their motors also seemed more powerful than other makers fitted.

The deck does however suffer the same problems of life expired cartridges and inter-wheel rubber hardening. The room inside the arm head is much less than the BSR, so the range of replacement cartridges that will fit is limited, although modern stereo cartridges will fit if you don't want to play any 78 rpm records. There are many forums on the internet that give detailed instructions on how to overhaul this changer, so if you run into problems I recommend referring to that source.

The Garrard AT6 autochanger

The third common make of deck was by Garrard, and this model is representative of some of their production, this being in the laboratories series. They aimed at a more sophisticated and expensive market and the cartridge head shell was removable by unscrewing a collar on the arm, thus allowing a range of pick ups to be fitted very quickly and easily. You could thus have a mono LP/78 crystal pick up in one shell and a stereo LP only magnetic pick up in another. It also featured a stylus pressure adjustment at the base of the arm to compensate for the different weight of heads. In all other respects it was similar to the BSR and some Collaro changers. Record size selection was achieved by a small lever in the tower. A 10" record would just contact the lever and move it sideways. A 12" record would move the lever much further sideways and a 7" record would not contact it at all. If there were no more records loaded on the stack the steady arm dropped to its lowest position signaling that on completion of playing the last record the pick up arm would return to the arm rest position and switch the motor off.

Collaro Conquest autochanger

Garrard AT6 autochanger

Hardening of the rubber inter-wheel drive pulley is a common fault if the turntable runs but does not initiate a load cycle, since there is not enough drive torque to operate it. In other respects it can suffer from grease hardening and lack of lubrication at key points. I have never found a problem that a good clean will not cure, but sometimes a spring will have become detached from one end fixing and need to be re attached, so a close visual inspection of the underside is recommended. Of course the previous comments about rusty levers and shafts from exposure to damp applies as much to this deck as any others, and a severe case is unlikely to be worth a re-build after treating all affected areas since there are still a lot of these changers about. While this has been very much a simplified overview of old changer problems, I hope it will help anyone who wants to revive a 50s/60s record player or radiogram, but is not familiar with the mechanics of the decks of this period.

PICGEN: a 405 line pattern generator that produces sixteen test patterns two of which are Test cards

by Frank Cuffe

Having an Aurora standards converter which is a fabulous piece of kit, I felt another source of 405 signal would be useful for the bench as it would save having to disconnect the Aurora from the working sets every time I wanted to work on a TV. While working on a TV it is the inbuilt test card in the Aurora that I mostly use so a pattern generator that could produce a test card would be ideal. There are test card generators available and looking at these they all appeared to produce the image in a similar manner by storing an image in memory which is read in sequence and converted into a video signal. It was evident from looking at these generators that it takes quite a bit of memory to store an image of a test card. I wanted to use a PIC microcontroller for this project but even the largest of them has only a fraction of the memory required to store a test card image, therefore storing a complete image would not work so another method was needed to produce a test card.

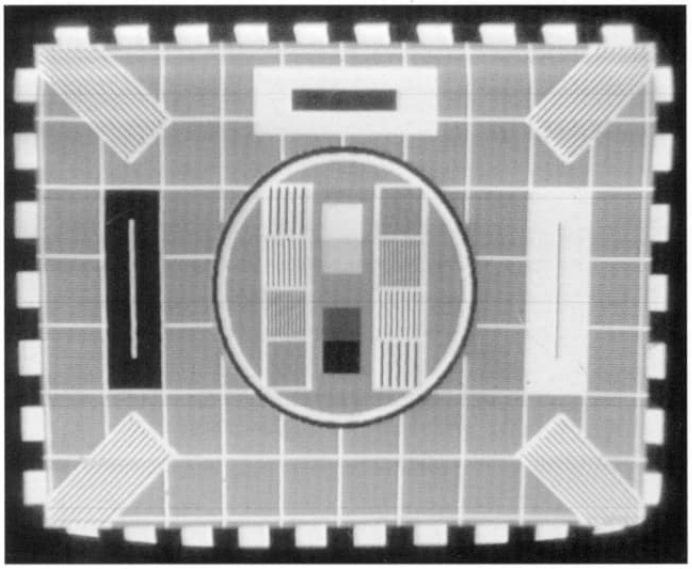


Fig 1: Test card 4:3 circle

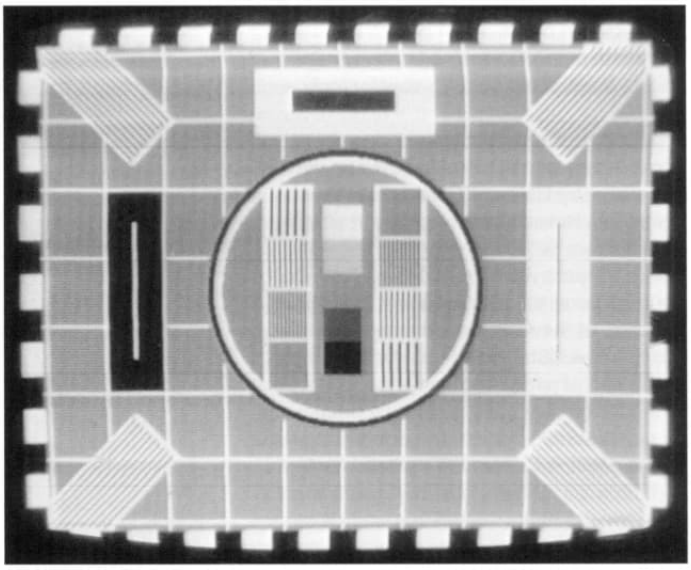


Fig 2: Test card 5:4 circle

If the lines that make up the test card are broken up into sections it can be seen that many sections are repeated throughout the fields. In software a subroutine can be wrote for each section and that subroutine can be reused as many times as necessary to make up the image. As the subroutine has only to be stored in memory once but can be used and reused an infinite amount of times, this delivers a great saving of memory.

Early on in the project I needed to decide what pixel rate to use, as with many things two conflicting requirements came into play. A high pixel rate would be desirable to give good definition but the higher the pixel rate the more memory that is required. It was decided that a 6 MHz pixel rate would be a good compromise as it is the lowest that can produce the 3 MHz frequency gratings. The active line length was set at 80 µS (480 pixels) and the line sync timing is front porch 1 µS, sync 9 µS, and back porch 9 µS giving a total line length of 99 µS. Total number of active lines is 376. Field sync consists of 8 broad pulses of 39.5 µS duration with 10 µS between each pulse. Equalising pulses are not used.

The patterns

The generator produces sixteen patterns, the following is a brief description of each.

Test card with a 4:3 circle. (fig. 1). This is the default pattern and will be displayed even if no switches are connected. The castellations take up 14 lines top and bottom and 14 pixels left and right. The white lines that make up the grid are 2 lines or 2 pixels wide and are spaced 42 pixels or 44 lines apart. The vertical lines inside the vertical black and white bars each side of the circle are 2 pixels wide which represents a pulse of 33uS. The circle has an aspect ratio of 4:3, the outer circumference of the circle is 200 lines by 192 pixels. The frequency gratings are 1, 1.5, 2, and 3 MHz. I was not able to reproduce a 2.5 MHz frequency grating with the 6 MHz pixel rate. The five step grey scale consists of black, light grey, mid grey, dark grey and white.

Test card with a 5:4 circle (fig. 2) is identical to the 4:3 test card except for the circle which is 196 lines by 200 pixels to represent an aspect ratio of 5:4.

9 bar test pattern (fig. 3) this pattern consists of 9 steps of grey scale going from black at the left to white at the right.

10 bar test pattern (fig. 4) is the same as the 9 except it has an extra bar on the left which is white. An oscilloscope scan of it is shown in (fig. 5).

Grey scale crossed (fig. 6) the top half is the same as the 9 bar test pattern, the bottom half is the reverse.

Grey scale grid (fig. 7) is a 9 x 9 grid containing grey scales.

Cruciform (fig. 8) is a black cross on a white background.

Checkerboard (fig. 9) is a 8 x 6 black and white checker board pattern.

Black level, is a screen of black level video.

Peak white, is a screen of peak white video.

Bounce, in this pattern the video toggles between black level and peak white every 25 fields.

Frequency gratings (fig. 10) is a screen of

Fig 3: Nine bar test pattern

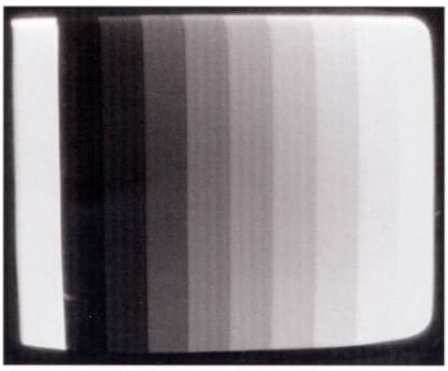


Fig 4: Ten bar test pattern

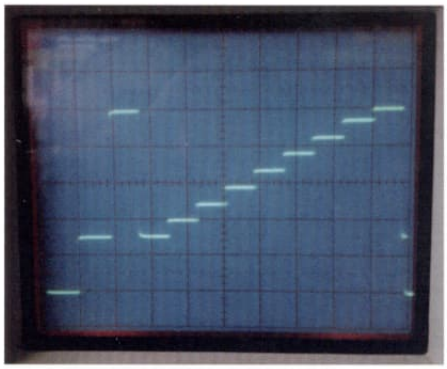


Fig 5: Oscilloscope scan of ten bar test pattern

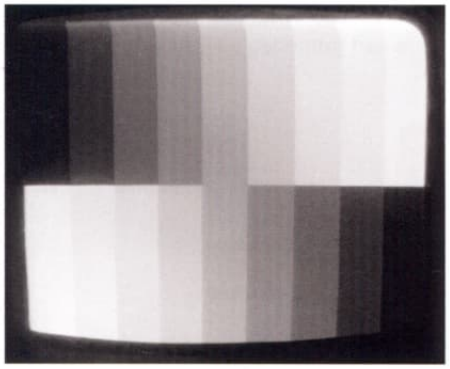


Fig 6: Grey scale crossed test pattern

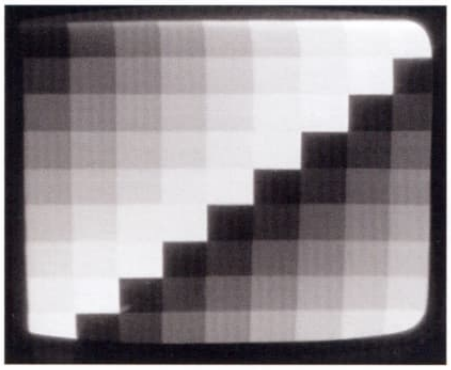


Fig 7: Grey scale 9x9 grid test pattern

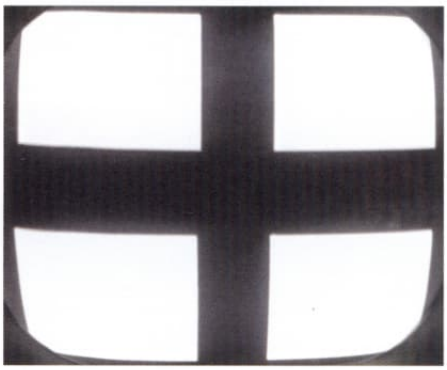


Fig 8: Cruciform test pattern

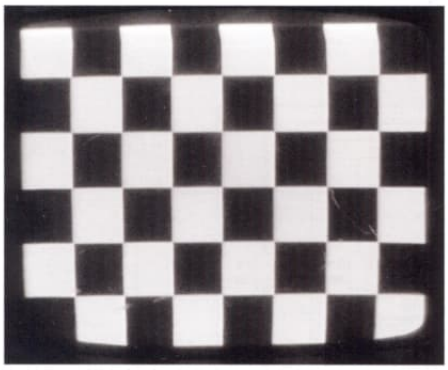


Fig 9: Checkerboard 8x6 test pattern

Fig 10: Frequency gratings test pattern

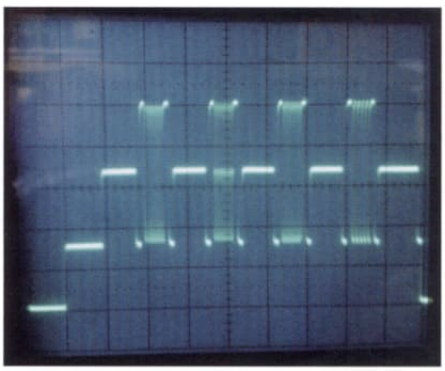


Fig 11:Oscilloscope scan of frequency gratings

3, 2, 1.5 and 1 MHz gratings displayed as vertical lines. An oscilloscope scan of it is shown in (fig. 11).

Crosshatch white on black (fig. 12) is a screen of horizontal and vertical lines white lines making up a crosshatch on a black background. The white horizontal lines start and end 12 pixels from each side of the picture.

Crosshatch white on grey, is the same as Crosshatch white on black except the background is grey.

Missing line sync (fig. 13) this pattern displays white vertical lines on a black background, a number of the lines have no line pulse, both odd and even fields are identical. Quarter way down each field there is one line with no sync pulse, half way down there are two lines with no sync pulse and three quarters way down there are three lines without a sync pulse. Each line without a pulse is marked with a single '-' in the centre of the line.

Early line sync (fig. 14) is similar to "Missing line sync" except in this pattern the sync pulses arrive early instead of not been there at all. Quarter way down there is a single line that arrives 0.33 µS early, half way down a single line arrives 0.66 µS early and three quarters way down a single line arrives 1 µS early. Each line with a early sync pulse is marked with two "-" one either side of the centre.

Sync pulse outputs

Horizontal and vertical sync pulses are provided on separate BNC connectors. The positive going edge of the horizontal pulse occurs just after the negative going edge of the line sync pulse, the negative going edge occurs just after the positive going edge of the line sync pulse.

The positive going edge of the vertical pulse occurs just after the negative going edge of the first broad pulse. The length of the vertical pulse varies by a half line, depending on whether the field is odd or even, with the negative going edge occurring towards the end of the frame blanking period. This arrangement will allow an Oscilloscope to lock onto the broad pulses by using the positive going edge (fig. 15), or lock onto the lines at the beginning of the fields by using the negative going edge (fig. 16).

Circuit description

The circuit is based around a PIC18F2685 microcontroller. A 6 MHz ceramic resonator X1, sets the clock frequency. The output latch of IC1 Port B and resistors R1, R2, R3, R4 and R7 form a rudimentary digital to analogue converter that produces a nine level video signal from black level to peak white. Port C7 (pin 18) produces the sync pulses, they are fed through R5 and R6 which reduce the pulses to a level suitable to add to the video signal. D2 and C6 were added to give a degree of pulse shaping. The combined video signal is fed through R8 to the base of the emitter follower TR1. The output is taken from its emitter via R10. Ports C2 and C3 of IC1 (pins 13 and 14) provide Vertical and Horizontal sync respectively.

S1 and S2 are push–to–make switches which are connected to Port C0 and C1 of IC1. They provide a means of scrolling through the test patterns. Resistors R11 and R12 are pull up resistors for the switches.

A wall wart of 9 to 12 volts DC is suitable to power the unit. Maximum

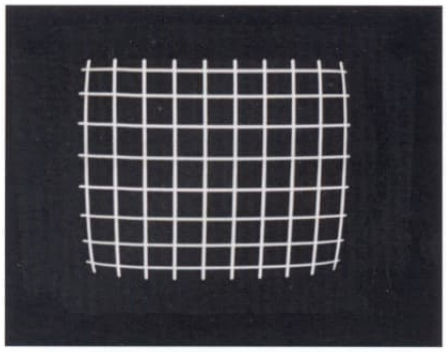


Fig 12: Crosshatch white on black

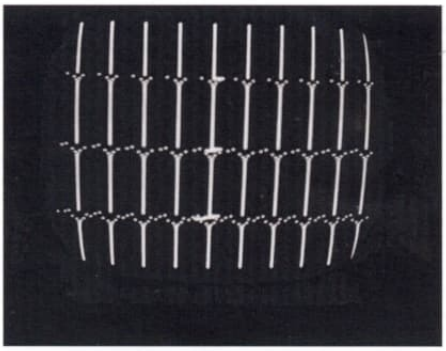


Fig 13: Missing line sync

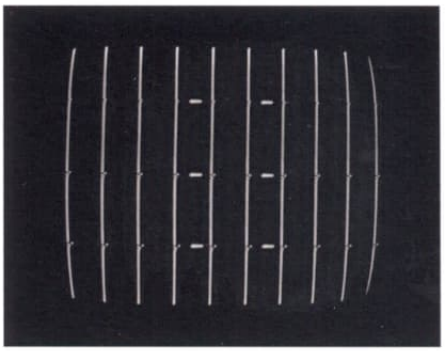
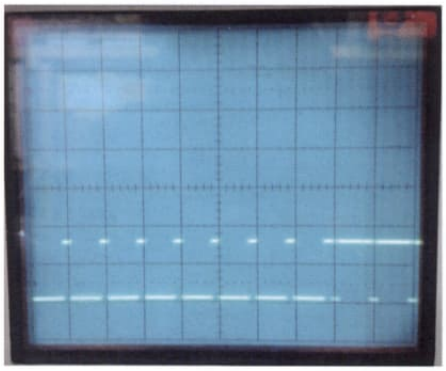


Fig 14: Early line sync



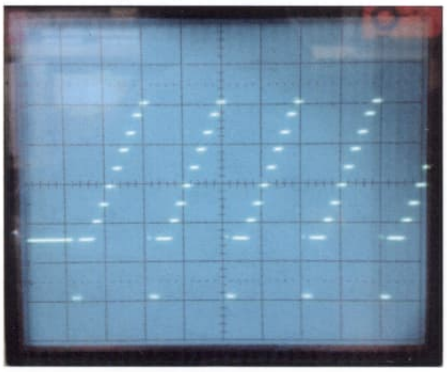
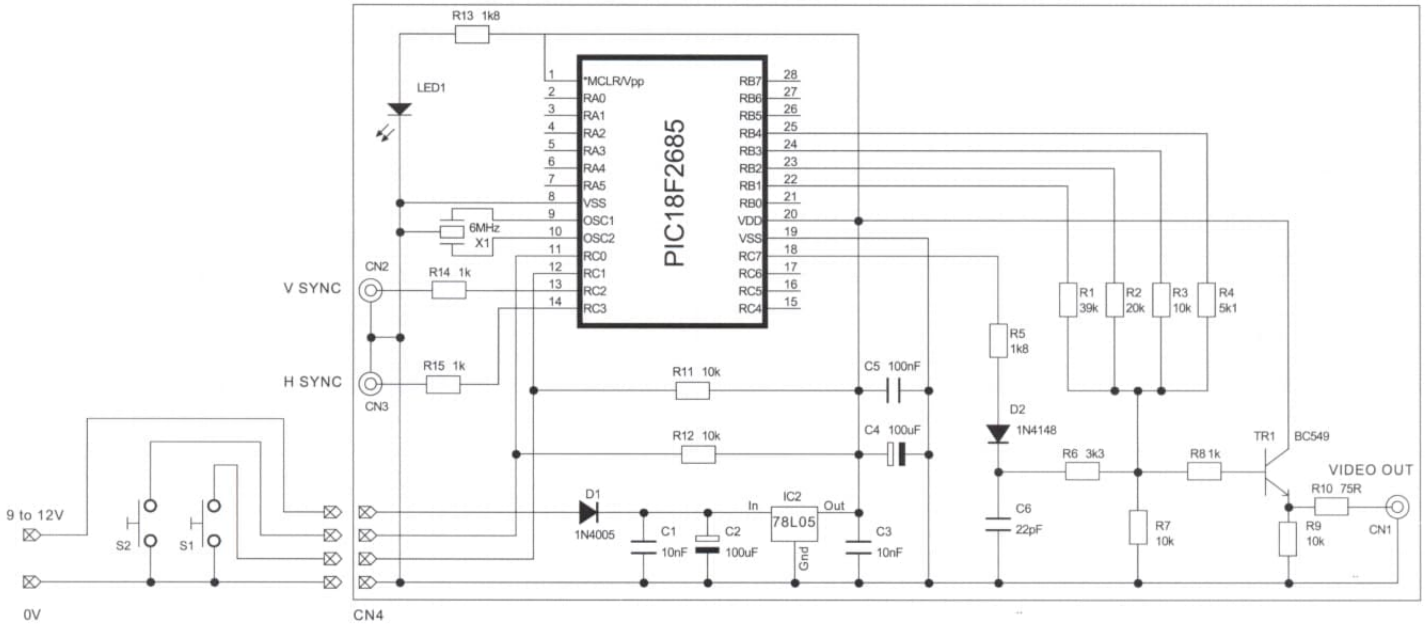


Fig 15 (far left): Broad pulses

Fig 16: (left): first lines of field

Below: PICGEN circuit



current drain is in the region of 33 mA. As it will be powered from a wall wart D1 is fitted for reverse polarity protection. IC2 together with its decoupling capacitors provides a regulated 5V supply for the circuit. LED1 is a power on indicator, its series resistor R13 was chosen so that it illuminated dimly.

Construction

The circuit was built on a PCB measuring 40mm by 84mm. To keep wiring to a minimum all parts apart from the two push switches and the DC power socket are mounted on the PCB. Connections for the switches and power socket are made by a 4 pin connector. A turned pin IC socket was used to hold IC1. This allowed the circuit to be built and the power supply tested before the IC was inserted and also allows the IC to be extracted easily for reprograming if required. To allow the LED to protrude through the front panel it needs to be raised about 10 mm off the PCB, a 10 mm length cut from a plastic pipe was used as a spacer. All resistors are 0.25W types and apart from the two electrolytics the capacitors are ceramic types. The ceramic resonator is a 6 MHz 3 leg type.

The three BNC sockets are types made by TE Connectivity, I mention the makers because if the PCB artwork is to be used with different sockets the footprint needs to be checked against the TE Connectivity ones to make sure they are the same otherwise the art work will need to be changed. The Video socket is a 75R type (TE Connectivity Part No. 1-1478033-0) and the two Sync sockets are 50R types (TE Connectivity Part No. 1-1337541-0).

The PCB was fitted into a Hammond instrument case (Hammond part no. 1598BBK). It can easily be fitted into a much smaller case but as I wanted it to sit on a shelf this case seemed the best option.

The PCB is held onto the front panel of the enclosure by the three BNC sockets. Three 13mm holes were drilled for the BNC sockets and a 6mm hole for the LED. The two push switches are also mounted on the front panel. They were purchased from China sometime ago and required 12mm holes.

The front panel legend was done up on a CAD programme, printed onto coloured paper and laminated. The sockets and switches hold it in place and its edges are tucked into the grove in the case that the panel sits in.

There is no reason why it can't be built on stripboard as the prototype was (fig. 17), though it is important to keep

the decoupling capacitor C5 as close as possible to the supply pins 19 and 20 of IC1 and likewise with C1 and C3 keeping them close to the pins of IC2. It is best to keep the tracks short, particularly around the base of TR1 as stray capacitance can reduce the bandwidth. Any unused pins on IC1 must be left floating as they are configured as outputs and may change state during operation.

Output level

Ideally the output for the generator should be, black level 0.3V and peak white 1V into 75R with the sync tips being at 0V. With the given component values it comes quite close to this. The generator has a feature to allow easy measurement of black level and peak white, which can be measured by connecting a DC volt meter directly to the Video output. While taking the measurements the output must be connected to a 75R load if one isn't to hand a 75R resistor can be strapped across the output. While keeping S1 or S2 pressed black level can be measured and if S1 and S2 are kept pressed at the same time peak white can be measured. There are no sync pulses on the output when either or both S1 or S2 is pressed. If a precise 0.3V/1V is required, it can be achieved by changing the values of R6 and R7. R6 sets Black level and R7 sets Peak white.

The software

It should be noted that I am not a Embedded Engineer, I am just an enthusiastic amateur. I have endeavoured to ensure that it works as it should, however all the information in this article including the software is given "as is" without any guarantee or warranty expressed or implied. The hex file required to programme the PIC can be downloaded from http://electronics.frankcuffe.ovh/picgen filename picgen_16_18f2685_v01.

A suitable programmer such as the 'PICKit 3' and its associated software is required to program the PIC, also an adapter board would be needed to connect the PIC to the programmer.

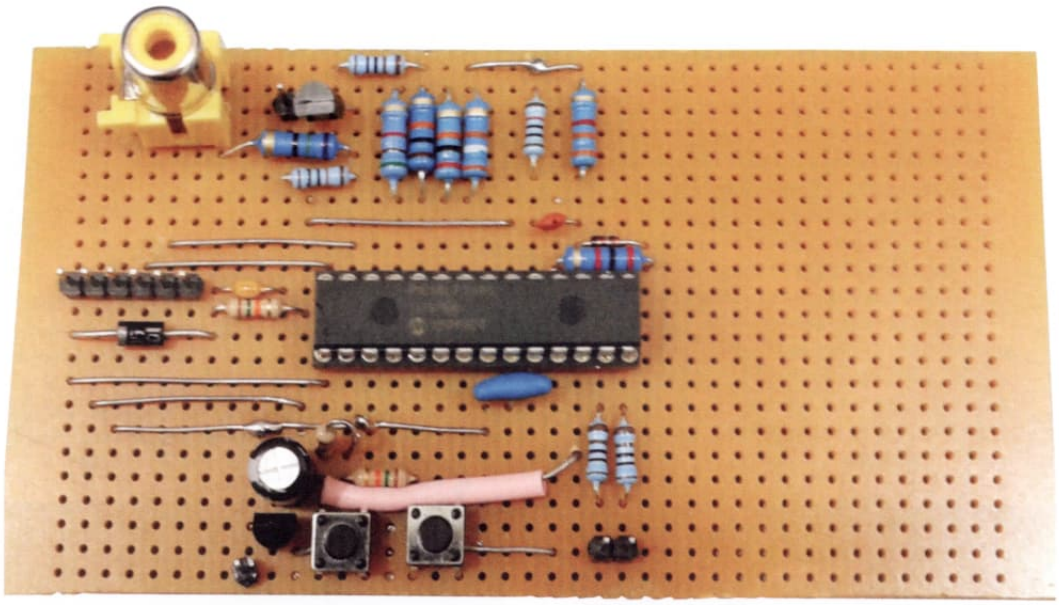


Fig 17: Prototype constructed on stripboard

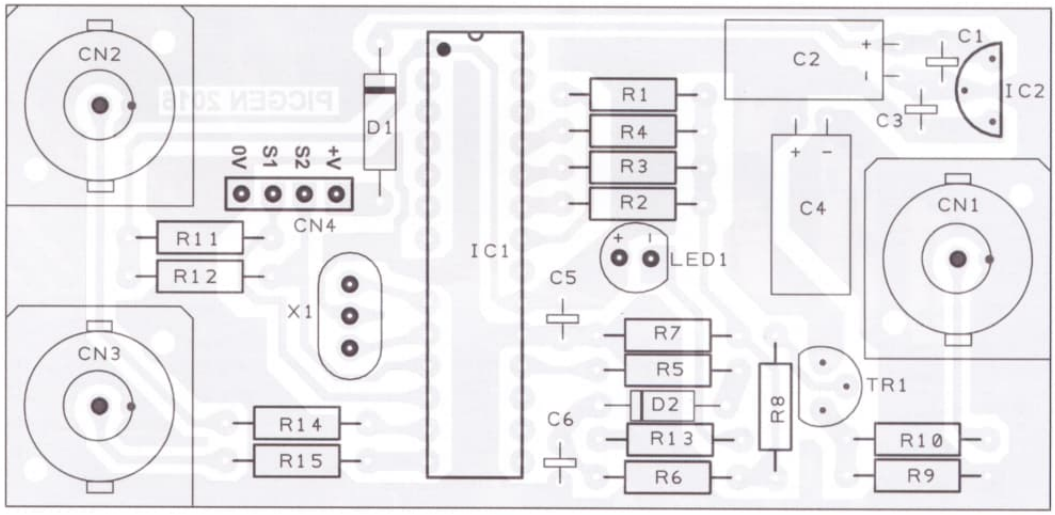
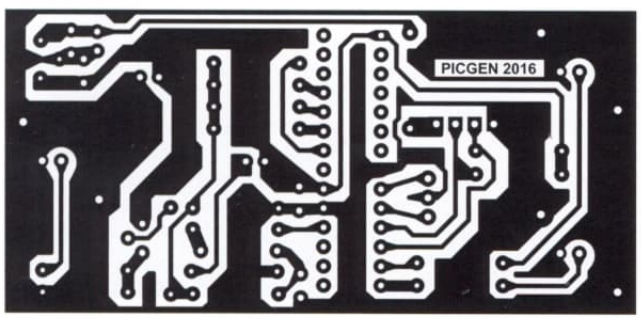
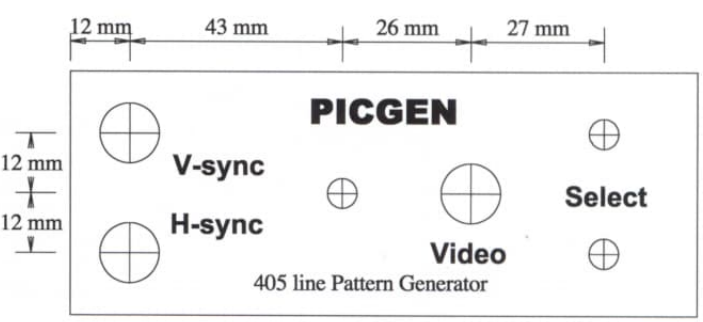


Fig 18 (right): PICGEN component layout

Fig 19 (below): PICGEN pcb layout

Fig 20 (below, right): PICGEN front panel legend





Restoration of an Ekco A147 'Festival' radio

by Stef Niewiadomski

The Festival of Britain, held in the summer of 1951, was a government-sponsored series of events intended to give the British a feeling of recovery in the aftermath of the war and to promote the British contribution to science, technology, industrial design, architecture and the arts. The South Bank (of the river Thames) Exhibition was the main event site in London, but events were held all over England, Scotland, Wales and Northern Ireland. A Festival Ship – the Campania, an escort aircraft carrier, which entered service in 1944, and saw active service – was despatched to cities with ports, and a travelling exhibition was used in inland venues. A contemporary map of the main event site can be seen in Figure 1. The Festival site was originally derelict land (said to have remained undeveloped since it had been bombed during the war), bounded on the north by the road leading to Waterloo Bridge, and on the south by County Hall (now a hotel). The land is now mainly occupied by the Jubilee Gardens, with the London Eye at the western river-side of the site, and the Southbank Centre.

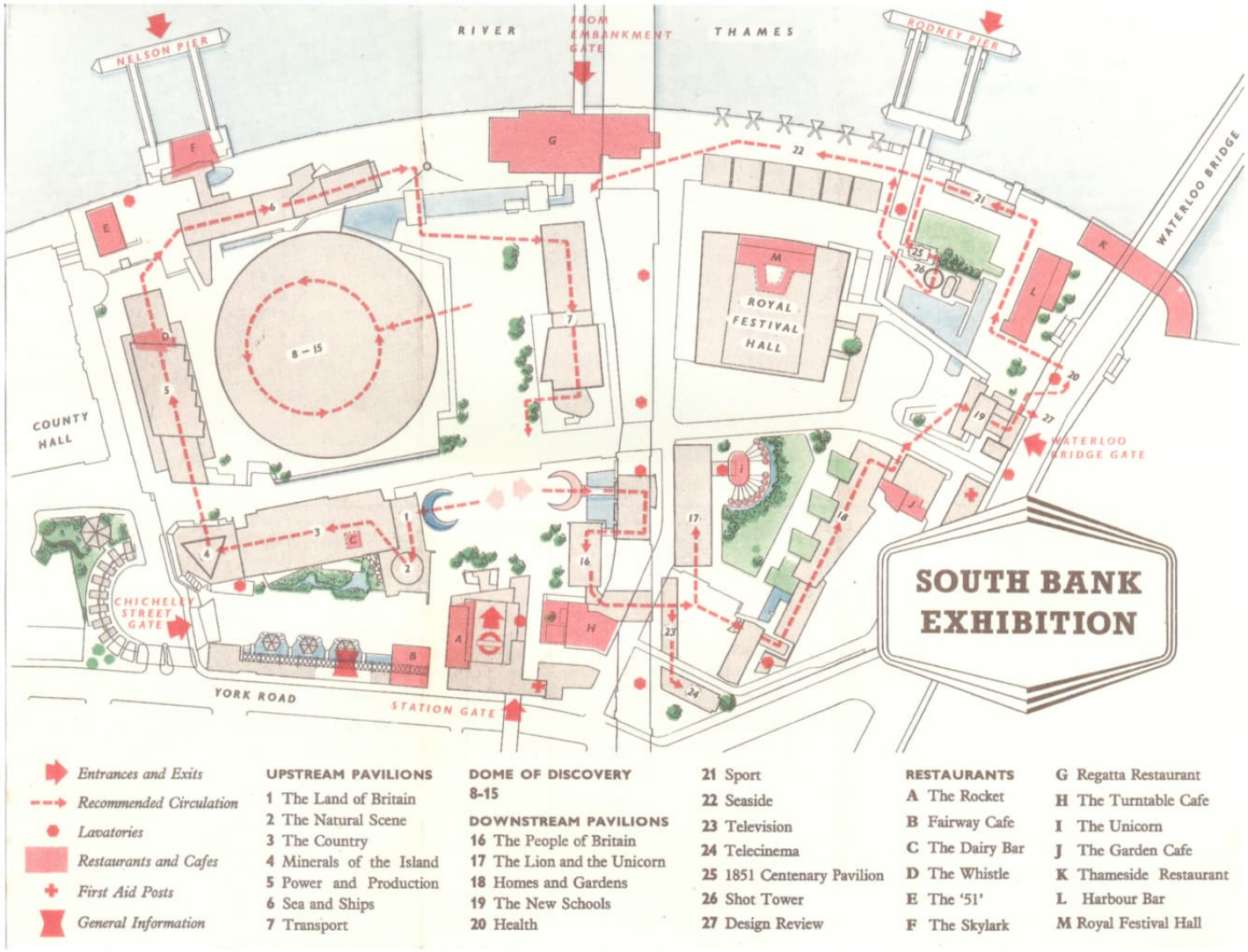


Figure 1: A contemporary map of the Festival of Britain main event site on the south bank of the Thames in London, held in the summer of 1951.

The Royal Festival Hall was built for the festival and was opened in May 1951, just before the opening of the festival on 4th May 1951, and is an enduring legacy - as part of the Southbank Centre - which now includes the Hall itself and a number of other arts venues, restaurants, cafes, bars and shops.

One of the enduring and striking images of the exhibition is the Skylon, a cigar-shaped aluminium-clad steel tower supported by cables, and lit from inside at night, which made it appear to hang unsupported in mid-air. Among the buildings on the site, there was a Dome of Discovery, and I wonder if this influenced the design of the Millennium Dome almost 50 years later?

Many commemorative items were produced and many still survive. A search on eBay reveals hundreds of 'hits': postcards, guides, maps, coins, medals, spoons and even an official weather forecast, which was produced every day.

A 1976 book – 'A Tonic to the Nation – The Festival of Britain 1951' (see Reference 1) gives a series of retrospective views of the aims, style and impact of the festival. The photos of the exhibition itself are very interesting, but also they show just how much people used to dress up in their 'Sunday best' when attending such events. In the early 1950s, there really doesn't seem to have been a casual dress style like we see today.

One of the stranger items on show at the festival was reported by Practical Wireless in its July 1951 issue: 'A radio device which is causing a lot of comment and amusement in

Figure 2: An Ekco advert showing an A147 (with no mention of the 'Festival' name) with the AC/DC model U199.

the Lion and Unicorn Pavilion of the Festival of Britain is the "Morale Raiser", a machine which steadily pats its wearer on the back and vociferates words of encouragement. It was described by Brian Johnson in "In Town Tonight", and we understand is shortly to be shown upon the television newsreel. The Moral Raiser incorporates a Scophony-Baird Home Recorder, made by the manufacturers of Baird television. This was chosen after a number of comparative tests and will now be in use continuously throughout the Festival".

The A147

The origin of the A147 (the radio, not the road) can be traced back a couple of years to the A110 'Connoisseur' of October 1949, priced at £15 10s 8d, plus purchase tax. The A147 has an identical B8A valve line-up and four station pre-set tuning to the A110, but was housed in a new, presumably specially designed for the Festival, cabinet.

The advert shown in Figure 2 shows an A147 (with no mention of the 'Festival' name) along with the AC/DC model U199, which was priced at 20gns, that is £21. In its Trader service sheet, the U199 is listed as being released in September 1953 and priced at £15 1s, plus purchase tax. Assuming that the advert was produced when the U199 was relatively new, this implies a purchase tax rate of about 40%. I believe that at this time, radios were subject to two rates of tax: 5% was applied for the cabinet (government logic said that this was furniture) and 50% for the chassis, so it seems feasible that the overall rate could be about 40%. The A147 is priced at £22 10s, for a radio that can be argued to have less functionality than the U199, since it did not have normal manual tuning. Maybe government opinion was that the furniture content of the A147 was greater?

Ekco were present at the Festival in force and Figure 3 shows their stand, which is quite minimalist in style. You can just about see an A147 on the right hand side, along with a few other radios. No doubt vintage TV collectors will be able to identify the TV sets on display.

Some parts of the A147 seem to have been re-used in the model A222, which appeared in 1954. This was a live chassis, AC-only, clock radio using U-series valves, with four preset stations – identical to the A147 – and the preset coil pack, IF transformers and the knobs (coloured red for the A222) seem to be identical to those in the A147.

Figure 3: Ekco's stand at the Festival's London site. Hopefully, you can just about see an A147 on the right hand side, along with a few other radios.

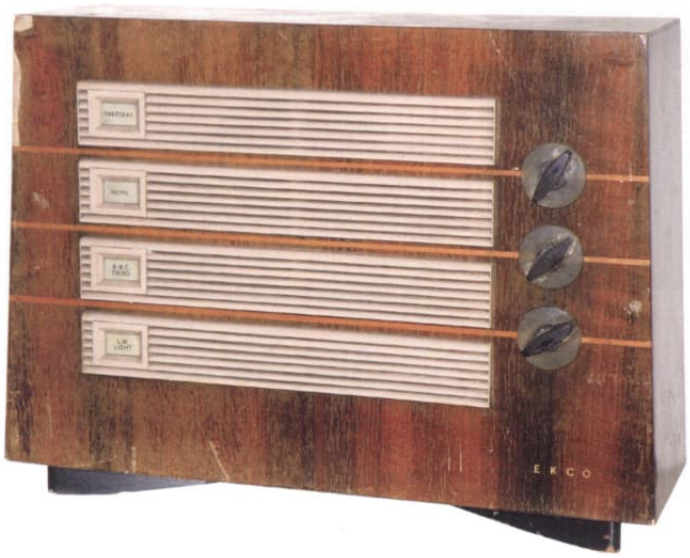


Figure 4: My A147 with the cabinet in its rather knocked about 'as found' condition. Luckily the plastic mouldings are all intact and all three knobs are present.

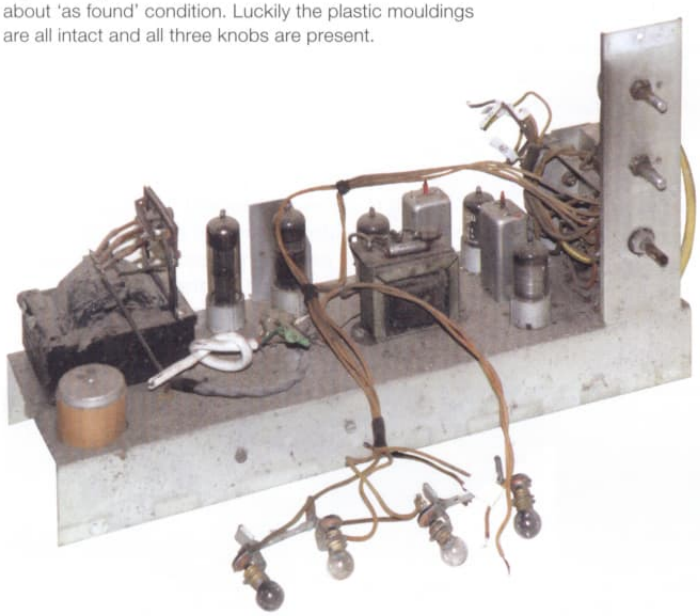


Figure 5: Top view of the chassis, removed from the cabinet. The darkened glass of two of the station indicator bulbs indicate that they are blown.

Figure 6: The stripped down cabinet, with the repair to the veneer in the top left hand corner, awaiting varnishing. I've been careful not to rub down the surface too much, to retain the 65 years old patina. The central openings allow the sound from the 8-inch Goodmans speaker to escape.

The cabinet

My A147, in original condition, can be seen in Figure 4. It may be just my imagination, but were the grips on the knobs designed to be evocative of the Skylon?

My A147 still had its back panel, and all four fixing screws, and the dusty state inside indicated that it hadn't been messed with previously. Full removal of the back panel needed me to unsolder the connections to the frame aerials, after carefully labelling the wires. Without unsoldering these connections, there was just about enough access to change a valve or renew one of the station indicator bulbs, but you would need very long and thin fingers to achieve this.

The mains lead had been chopped off and pushed back into the cabinet. Two out of the three knobs pulled off easily, but the third one was more difficult. After considerable pulling and grunting, it eventually came off. I removed the four chassis fixing screws, a fifth screw above the tone control, and the woodscrews securing the station indicator bulb holders to the cabinet. After unsoldering the leads to the impressive 8-inch Goodmans speaker (this size is permitted by the lack of a dial and a tuning capacitor) marked 'specially designed for Ekco', the chassis slid out of the cabinet. Figure 5 shows a top view of the chassis after it had been removed from the cabinet. The darkened glass of two of the station indicator bulbs indicated that they were blown, but I'd confirm that later as I decided to tackle the cabinet first.

The wooden cabinet was generally in good condition: the varnish layer had lots of scratches and dings, but most of these did not extend into the veneer itself. All the veneer was attached apart from a small section at the top left hand corner of the front which had gone missing. I removed the plastic sections which effectively formed the speaker grille and the four station indicator panels, and the speaker itself. As well as being attached with screws from the inside, these plastic sections were lightly attached to the front panel with a few dabs of glue, presumably to stop them from rattling in sympathy with the audio output, but this glue was easy to scrape off and didn't damage the veneer.

I rubbed off the varnish with P150 sandpaper and although I couldn't see any evidence of woodworm, I applied woodworm killer to all the surfaces, just to be sure. Unfortunately I managed to rub away the Ekco name from the front panel: I had assumed that it was a wooden inlay, but it turned out to be a transfer.

I trimmed off the edge of the missing veneer section so that I had a good straight line to butt the replacement sections to. I could see that I could cover the missing area with just two new pieces, and so I cut the replacement sections to size and glued them into place. After letting the glue dry overnight, I rubbed the sections down to get a good match to the original surface. The colour match wasn't perfect, but I'm not too fussy when it comes to small sections of replacement veneer, and I like the repair to be visible, though not too obvious.

Figure 6 shows the stripped down cabinet, with the repair to the veneer in the top left hand corner, awaiting varnishing. I was careful not to rub down the surface too much, to retain the patina the radio has collected over the years.

The knobs were covered in a gooey mess and needed a good wash in hot soapy water to get them to a reasonable condition.

The chassis

The schematic of the A147, taken from the manufacturer's service sheet, is shown in Figure 7. This schematic has the component values shown, which Trader sheets typically do not, and you need to refer to a separate table to determine the values.

My A147 has the serial number C10359, and has an all-glass B8A valve line-up of an ECH42 frequency changer; an EF41 IF amplifier at 470kHz; an EBC41 audio/AGC detector and audio amplifier; an EL41 audio output stage; and finally an EZ41 full wave rectifier, all of which were marked Mullard and looked original. These valves have a locating pip moulded into the lower section of the glass which engages in a slot in the socket. You also come across B8A valves with a metal sleeve fitted over the lower section, with the pip formed into the metal. I find it tricky to identify the pin numbers from the bottom of these sockets: there is no obvious feature that identifies pin 1 and you have to work it out either from above, or from the connections made to the socket. I removed all the valves so that I could give the chassis a good clean, and took the opportunity to clean their pins and check the continuity of their heaters, all of which were OK.

I started at the top of the chassis: tags on the output transformer

hold R16 (nominally 1.8MΩ) and C27 (0.001μF). The resistor measured at about 2MΩ, and so I left it alone, but the Dubilier capacitor was a gooey mess and so I changed it for a modern component. The transformer itself measured 807Ω on its primary (which seemed rather high, but not too far off its value of 700Ω given in the service sheet) and about 1Ω on the secondary, so both windings were intact.

R17, the 500k Tone control and R13, the 1MΩ Volume On/Off control are both mounted on a vertical panel on the right hand side of the chassis, when viewed from the front. Both these potentiometers checked out OK for resistance. Selection of the four preset stations, or the gram input is made via a multi-pole switch shown as S1, S2, S3, S4 and S5 on the schematic, also mounted on the panel. Specifically, S1 and S2 select the medium or long wave frame aerials and the preset trimmer capacitors which tune their inductance; and S3 sets the local oscillator frequencies corresponding to each of the four stations to which the aerial circuit is tuned. S4 de-selects the pickup socket when the radio is tuned to one of the four stations, and enables this input in the fifth position. Finally S5 controls which one of the station indicator bulbs is lit, and in its fifth position, it lights the top and bottom bulbs, showing that the pickup socket is connected, and radio mode is disabled.

Two of the station indicator bulbs were darkened, indicating that they were blown, so I changed them for new MES 6.5V 0.3A bulbs. Their glass envelopes were a little bigger than the originals, but they would be hidden behind the front panel, and so this wouldn't be obvious.

Mounted on the rear of the chassis, on the external speaker / pickup panel, S6 is a screw-in contact that disconnects the internal speaker when an external speaker is connected.

Turning the chassis over – it's one of those annoying chassis that tends to fall over and so I propped it up with various pieces of wood – the power supply choke, L12, measured at 360Ω, bang on its nominal resistance. It's quite unusual to find a choke in the HT smoothing circuit of a radio around this date, and it's an indicator of a high quality product. Working my way through the power supply, I checked the capacitance of the smoothing capacitors and they measured 16.6μF and 23.0μF before reforming, and pretty much the same afterwards. At manufacture, their can had been pushed into a hole in the chassis and was held in place by prongs exerting side pressure. This would have made removal tricky, had I needed to.

Looking at the area around V4, the EL41 audio output stage, there was evidence of burning, and cracked and broken insulation, presumably caused by heat conducting through the valve's pins and heating up the area generally. In the view of the top of the chassis you may have noticed the aluminium screen behind V4, which I think is there to stop the back panel from being 'cooked', but it has the undesirable effect of reducing the air flow around the valve, and therefore causes it to get hotter than it should. So I took the decision to remove V4's socket, and replace all the components and connections in the area. I drilled out the rivets holding in the B8A socket, and fitted a new one, with some earth tags which would be useful when connecting any new components to the chassis. I renewed R19 (V4's cathode resistor) and C29, its bypass capacitor, as well as C26, C28 and C30, avoiding using NC (no connection) pins on V4's socket, which I always find confusing when I come to restore a radio. Moving further towards the front end, I changed all the suspicious looking paper capacitors and C25, V3's cathode bypass capacitor, and C17, the 4μF HT decoupler for V3. All the resistors measured close to their nominal values, and so were left alone.

Figure 8 shows a view of the underside of the chassis after these component changes had been made.

Two core cable and switch on

The radio was fitted with a two-core mains lead, which was common practice at the time the radio was designed, as most mains sockets did not have earth connections. After checking the insulation resistance between the mains transformer's windings and the chassis, I fitted a three-core cable, with the chassis earthed, and a mains plug with a 1A fuse. I also secured the mains lead to the chassis with a P-clip, so that its

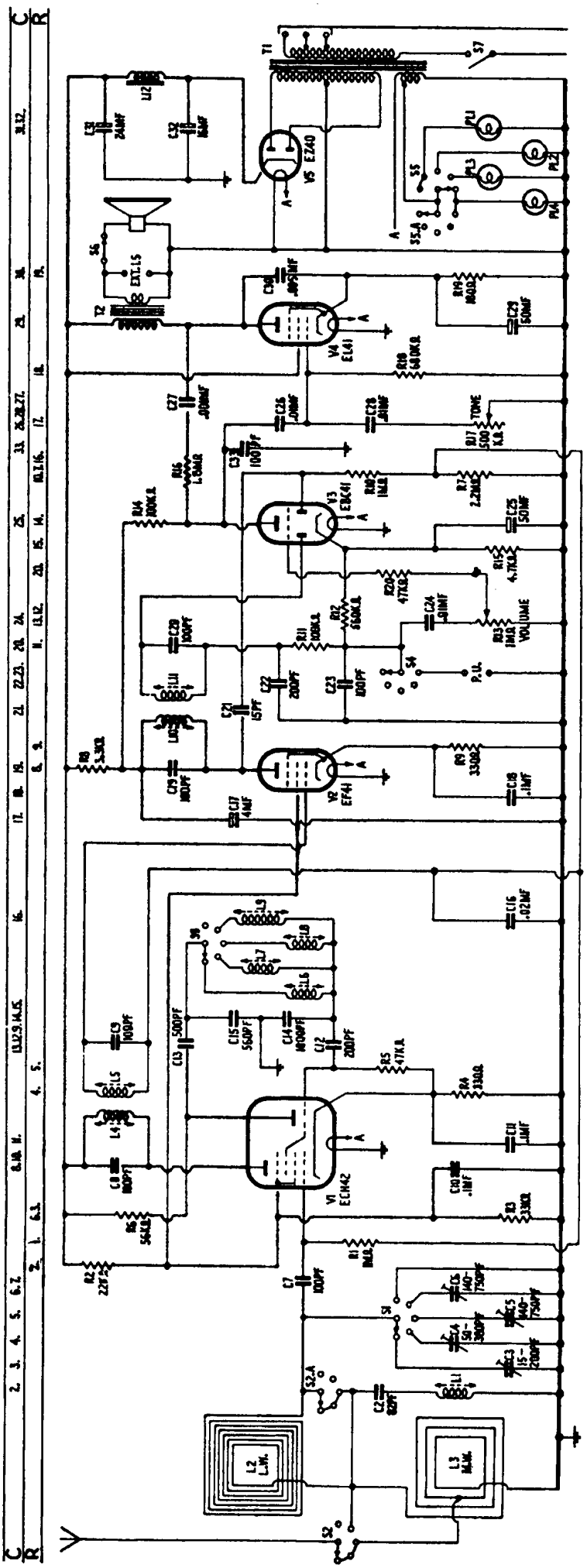


Figure 7: Schematic of the A147, taken from the manufacturer's service sheet.

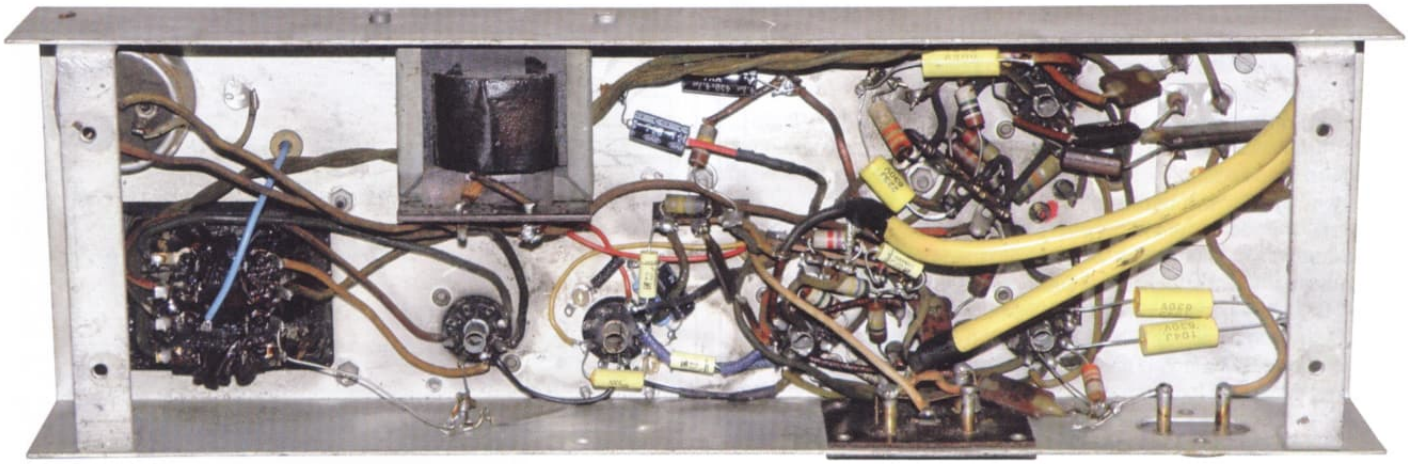


Figure 8: Underneath view of the restored chassis. L12, the power supply smoothing choke, can be seen close to the mains transformer, adjacent to the rectifier's socket. The two thick yellow pieces of sleeving carry the pickup connections to the station selector switch.

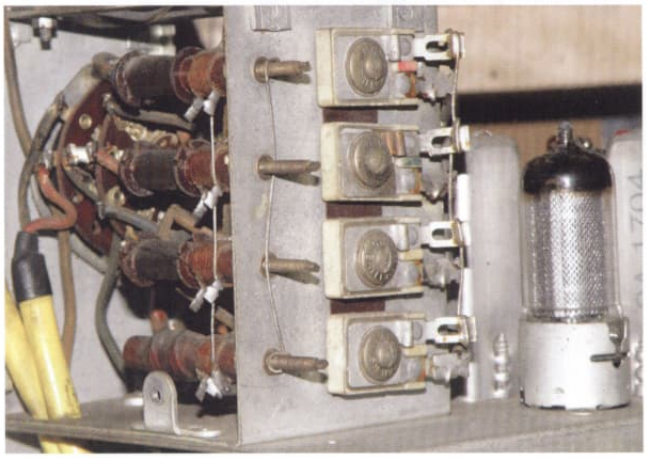


Figure 9: The local oscillator inductors and aerial trimmer capacitors, used for setting the four preset stations.

CONTROLS

TOP. Continuously variable TONE CONTROL.

CENTRE. Volume control and ON/OFF Switch.

LOWER. Station Selector and Gramophone Switch covering—Gramophone (fully anti-clockwise).

1.	Long-wave	1200-1800 metres.
2.	Medium-wave	310- 550 ,,
3.	Medium-wave	245- 435 ,,
4.	Medium-wave	188- 343 ,,

(The stations selected on positions 1—4 may be easily altered by the user—see Alteration of Pre-set Stations)

Figure 10: The section in the radio's instructions showing the control functions, including the tuning range of the preset adjustors.

connections couldn't be pulled loose.

I re-attached the frame aerial with longer than ideal wires, but at least this would give me a good indication of how well the radio was now working, and connected the speaker, with the whole arrangement scattered around my bench. I plugged the radio in and switched on. The loudspeaker produced a loud hum immediately, which was strange as the valves had definitely not had time to warm up! One of the station indicator bulbs lit up, and the bulbs lit up in turn as I rotated the station selector switch, indicating that S5 was working correctly. The fifth position caused two bulbs to light, as expected. I checked the wiring to the speaker and discovered that I had connected the ground current return lead from the bulbs to the wrong side of the speaker, which was causing all this AC current to flow through the speaker – not a good idea! Once I'd fixed this wrong connection, the hum went away.

Switching on again, after a half minute or so, the radio came to life, so luckily I hadn't killed the speaker. Now I could hear a faint audio output in the bottom two positions of the station selector, the LW LIGHT position and the BBC THIRD position. Plugging my workshop long wire aerial to the aerial socket on the back of the chassis improved things slightly.

By first adjusting the local oscillator inductors and then the aerial trimmers (see Figure 9), I could accurately tune in Radio 4 on the long wave and Radio 5 Live at 693kHz on the medium wave. 693kHz corresponds to 432m in old-speak, and so it made sense that it would come up on position 2, which was designed to have a tuning range of 310-550m (see Figure 10 for the relevant section in the radio's instructions and Figure 11 for the markings on the back panel). I confirmed that in the Radio 5 Live position, the local oscillator was running at (693+470) = 1163kHz.

I used pliers to adjust the local oscillator inductors, which was not ideal, and a screwdriver for the aerial trimmer capacitors. I presume that originally a special tool had been shipped, which has long since been separated from the radio.

Selecting the other two positions (both medium wave) produced no output. On a nearby receiver, I monitored the local oscillator frequency, and this didn't change as I twiddled the relevant two inductors. The cores inside the inductors were obviously not moving. I removed the aluminium panel covering the inductors and by manoeuvring the chassis, I got one of the cores to fall out, but the other one had disappeared. I applied a small blob of superglue to the remaining core, inserted it into its coil former and pushed it until it made contact with the threaded adjustor. I left it to set for a few minutes, and twiddled the adjustor again and happily the oscillator frequency changed. I could now tune in a station with this adjuster and peak it with the aerial trimmer. The fourth position would have to wait until I could find another core.

The instructions for the radio suggest that you wait for the radio to warm up for at least half an hour before setting the stations. This implies that whenever you switch the radio on, it could be off station for this period while it drifts to the correct frequency. I suppose you didn't find this out until after you had bought the radio, so it may have come as an unpleasant surprise, but by then it was too late. Hopefully, it wasn't as bad as it sounds.

Figure 12 shows the wavelengths of the various BBC stations (Home, Third and Light), taken from the instruction manual, with the positions of the selector switch and the approximate number of turns of the inductor adjustors needed to set the correct local oscillator frequency. Possible 'Foreign' stations are also shown. As you can see, if you had chosen to set the radio to receive Luxembourg on the long wave, then you would have had to use one of the medium wave positions for the BBC's Light programme on 247m, rather than its normal 1500m long wave position.

Now I could put the radio back together and connect the frame aerials on their 'normal' wires. Figure 13 shows a 'peep' into the back of the re-assembled radio. With the back panel re-secured, I tweaked the tuning again. Figure 14 shows the restored radio in all its glory. Hopefully you can see that the bottom station indicator is lit, showing that the radio is tuned to the BBC Light programme on the long wave.

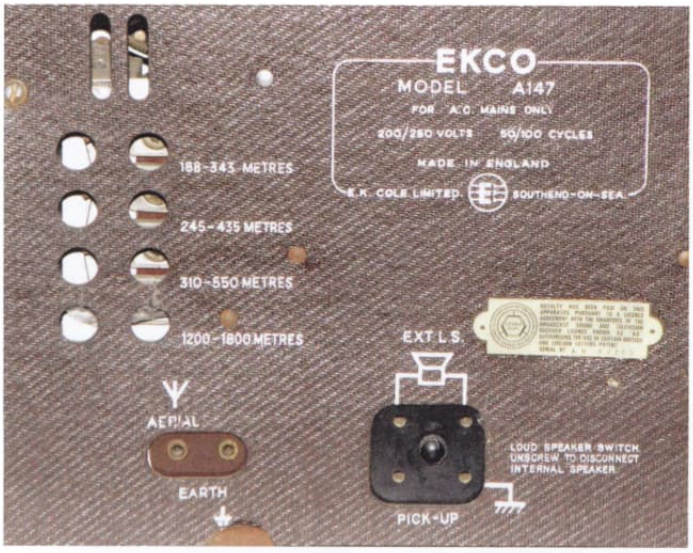


Figure 11: Markings on the back panel showing the preset tuning ranges, and the holes to give access to the adjustors. A screwdriver would have been suitable for adjusting the trimmer capacitors, but a special tool was needed to adjust the local oscillator inductors.

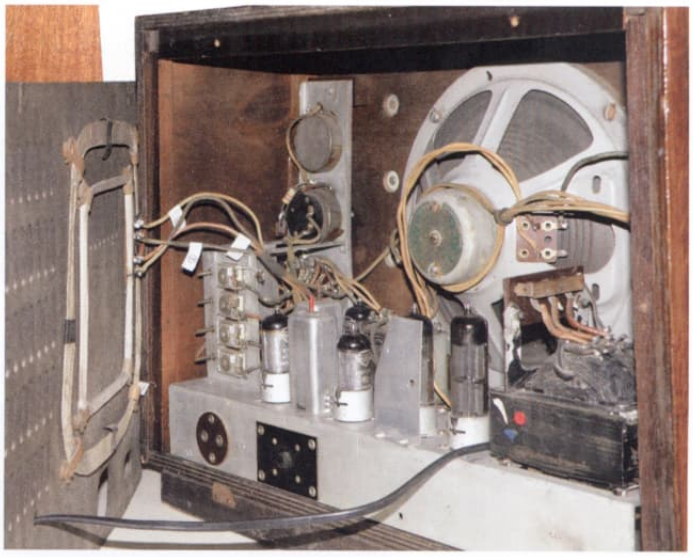


Figure 13: View into the rear of the re-assembled radio. Once the back panel had been re-secured, I tweaked the tuning to accurately tune in the selected stations.

STATION ADJUSTMENT GUIDE

B.B.C. STATIONS

Station	*Metres*	*Position*	*Approx. Turns Left Hand Adjustor*
London Home	330	4	19½
		3	13½
		2	11
Third Programme	463	2	17½
	194	4	7½
West Home	206	4	9
	285	3	8½
		4	14
Welsh Home	340	2	11
		3	14
		4	20½
Midland Home	276	3	10
		4	15
North Home	434	2	16
		3	19
Scottish Home	371	2	13
		3	16
Light Programme	247	3	7
		4	13
	1,500	1	13

FOREIGN STATIONS

Station	*Metres*	*Position*	*Approx. Turns Left Hand Adjustor*
Paris	280	3	10
		4	15½
	214	4	9½
	348	2	11½
		3	14½
Brussels	484	2	18
Hilversum II	402	2	14½
		3	17½
Hilversum I	298	3	11½
		4	17
Luxembourg	1,293	1	11½

Figure 12: Wavelengths of the various BBC stations (Home, Third and Light), and a few Overseas stations, taken from the Ekco instruction manual, with the positions of the selector switch and the approximate number of turns of the inductor adjustors needed to set the correct local oscillator frequency. At the time, there were no non-BBC stations in the UK, of course. It took the activities of the 'pirates' in the 1960s to shake up the BBC to some extent, but the first commercial radio station was not opened until 1973!

Figure 14: The A147 in restored condition, showing the distinct obelisk shape of the cabinet. The four plastic strips are attached separately and effectively form the grille over the 8-inch speaker. The radio is tuned to what is now BBC Radio 4 on 198kHz, as indicated by the 'LW Light' lamp being lit. Additional labels, other than those shown, were provided with the radio, but not surprisingly these have been lost over the years. When the station selector switch is set to the 'gram' position, the top and bottom lamps are both lit.

Summary and conclusions

The Ekco A147 'Festival' radio is an attractive wooden cased superhet, introduced in 1951 to celebrate the Festival of Britain, held in London and at sites around the UK. Having four preset stations, and no manual tuning, the radio probably had limited appeal at the time, and the examples that were sold may not have survived long in homes, as evidenced by the relatively few A147s that seem to pop up these days. Today, prevailing opinion seems to be that although contemporary research had shown that listeners typically only ever listened to two or three broadcasts, they wanted the ability to tune around the bands, although they seldom, if ever, exercised this flexibility. Over the years, Ekco produced several versions of the four-preset radio, and so they thought that it was commercially worthwhile to invest in the design and manufacture of such a radio.

The sloping sides of the A147's cabinet give the radio a unique obelisk appearance, which was a quite different look to other square and curve-sided radios of the day. I restored the cabinet, being careful not to remove the surface patina it had picked up over the past 65 years.

I hadn't been born when the Festival was held: maybe readers who remember being taken along as children might want to write in with their memories of the event.

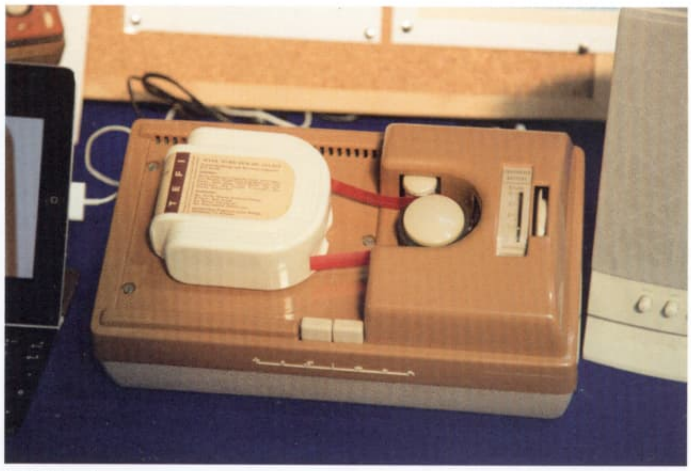
References

Reference 1: 'A Tonic to the Nation – The Festival of Britain 1951' edited by Mary Banham and Bevis Hillier. Published in 1976 by Thames and Hudson.

BVWS 40th anniversary collectors exhibition photos by Alex Hewitt

Some rare and unusual Ekco radios

Black and chrome beauties



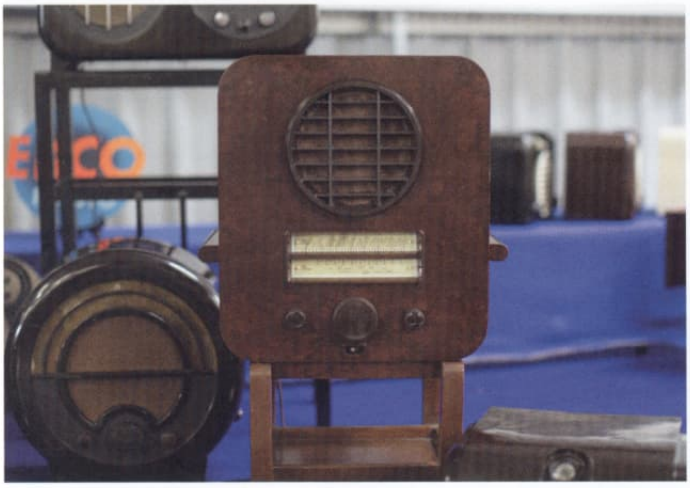
A Tefifon player

An early 1920's three valve set

A display of working vintage televisions

1920's and 30's treasures

A selection of coloured sets



Ekco AC74 on stand

Pye 'Music Maker' with magnetic recording disc

Various novelty radios

Gecophone 'Smoker's Cabinet'

Vintage HiFi

Vintage horns, receivers and players

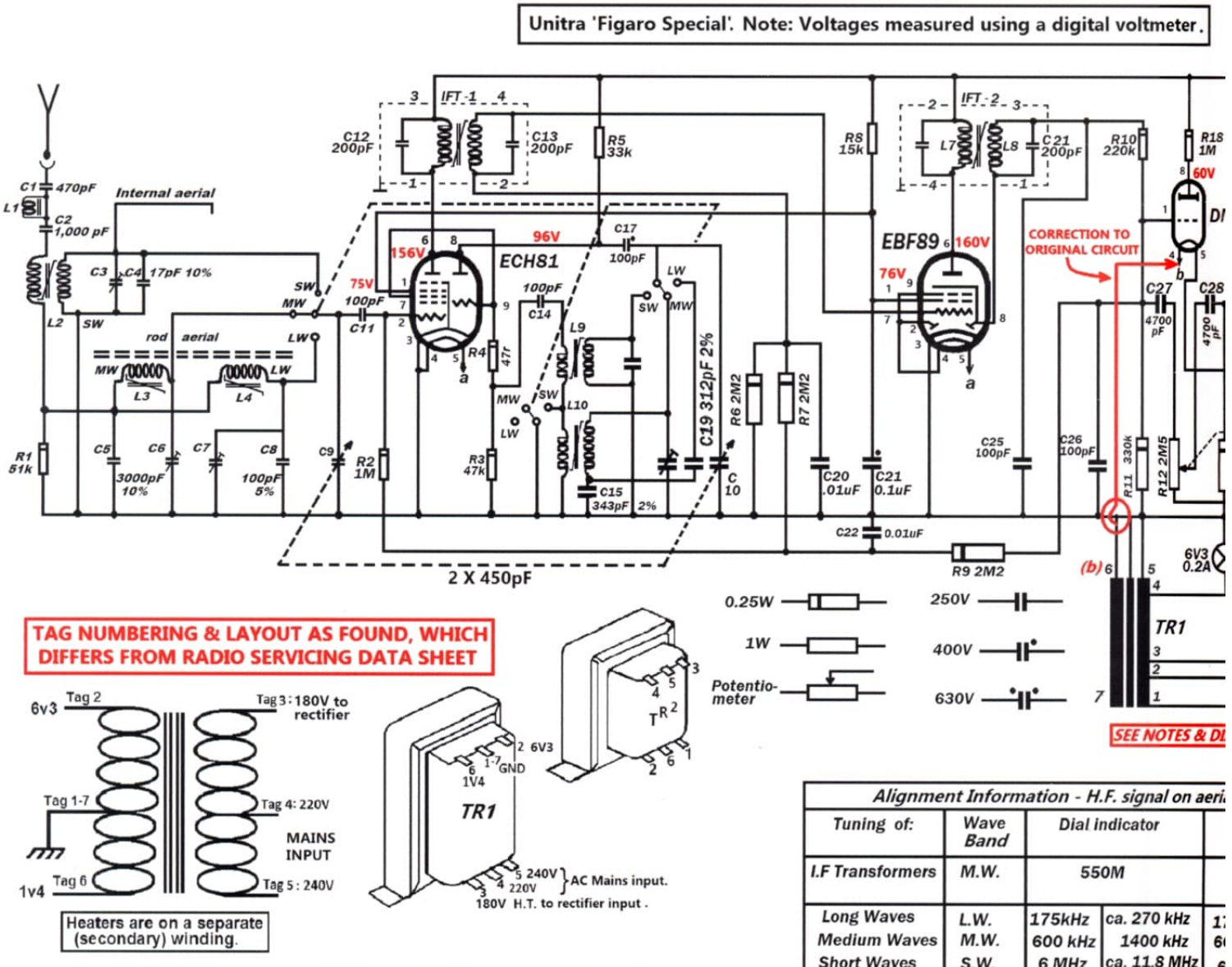
Wartime utility sets, Philips receivers, and early 1920's equipment

Restoring the Unitra 'Figaro Special' by David Taylor

The 'Figaro Special' is a compact wooden-cased table model AM only receiver for 220/240V A.C. 50Hz mains, of Polish manufacture. It covers three wavebands: LW 165 – 280 kHz; M.W 535 - 1605 kHz, and SW 6 – 8 MHz. I already had a plastic-cased Unitra 'Figaro' and was pleased when this wooden-cased variant - the 'Figaro Special' - came my way for a fiver for 'spares or repair'.

These sets date from the 'Cold War' era of the mid 1960s, several years after most manufacturers had ceased to make valve radios. (Mine was dated 1967). The dial markings and station names are all in English, and I believe that for a time, they were imported to the UK and sold through mail order companies. They were clearly built down to a price rather than up to a standard, but that said, they're attractive little sets, nicely designed, well built, and perform surprisingly well. In addition to the ferrite rod antenna, there is a wire clipped around the inside of the cabinet to aid signal pick-up, and a socket for an external aerial. It uses three valves, (ECH81, EBF89, ECL82) plus a DM70 'exclamation mark' magic eye tuning indicator, and a contact-cooled metal rectifier. The use of an auto-transformer rather than a mains dropper minimises heat generation, though as it isn't a full mains isolation transformer, it means that the HT is derived directly from the mains, so in effect, the set uses 'live chassis' techniques - hence, the usual safety precautions are called for when live testing.

Information on these dinky little Polish sets is sparse, amounting to just two pages from Radio Servicing, though the data includes the circuit, an outline of the placement of the main components, brief alignment instructions, a dial stringing diagram, and tag identification of the output transformer and auto-transformer, though I discovered that the latter diagram did not correspond to the actual auto-transformer in my set. There was also an error in the circuit diagram regarding the 1.4 volt heater supply to the DM70 'magic eye' which I've highlighted on the circuit – Fig 1, along with the actual tag layouts as found on the auto-transformer. The layout of the main components on the underside of the chassis is illustrated in Fig 2.



Alignment Information - H.F. signal on aeri			
Tuning of:	Wave Band	Dial indicator	
I.F Transformers	M.W.	550M	
Long Waves	L.W.	175kHz	ca. 270 kHz
Medium Waves	M.W.	600 kHz	1400 kHz
Short Waves	S.W.	6 MHz	ca. 11.8 MHz

Note: The numbering of the tags shown on the circuit differs from the actual (factory fitted) autotransformer in my set and another. Using the picture and tag numbering from the Radio Servicing Data Sheet, the above diagrams show the connections & voltages of the tags as found.

Fig 1: Unitra 'Figaro Special' circuit

The cabinet:
The high gloss lacquered mahogany veneered ply cabinet had scratches and dings, but was basically sound and the dial was in nice condition. Rather than strip the lacquer on the cabinet back to bare veneer, I flatted it down to remove the blemishes using 0000 grade wire wool, then sprayed it with several coats of clear polyurethane aerosol lacquer, flatting each coat until I was satisfied with the finish. The corners of the plywood cabinet were made by a low-tech process known as 'kerfing' whereby saw cuts were made on the reverse side of the ply almost all the way through, to enable the ply to become flexible and to be bent to shape. (see Fig 3). The same technique is used by carpenters to bend skirting boards around bay windows. Almost all other cabinets I've seen - from UK manufacturers for example - appear to have been bent using steam and a vacuum press.

Safety considerations:
The design has some safety shortcomings, but perhaps no more than other makes and models of live chassis valve sets of yesteryear. My approach to restoration is that safety comes first, functionality second, and originality third. There were three safety concerns that I had, which I corrected during restoration. Most serious was the factory fitted single-insulated non-polarised twin mains flex, so without a continuity check, there's a 50/50 chance of the chassis being live. I fitted a new double insulated colour-coded mains flex. Secondly, the flimsy plastic knobs are held on with spring clips and simply pull off, which could expose live tuning and volume control metal shafts. Hence, I decided to fill the hollow knobs with two-part epoxy, drill them out to 6mm diameter and fit 4BA brass grub screws, sealed with wax. (See Fig 4) The external aerial socket is isolated by a 470pF paper capacitor, which - if it failed and the chassis were to be live - could make the external aerial socket live and the aerial too, if connected. Unlikely though some may consider this eventuality to be, I replaced the capacitor with a 500V rated X class disc ceramic one.

The set wasn't working when I bought it, and had either the auto transformer and/or output transformer been faulty it would probably have been beyond economic repair, but on checking the continuity of the primary and secondary windings of each transformer, they all tested fine. So far, so good!

An initial check with an Ohmmeter at the mains input wasn't hopeful as the set was open circuit. I checked the internal 0.4A fuse and saw that it was intact. However, on removing the fuse, I noted that it - and the clips on the fuse carrier - were very tarnished. On cleaning those it restored their continuity, but then the double-pole mains switch ganged to the volume control was found to be open circuit, so I fitted a new potentiometer.

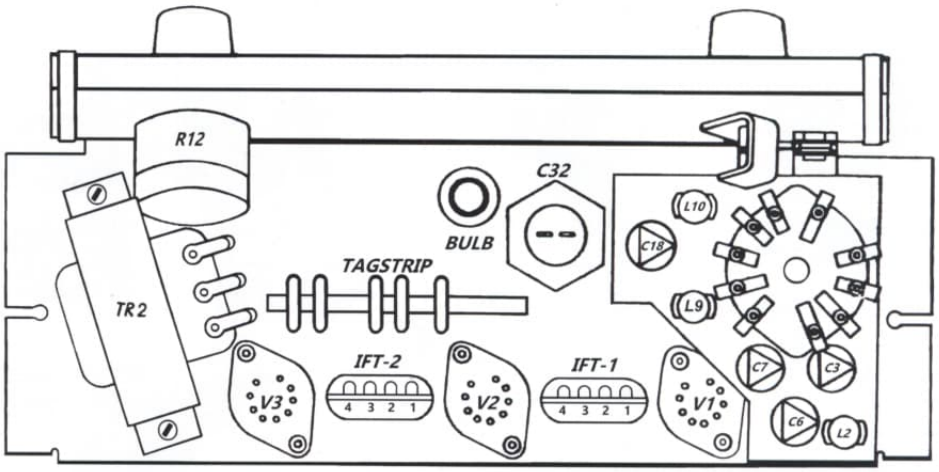
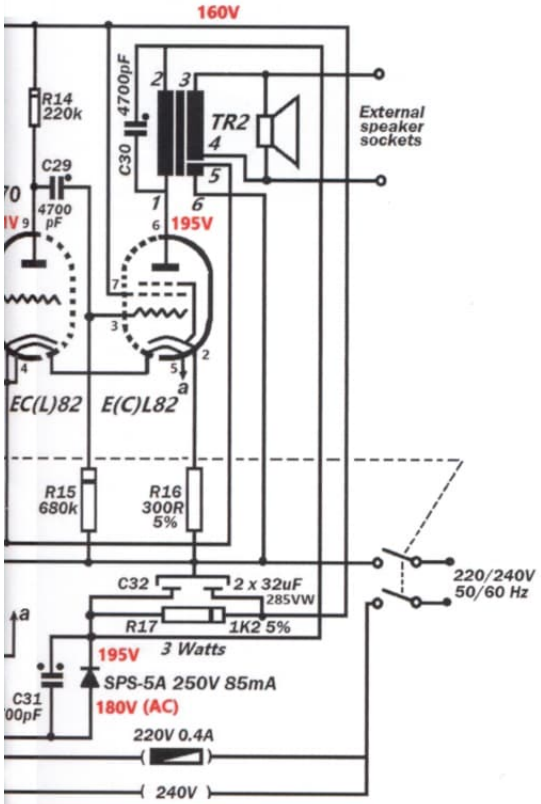


Fig 2: Chassis underside component layout


Fig 3: 'Kerfed' bends on cabinet corners

Dismantling the set:
Care is needed when removing the chassis from the cabinet as damage can easily be caused to the fragile and irreplaceable forked Bakelite wave-change slider on the side of the cabinet, which must first be removed. To remove the slider, the wave-change switch must be set to the central (M.W.) position. Inside the cabinet there is a forked thin-gauge spring steel tensioning clip which should be pulled off with thin-nosed pliers. The Bakelite slider - which engages with the wave-change switch spindle - can then be pulled out. There is a slotted thin gauge steel flat retainer strip inside the cabinet which will fall free. Figs 5 and 5a shows the wave-change slider components to make this clearer. The four Bakelite headed screws on the underside of the cabinet can then be removed and the wire aerial around the inside of the cabinet can be left in place if unsoldered from the rear of the aerial socket.

With the speaker leads unsoldered, the chassis, complete with the tuning dial, can be then be withdrawn from the set. Care is



RAM RE ACTUAL TAG NUMBERING!!

ocket via 100pF capacitor.		
Measuring frequency	Tune	
465kHz	L8,L7,L6,L5(maxout) L1:(min ouput)	
kHz	270 kHz	L4 C7
kHz	1400 kHz	L10,L3 C18,C6
Hz	11.8 MHz	L9,L2 C3

dm David Taylor June 2016

Fig 4: Spring–clip removed, knob filled, drilled out to 6mm, and a 4BA grub screw fitted in the side.

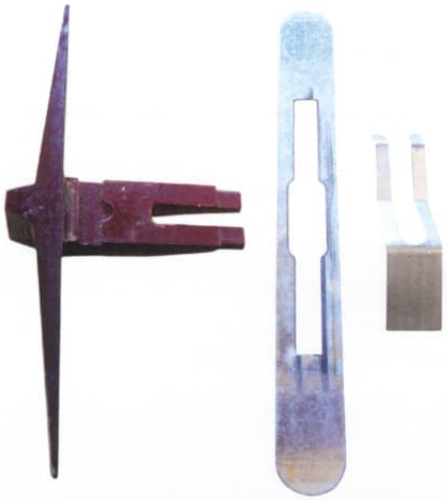


Fig 5: Wavechange switch components

Fig 5a: Wavechange slider on cabinet side

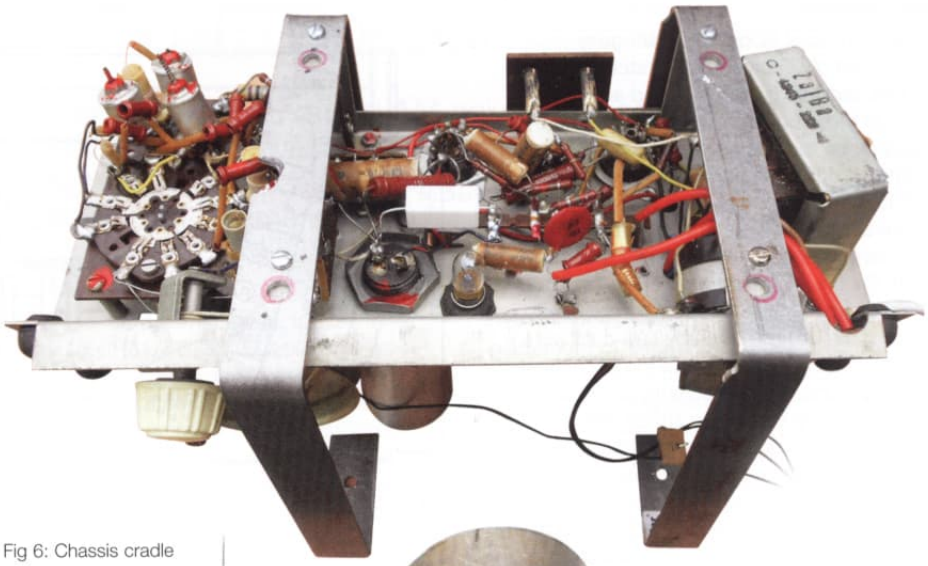


Fig 6: Chassis cradle

Fig 7: Smoothing capacitor ready to stuff

needed when placing the chassis down on the bench as the beehive trimmer capacitors in the aerial and frequency changer stages protrude beneath the unsupported chassis and are easily damaged. To work on the underside of the inverted chassis I made and fitted two flat steel brackets to act as a 'cradle' to support the chassis. (Fig 6)

On examining the set and the circuit it became obvious that the 1.2kΩ HT load resistor (R17), which fits between the two sections of the reservoir/smoothing capacitor, was missing, so someone had been there before me! Attempts to reform the twin 32 uF electrolytic capacitor proved unsuccessful. The can was small in size – 25mm diam x 75mm tall - and fixed with a large nut at the base. I wasn't hopeful that I could source one of similar size, albeit I did later discover that they could be had from a vintage radio spares supplier in Germany. I set about re-stuffing the can with miniature radial electrolytics with a high ripple rating, which fitted neatly in the can. (Figs 7,8,9,10) I refitted the can and fitted a 4 Watt 1.2kΩ HT load resistor.

As it was my intention to restore rather than simply 'mend' the set, I first checked all the resistors and found three that were significantly out of spec - more than 50% high in value, so replaced them. All of the rest were well within 10% of their stated values. There were six paper caps - mostly .0047uF so I replaced those. As the set is so compact, it's something of a challenge to get at and to replace components. Though it's something of a 'rat's nest', several components are terminated on a tag-strip, which does at least aid testing. (Fig11).

Silence is golden!

On checking at the input to the metal rectifier there was 180V AC from the auto-transformer, and 195V DC at the rectifier output, so the rectifier seemed to be in good shape. I tested all the valves on my Taylor 45D valve tester, and all were healthy so I fitted them into the set, and decided to give it a try. The valves all lit up, as did the dial light, and the HT was healthy at all of the expected points, but not a peep came out of the set. I injected a 1kHz signal into the slider of the volume control - again, not a peep from the speaker. I then applied the probe of my signal tracer to the slider, and with the set on Medium wave, several signals were present, as they were on Long wave and Short wave, so any fault which silenced the set was in the audio stage. Could it be that the speaker was faulty? Yes - it was indeed open circuit.

Given the set is so compact, and the speaker is elliptical - 14.5cms wide, and 10cms tall - I wasn't hopeful of finding a suitable replacement, but an internet search quickly turned up a new one for just £6.00 post free from a UK supplier. The original speaker was 4 Ohms impedance – the replacement was 8 Ohms, but that was no detriment in terms of performance.

The new speaker is designed to be a universal replacement and had a flange with several alternative fixing centres. Using the old speaker as a pattern, I was able to trim the flange to size and the speaker fitted nicely. (figs 12, 13 & 14).

Missing back panel and baseboard:

As is so often the case, the back panel was missing, (where do they all disappear to?). The baseboard – which slides into place beneath the cabinet – was missing too. An internet search turned up a picture of what the missing back panel should look like, so based on that, I created a layout using MS 'Paint' to use as a

drilling template to drill the ventilation holes. With the holes drilled, slots cut, and the new 3mm MDF panel cut to shape, I created a text layout, which I printed onto brown art card and stuck onto the new back. (Fig 15)

I sprayed the new back panel with three coats of clear lacquer to protect the text and was pleased with the result. I also made a baseboard for the set, which has ventilation holes and slides in place beneath the chassis to cover exposed components. (Fig 16) The chassis and the baseboard are held in place with four Bakelite-headed M3 screws.

DM70 magic eye:

This showed no signs of life and on examination, the filament was open circuit. I was able to source a new/old stock Mullard one for just £6.00. The DM70 has four 'flying leads' rather than a conventional base - two for the 1.4V heater, plus anode and grid, so care is needed to correctly wire it into circuit. The connections are shown in fig 17.

Luckily, the IFTs and coils were sealed with wax and showed no signs of tampering. The IFT alignment was spot on at 465 KHz, and the beehive trimmers just needed a slight tweak to peak up and track the front end. See the alignment notes on the circuit page, (Fig 1), the Diagram of the IFTs - Fig 18, and the picture of the beehive trimmers and coils L2, 9 & 10, clustered around the wave-change switch on the underside of the chassis, Fig 19.

Fuse panel problems:

There are three fuse clips on the voltage selector panel to enable either 220V or 240V input to be selected by changing the position of the fuse. As I reinstalled the chassis back into the cabinet I noticed that one of the clips had hairline cracks so I decided to renew all three clips. I made three brass terminals, which I tinned and drilled to accept three PCB style fuse clips. The old and new clips are illustrated in Figs 20 - 23. Although I didn't have to re-string the dial cord, Fig 24 shows the arrangement. Fig 25 shows the above chassis view, which only required replacement of C31 - a .0047uF capacitor across the contact cooled metal rectifier, which for now at least, is still behaving itself, but I guess is living on borrowed time. If need be, there is space inside to substitute a 1N4007 and series resistor at some later stage. Fig 26 shows the completed set.

Performance of the set:

The set was quite lively on its internal aerial, but even on stations at good signal strength, the magic eye varied only slightly. Off tune, the voltage on the grid of the DM70 was -0.45V, and on tune, was -0.75V. However, just a few metres of wire plugged into the aerial socket greatly enhanced signal strength. When on tune, the grid voltage of the DM70 then varied from -4.0V to -9.0V and the display responded accordingly.

For such a small and simple set, it involved a lot more restoration work than I'd initially imagined, but the end result is an attractive little set which performs well on all three bands, with a pleasing sound.

Fig 8: The can ready to be sealed up

Fig 9: The Ground connection tag

Fig 10: The finished can

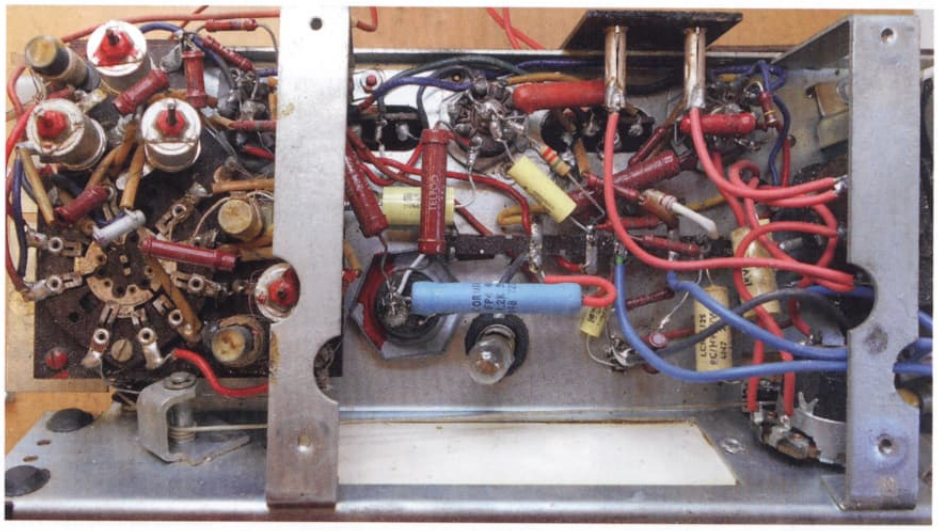


Fig 11: The restored chassis

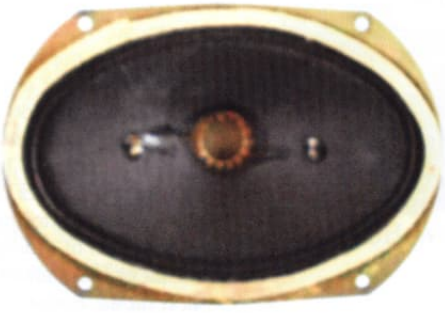


Fig 12: The original speaker

Fig 13: The new speaker

Fig 14: The new speaker installed

Fig 15: The new back

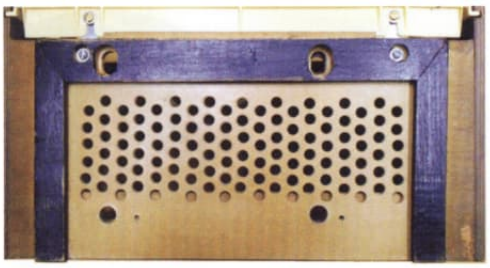


Fig 16: The new baseboard

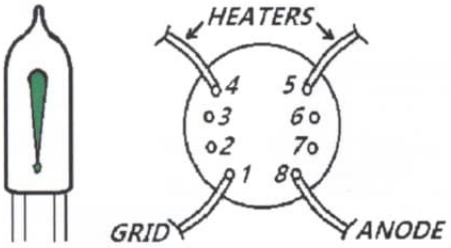


Fig 17: Magic–Eye connections

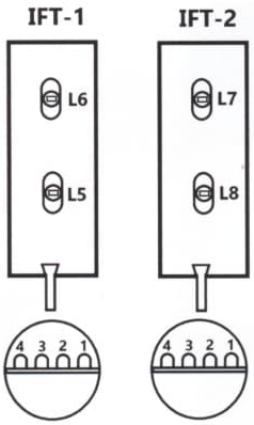


Fig 18: IFT connections

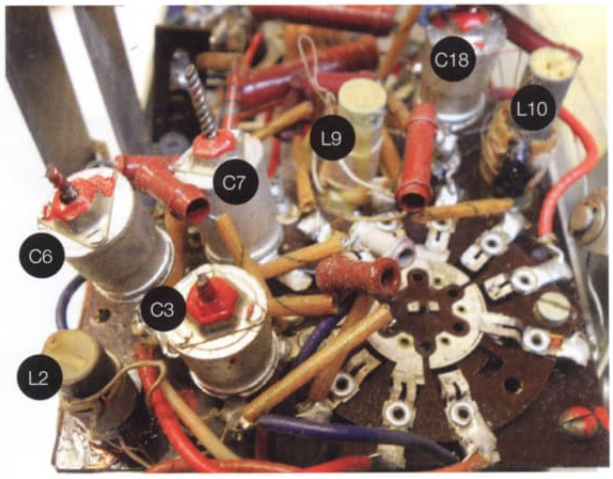


Fig 19: Locations of coils L2, L9, L10, and beehive trimmers

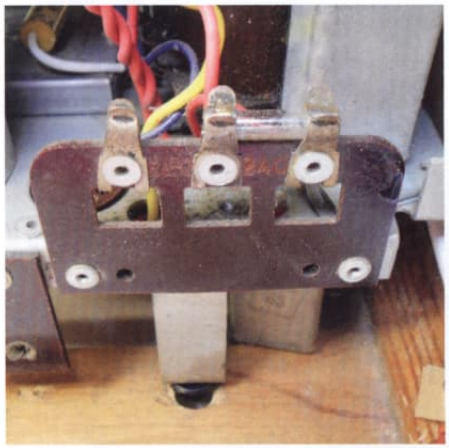


Fig 20: The broken fuse clip (right hand side)

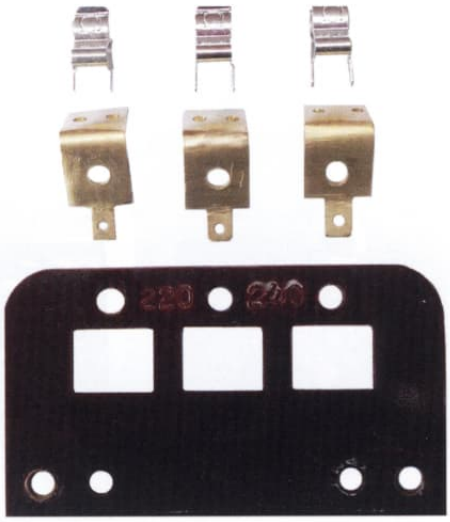


Fig 21: Fuse clip replacement

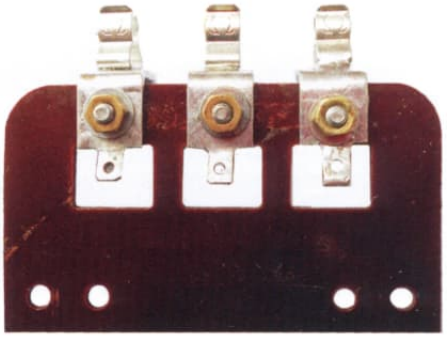


Fig 22: Fuse clip repaired and installed

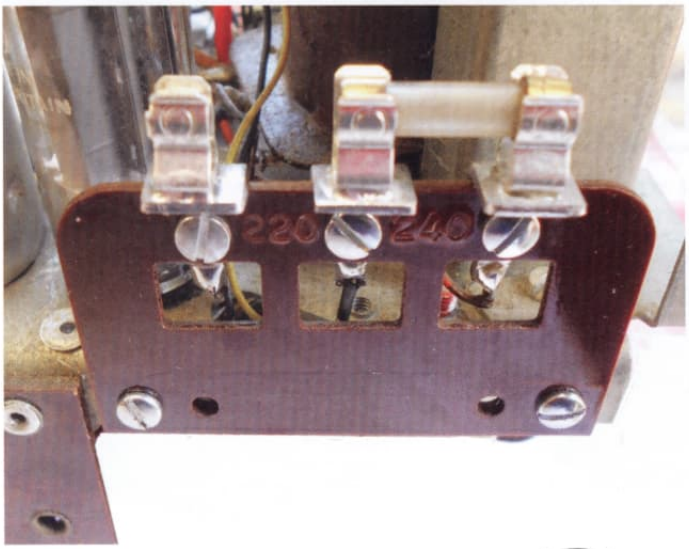


Fig 23: Fuse clip repair completed

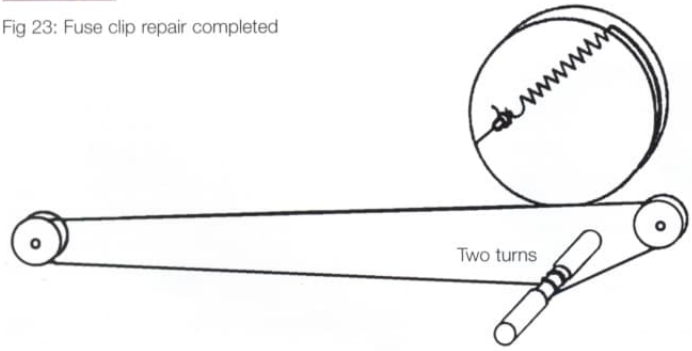


Fig 24: Drive cord stringing

What was the Unitra Union?

I was curious as to who 'Unitra' was, so I searched the internet to glean a little more information. I discovered that the company who actually manufactured these sets was the Polish Zaklady Radiowe Kasprzaka company, which has its origins in the Wola district of Warsaw, and was founded in 1951 in the old Philips Wola manufacturing plant. The company was named after Marcin Kasprzak, a Polish revolutionary who was hanged in 1904 for killing four policemen a year earlier but was later martyred by the communist government of post-WWII Poland.

The ZRK company started manufacturing radios to its own designs in 1953 and introduced Poland's first commercially manufactured tape recorder in 1958 and the first car radio receiver a year later. ZRK was also a pioneer in the research, development and production of ferrite materials from the mid 1950s. Their tape recorder products became quite well known in the West during the 1960s due to their keen price. In the late 1960s the entire production of radios was transferred to Diory and ZRK specialized in the production of tape recorders, portable cassette players and tapes. Some of them sold under their own ZRK (Primarily in Eastern Europe) or ZK names, but more frequently as an OEM producer with products sold under a variety of names including Marconi and Ferguson. Some of these tape recorders were designed by the German company Grundig and in the 1970s, when open reel tape recorder sales began to slow, Grundig, moved their production from Germany to the ZRK factory.

At some point in the 1950's ZRK became part of 'Unitra' - Union of Electronic Industry but in the West, their products mostly continued to be branded ZRK until the foundation of PHZ Unitra in 1972. From then on, most of their consumer products appeared under the Unitra banner. From the early 1970s it produced VCRs, and in the 80s "tower". Music centres. At the end of the 80s it produced the first Polish 'walkman' - the PS 101 Kajtek. The

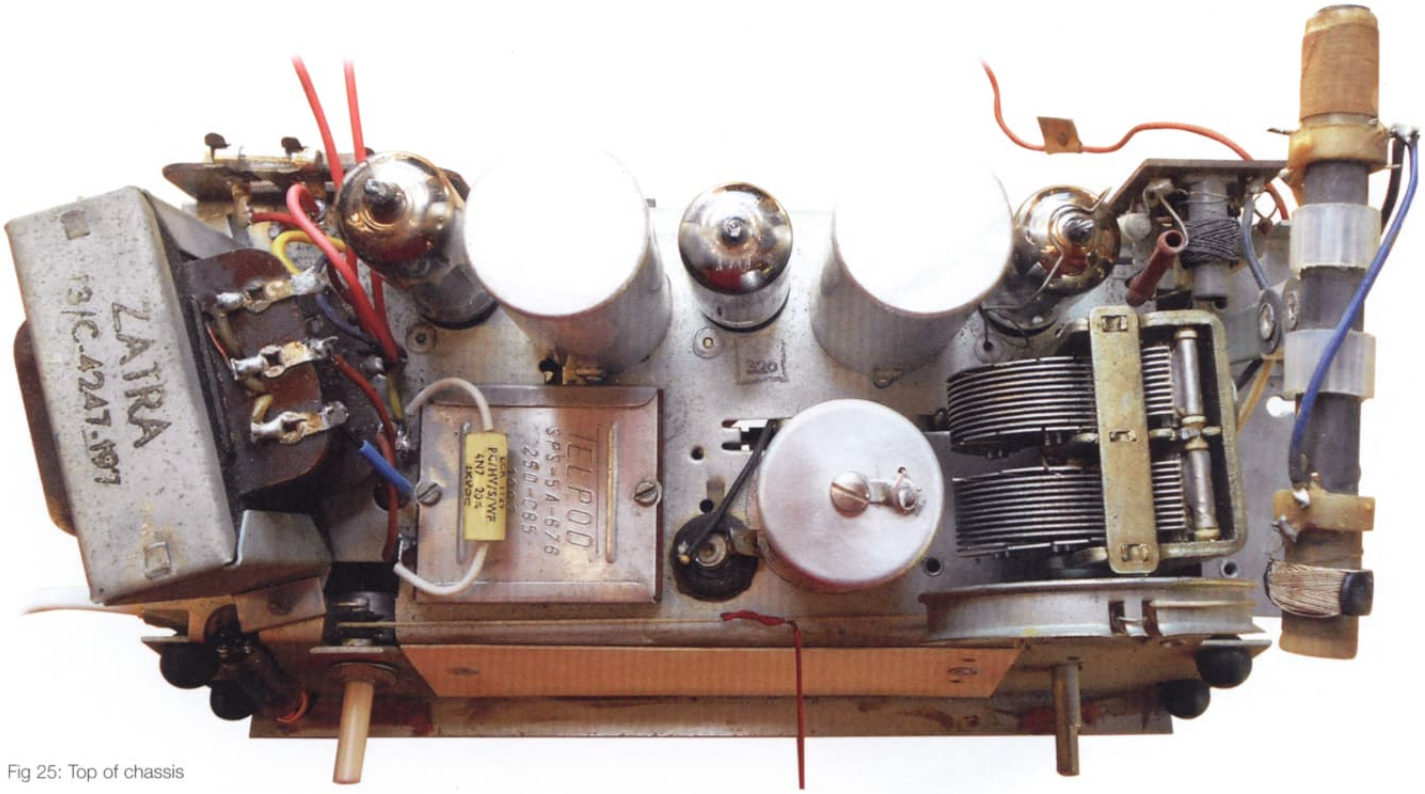


Fig 25: Top of chassis

company was liquidated in the early1990s as it was unable to compete in a market economy. The old factory has since been refurbished and turned into an office block.

The Unitra Union comprised the bulk of Polish consumer electronics manufacturers and by the late 1970s had more than 20 member companies employing more than 50,000 people in total. It operated almost 100 factories and in the budget sector of the market between 1972 and 1979 they manufactured 72 million radio sets for Instancek. I suppose that the Unitra Union can be likened to the part nationalised British Leyland Motor Corporation in the 1970s, which at that time accounted for 40% of the British motor industry, in 40 plants across Britain.

It may surprise some to learn that at its peak in the late 1970s - early 1980s, the Unitra Union was mostly an export company. It sold to the West, and was particularly strong in selling electronic components in Western Europe, loudspeakers in France, and for a time it sold them to the USA and a few other export markets. All told, the company was exporting to over 80 countries. Unlike other East European companies that designed their own equipment, Unitra licensed most of their more complex CE designs from foreign companies and used a lot of specialised Western manufactured parts. Unitra was privatised in the early 1990s. It still exists, though primarily as a holding company.

Acknowledgements:
I'm indebted to Howard Craven who had earlier restored one of these sets and had written a helpful write-up on the UK Vintage Radio Forum in 2012, and to Gary Tempest, for his advice and encouragement.

Fig 26: The finished set

Links:
'1967 Unitra Figaro Special AC mains MW/LW/SW midget table radio' by Howard Craven:

www.vintage-radio.net/forum/showthread.php?t=88284&highlight=Unitra+Figaro
Altai General Purpose 4W 8 Ohm Elliptical Speaker - 4.00 x 10.50 x 15.50 cms:

www.yourspares.co.uk/manufacturers/altai/parts/ys117258/altai-general-purpose-elliptical-speaker-4w-8-ohm-L001.aspx

A glasshouse for a Defiant

by Mark R James

This project continues the theme of my previous one ("A Dragon of a Nixie" Vol. 40/2) in that it evolved from an unplanned auction opportunity. Constructional photographs are a little limited as the request to write up the techniques was received after completion! However, this article should enable any radio enthusiast to follow in my footsteps.

The item of interest on this occasion was a Defiant MSH248 which was said to have come from a wireless retailer who had been shut for many years. It was thought to be N.O.S. and the chassis (actually an Ultra U506) was immaculate with the appearance one would expect straight from the factory with a full set of mint condition original valves. The case it was in had, however, sustained some damage. After successfully bidding for the item I then considered what to do with it. I have had numerous visitors who have wanted to see the working innards of a valve radio and a glass case would fulfil this need and also show off the lovely chassis. Safety from straying fingers was also a consideration. The radio had to sound OK so would require a wooden baffle and the concept of a wood/glass composite case was born. I have made all the house doors in a traditional fashion with oak boards pegged with tree nails so a matching design would be in keeping, and more acceptable to the authorities if it was to be on permanent display.

One of my concerns was that the chassis may have been a "return" that the dealer had been unable to repair. However, restoring the chassis to working order was straightforward. The wax capacitors were all leaky and therefore replaced by re-stuffing and dipping in wax to maintain the original appearance. For the wax I used reclaimed wax topped up with pure beeswax which, as beekeepers, we have in abundance. The former is collected by heating old wax capacitors in a sieve lined with several layers of muslin over a bowl in an oven at about 90°C. If the capacitors are removed from the sieve while hot the innards pull out easily and the outside wipes clean. This also gives a ready supply of the common printed tubes to re-stuff when needed. Heating the wax mixture is best done over water in a bain-marie. (If done directly over heat it can result in a very dramatic fire - I know .... went there when learning how to make beeswax candles!) The ends of the capacitor are then plugged and the whole item dipped 2 or 3 times to give a very original appearance. A couple of resistors had gone high and the switches required cleaning. It then worked as well as could be expected.

A simple L-shaped wooden base and front was made out of oak off-cuts. The edges were moulded with a router and speaker and dial cut-outs made with a fret saw. The holes for the controls and chassis anchor bolts were marked from the chassis. The grooves in the base for the glass frame were routed. The front and base were held together with tree nails although brass round headed screws could have been used. Photos 1-3 show the process of using tree nails. With a tight fit these were traditionally used without glue. If using a smear of glue a groove for most of the length of the nail is important to avoid a "hydraulic lock". When dry the nails are trimmed to length and the bevel carved. The wood was then spirit stained and sprayed with several coats of cellulose.

I had no previous experience of constructing glass cases and have to confess that I made this up "on the hoof" but it seems to have worked and is straightforward to do. Most people should be able to emulate the techniques to display a radio or project. I wanted the finished article to look professional so the quality of the glass was important. I purchased a sheet of 2mm picture glass from the local glaziers. The milled brass channel of the correct size was sourced via an internet search. Careful measurement

Fig 1: a prepared nail

Fig 2: the nail halfway in

Fig 3: the finished nail in place

Fig 4: Vitrex cutter

Fig 5: Cutout made and bend commenced

Fig 6: mini blow-torch

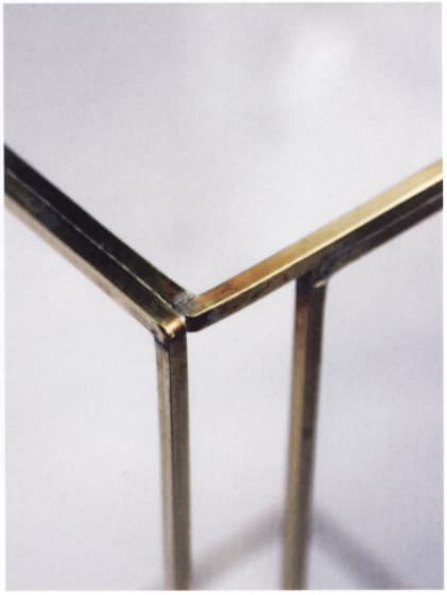


Fig 7: soldered corner detail

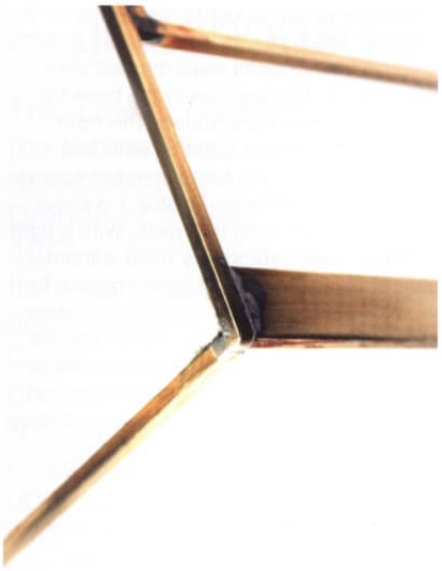


Fig 8: lower bar detail

Fig 9: the completed case

Fig 10: case fittings

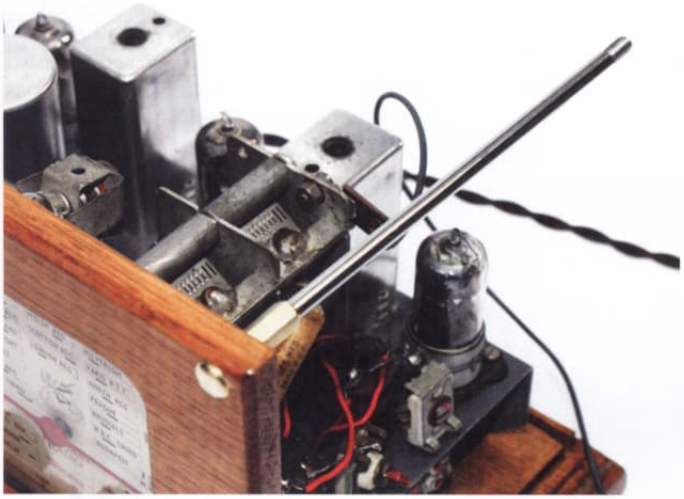


Fig 11: fittings in place

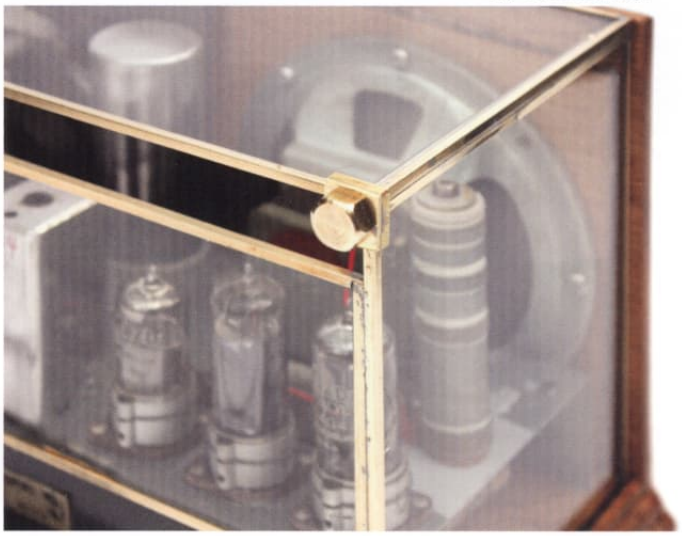


Fig 12: top anchor detail

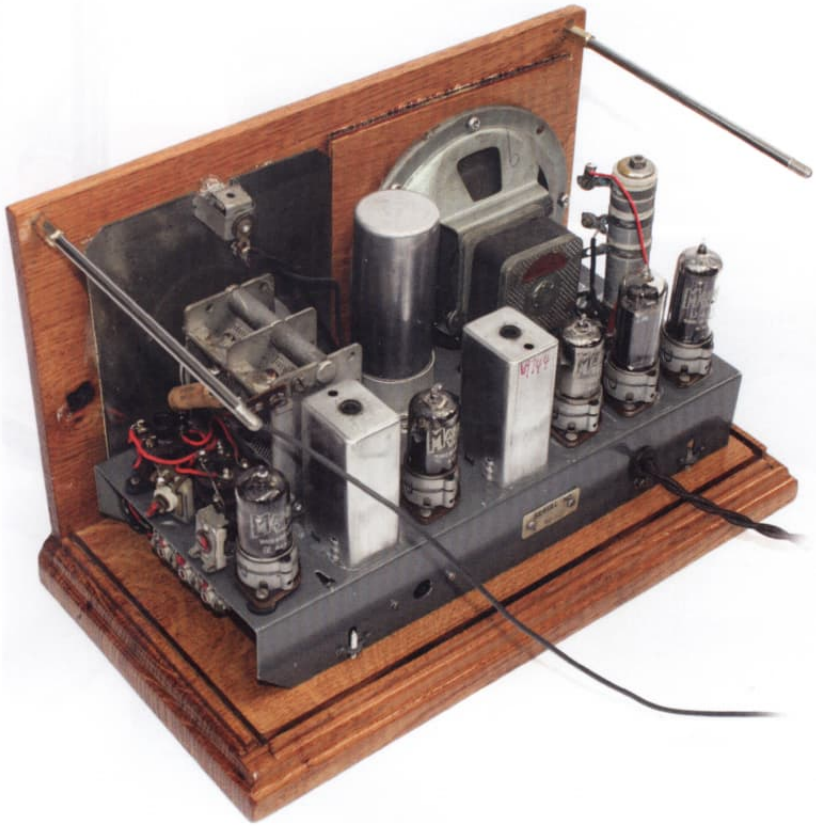


Fig 13: chassis in situ

was then the order of the day. The glass was easily cut using a decent cutter (Photo 4), scoring along a straight edge and then tapping from below with a small hammer. Each piece of glass was cut and framed before measuring for the next. The brass channel required annealing before bending as it had obviously work hardened during manufacture. Experimentation revealed that the best technique for the corners was to cut a gap in the edges of the channel (Photo 5) then heat to a dull red with a mini-torch (Photo 6) and bend. Too little heat and the metal fractured and too long a heat and it also broke presumably due to alteration in the alloy. I used "Baker's" Fluid No. 3 for fluxing. This is quite corrosive but washes off easily and ensures a perfect joint with conventional lead solder. Each piece of glass was framed and the corners soldered (Photo 7). My concern was that the stresses caused by the heat would fracture the glass, but with careful application of heat to the brass this did not occur.

The rear of the case has one narrower piece of glass to give air vents above and below. A piece of 3mm brass bar at the lower edge provides stability to the structure and location in the base

plate (Photo 8). As each piece of glass was completely framed with brass, joining them into the final structure was surprisingly easy. The sides and top were held in place on the base with elastic bands, fluxed and then tack soldered at intervals. The bands were then removed and a seam of solder was run along each intersection. The back panel was then inserted but I overheated it or got it too tight and caused a couple of short cracks. This was a learning point for next time. I could not face complete disassembly to replace the glass so stabilised the cracks with super glue. It is important to use glass specific superglue which is now available not requiring U.V. light to cure. I understand that standard superglue is too rigid and when used on glass tends to cause further fractures due to differential expansion. Photo 9 shows the finished case complete with cracks!

The top of the case is held to the wooden front with stainless steel and brass fittings some of which I made on a lathe (Photos 10-13). This was purely for appearance, economy and pride. Commercially available threaded rod, tube, nuts and washers could have been used.

The case was thoroughly soaked/washed/dried to remove flux residue. The brass was then polished and the glass cleaned. I was concerned that the heat from the dropper or valves would crack the glass but this has not yet occurred.

I am very pleased with the result which has achieved my original aims and the radio certainly provides a talking point. Anyone up for a TV in a glass house?!

Pictures from the special auction at Royal Wooton Bassett by Greg Hewitt

Eyes down – full house!

HMV 904 5" TV/radio 1939

British, American, and French sets

Lafayette, KB, Ultra, and Emerson sets

Ekco AC97 and Gecophone BC2001

KB 'Royal Star' in rare red cabinet

Early colour televisions - now quite collectable

Is your equipment radioactive? by Richard Shanahan

To many the question would seem like an introduction to a joke, but to others a serious question. I have known about the subject for many years, mainly concerning the luminous dials on watches. My first watch, a Smiths 'Empire' wristwatch (forty two shillings and sixpence) was a gift from my gran for my 12th birthday. It had a luminous dial.

I wore it for many years and had it repaired twice as it would lose time after a while. When I tested it on my Geiger counter it pushed the pointer close to the 80 mA mark! Like many, I was unaware of any danger until much later in my teens. I knew that luminous materials, usually radium were comparitively harmless when behind the watch–glass.

Around the late 1960's to the 80's, a number of tragic accidents occurred, mainly on the American continent. During WWI the US Radium Corporation produced 'Undark', a high-tech paint which allowed America's infantrymen to read their wristwatches and instrument panels at night. Most of the work in applying the paint by a fine brush was done by women. They were required to paint delicate lines with fine-tipped brushes, applying the Undark to the tiny numbers and indicator hands of wristwatches. After a few strokes a brush tended to lose its shape, so the women's managers encouraged them to use their lips and tongues to keep the tips of the camel hair brushes sharp and clean. The glowing paint was completely flavorless, and the supervisors assured them that rosy cheeks would be the only physical side effect to swallowing the radium-laced pigment. Cause for concern was further reduced by the fact that radium was being marketed as a medical elixir for treating all manner of ailments. Many women had early deaths from ingesting the radioactive paint.

There were other cases where an entire town was discovered to be radioactive by a passing scientist who happened to have his Geiger counter on whilst in a moving bus! It was due to a local factory which had been leaking radioactive material over a period of time.

Another case, involving a caesium-137 sourced blood irradiator occurred in September 1987, in Goiana, Brazil.

A Mullard MX133, mounted on an octal base with an accompanying data sheet (below Fig. 2)

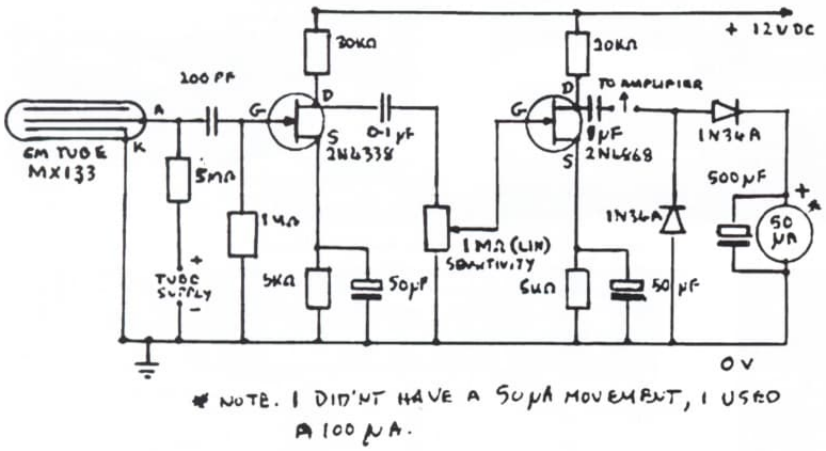


Fig.1: The circuit as found in the book.

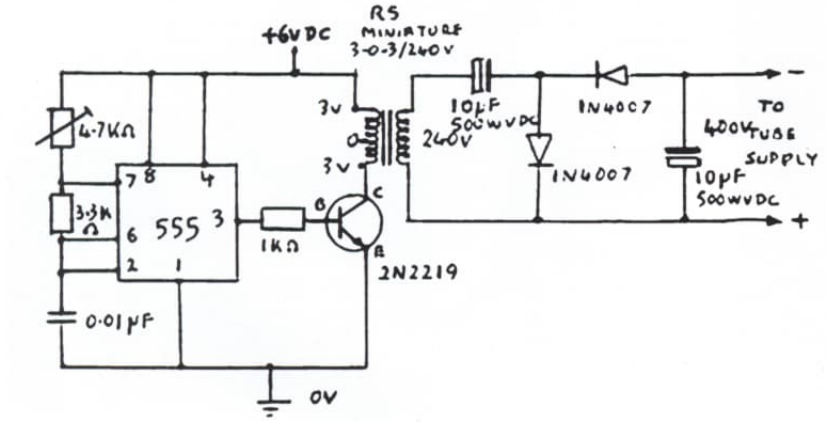
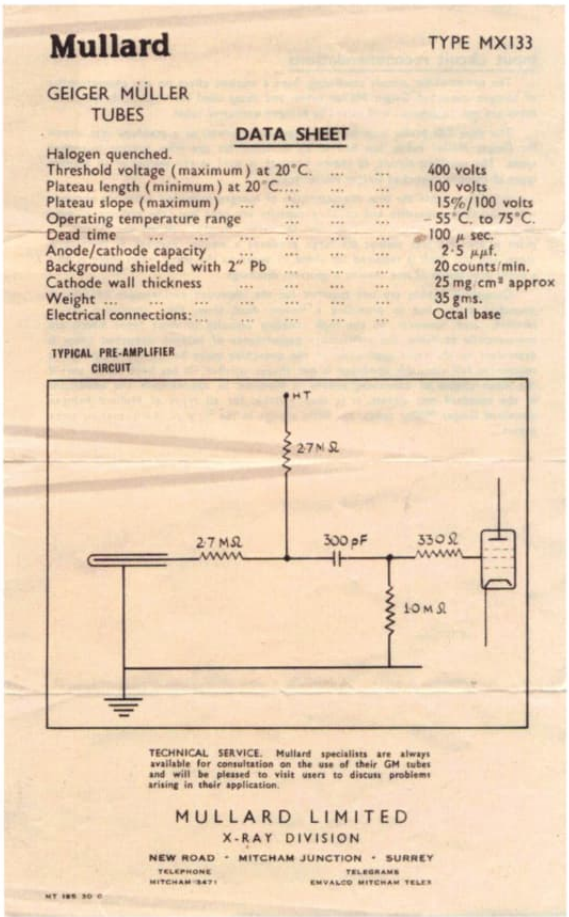


Fig.3: The HV supply to the tube



Mullard TYPE MX133

GEIGER MÜLLER TUBES

DATA SHEET

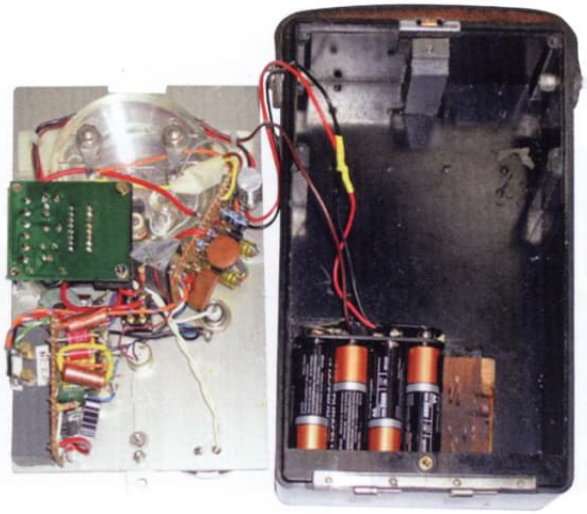
Halogen quenched.	
Threshold voltage (maximum) at 20°C.	400 volts
Plateau length (minimum) at 20°C.	100 volts
Plateau slope (maximum)	15%/100 volts
Operating temperature range	– 55°C. to 75°C.
Dead time	100 μ sec.
Anode/cathode capacity	2·5 μμf.
Background shielded with 2" Pb	20 counts/min.
Cathode wall thickness	25 mg cm² approx
Weight	35 gms.
Electrical connections:	Octal base

TYPICAL PRE-AMPLIFIER CIRCUIT

TECHNICAL SERVICE. Mullard specialists are always available for consultation on the use of their GM tubes and will be pleased to visit users to discuss problems arising in their application.

MULLARD LIMITED
X-RAY DIVISION
NEW ROAD · MITCHAM JUNCTION · SURREY
TELEPHONE MITCHAM 3671 TELEGRAMS EMVALCO MITCHAM TELEX

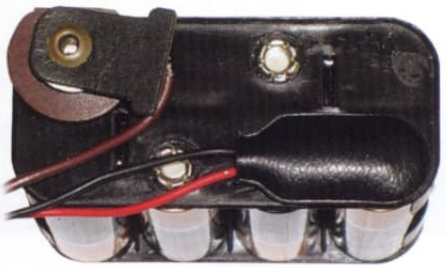
Fig.2: Mullard MX133 data sheet



Left: The geiger counter in it's case, which was purchased at Harpenden for a Pound

Above: internal layout. The lower left hand side has the oscillator components, transformer, and voltage doubler. The right hand board is the counter circuit. The inverted board is the Maplins amplifier.

Below: The battery supply using 12v for the counter-circuit, and 6v for the oscillator



A group of scavengers raided an abandoned medical centre and found a small lead canister, later selling it to a scrap yard. An employee opened the container to discover a radiant, blue, glowing dust. The dust was caesium-137, the same highly radioactive material used in blood irradiators throughout the world. Over the next week, children and adults rubbed the substance on themselves because of the sparkle and the dust passed from home to home eventually contaminating 244 people, 54 who ended up in hospital. In addition, several medical personnel and emergency workers, as well as their clothing and instruments, were contaminated. Within one week, four of the first six people to handle the caesium had died from pneumonia, blood poisoning and haemorrhaging. The accident contaminated everything from people to homes, businesses, soil and water. Those objects and structures that could not be decontaminated were dismantled or collected and stored in concrete drums as nuclear waste.

Like many involved with radio I had one with a Iminos dial - an RBZ S marine receiver prchased for £4 17/6 from Reldaradio in the early 1960's. I possessed one or two other items, a marine compass and an aircraft altimeter. This last object alerted me to the possible danger involved when my son took it to school to show it to his science teacher, who tested it with a Geiger-conter and promptly told him to take it home and store it in a safe place!

The piece of equipment which prompted me to make a Geiger-conter was a WWII Japanese radio from a Mitsubishi bomber (see my article in The Bulletin, issue 34, 2009). I contacted a group who specialised in military eqipment, who asked me to check the dials for radiation, luckily the set was safe! I decided to make a Geiger-counter anyway.

Construction

The first thing was to locate a circuit. My college technician had a wonderful book, containing the one in figure 1. The appropriate tube was obtained from Langrex for £63.45 including VAT in 2008. It is a Mullard MX133, mounted on an octal base with an accompanying data sheet. The circuit should present no problems, the HV supply to the tube might (Anode is pin 3, K pin 8), again, I looked in the book, the result is illustrated in Figure 3. The chip was easy, the transformer not so. I thought 'why not try a conventional one?' Ie 240/3-6 Volts reversed? This is followed by a voltage doubler. With this arrangement I get 400v DC. The transformer is an RS miniature, 3-0-3/240V.

The case came from a BVWS stall for £1, it was originally used to test a number of voltages. The meter was o/c, with modifications everything fitted. The wiring and housing details are left to the constructor. I fabricated a protective covering with a rotating window for the valve. I used a couple of pieces of veroboard. The Maplins amplifier (3W) comes as a kit.

The photograph on this page shows the internal layout. The lower left hand side has the oscillator components, transformer, and voltage doubler. The right hand board is the counter circuit. The inverted board is the Maplins amplifier. I added this for speaker output, the original circuit shows an earpiece. I have used these amplifiers a couple of times. The output drives a telephone earpiece, which fits in the lid space. I used a very small meter for the battery condition, with a suitable dropper across the 'switched' side of the on/off switch.

Power supply

The battery supply needs some explanation, as the counter circuit needs 12v, and the oscillator 6v. I decided to use a battery holder for eight AA batteries tapping off at 6v. If you try to solder connections to these holders, the plastic is often damaged. I obtained the tapping by cutting in half a PP3 connector, the normal PP3 connector is then used for the full 12v.

Setting the frequency of the SSS

I am aware of the frequency limitations of a mains frequency transformer, frankly I was surprised at how well it works! I 'breadboarded' the supply, adjusting the 4.7kΩ trimmer to give the maximum output. I found this for my transformer/ circuit, was 60 kHZ for a 400v output.

Calibration

Far from being familiar with radiation physics I decided to take advice from a friend. When we both worked at NPL Teddington, I could have my counter calibrated. As a private customer I would now have to pay serious money!

Using my friend's counter with my gran's watch present we got a count of 90 at 100μA at a distance of about a foot at maximum sensitivity. I thought that this was a reasonable calibration. Above 100μA, switch to a lower sensitivity and then evacuate the area!

Use and summing-up

Unless you have a source nearby that radiates, the occasional click and a reading of one or two microamps will show the background radiation nearly everywhere. Tests on my RBZ radio mentioned earlier in the article showed it very active, it is now in a safe place.

If you do have an old watch with luminous details, you may be surprised at its radiation level. A Geiger-counter may save you from radiation damage.

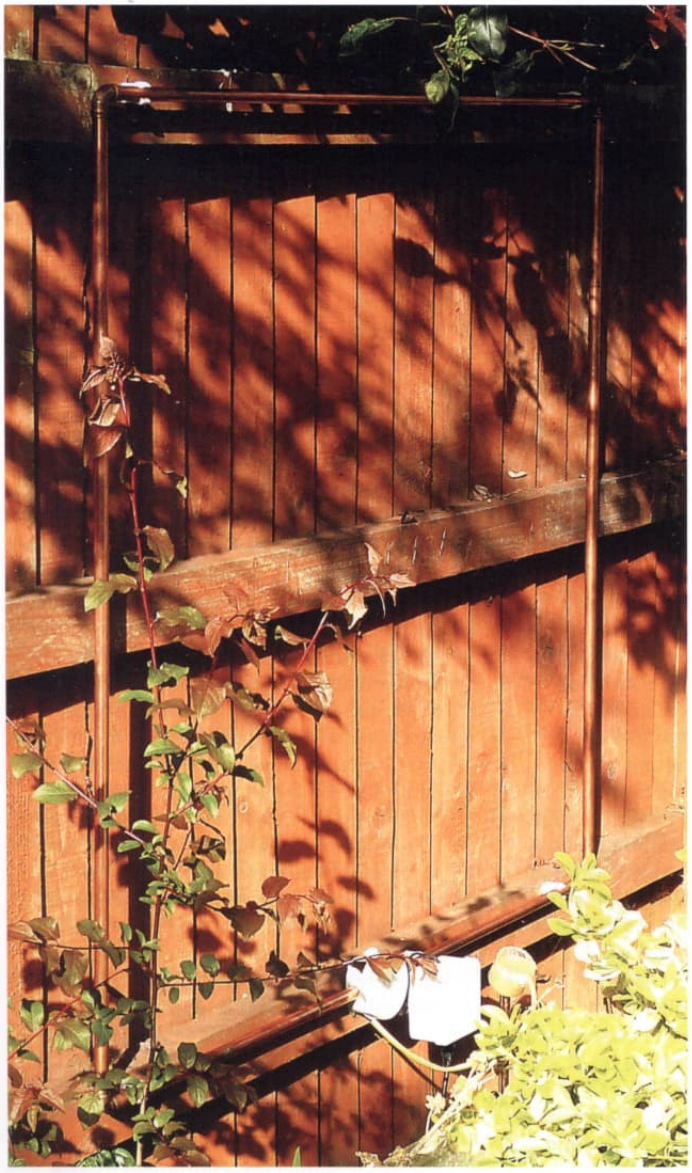
Reference 1: Langrex, Unit 4, Daux Road, Billinghurst, West Sussex RH14 9SJ

Reference 2: Maplins 3w amplifier K8066

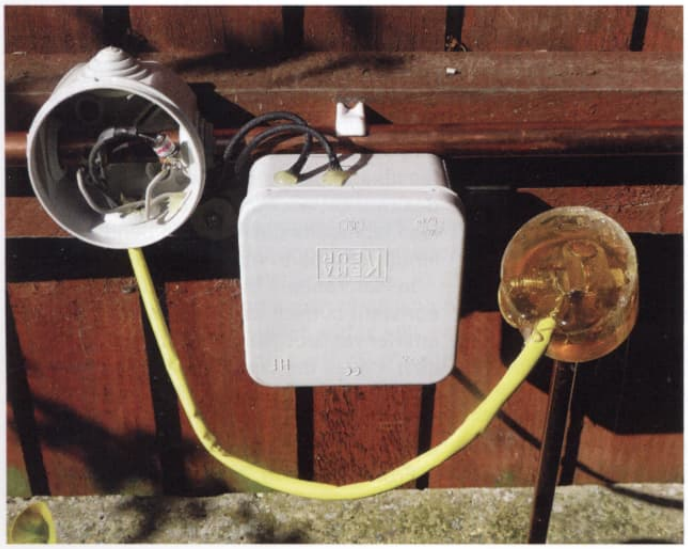
Pictures from the garden party at the British Vintage Wireless and Television Museum, West Dulwich by Carl Glover and Ken Brooks

Magnetic loop aerials (or loopy about loops) by Gary Tempest

I have aerials for the lounge and dining room but needed something in the upstairs Den. This is a display area, main computer room and is also my electronic workshop with a tiny bench and a test gear trolley; it's smaller than I would like but I get by. Had I known that I was going to get so involved with the hobby I would have had a proper garden workshop erected; seems too late now.



Loop and final amplifier in service



The loop connections and Earth stake

To test restored radios of course an aerial is needed. This used to be the aluminium frame of secondary double glazing. However, it was replaced with a UPVC window and I had been making do with a length of wire strung around the room. Obviously reception was very poor. The options for something better were a garden long(ish) wire, ("Oh! No! Not another one", from my wife), a wire in the loft or a loop. For me, a multi-turn, frame aerial with tuning were not what I wanted; just something that plugged in the back of the set in question would be ideal. At about this time the topic of magnetic loop aerials came up on the Golborne Vintage Radio Forum (GVR) and sounded like what I needed.

It's surprising that in more than a decade I have been around the hobby, I have not taken an interest in these aerials before, although I had read odd bits about them. Of course, being me, I jumped right in and started building before doing a comprehensive Internet search. But perhaps if I had it might have put me off trying to get very far as it can be bewildering. There are quite a few for sale, often at high prices, but nearly all are unsuitable for domestic radios as they concentrate on SW bands, by 'hams' using exotic receivers (and the text is written in their jargon). Even ones suitable for domestic radio listening, might have made me believe that making relatively simple set ups, that had surprising performance, was beyond me with limited test equipment: it was good that my Web search was mainly retrospective.

A little theory

A loop responds mainly to the magnetic part of the radio wave rather than the electric. It has the property of reducing mains radiated interference, as noise has been shown to have a significant vertical component.

A magnetic loop is directional to an extent that depends on the balance of the loop, the waveband (in my experience) and the Amplifier. This is needed because signal is lost but with good amplifier design, overall a higher S/N ratio is achieved. The vertical components of the loop, round or square, pick up identical signals if directly facing the radio wave of interest and cancel out. Signals that arrive edge on to the loop, because of its small size compared to the distance to the radio transmitter, will be at the same strength but will arrive at one side before the other. These results in a phase difference between them and will produce a difference signal at the loop terminals. This tiny difference is what the Amplifier has as an input.

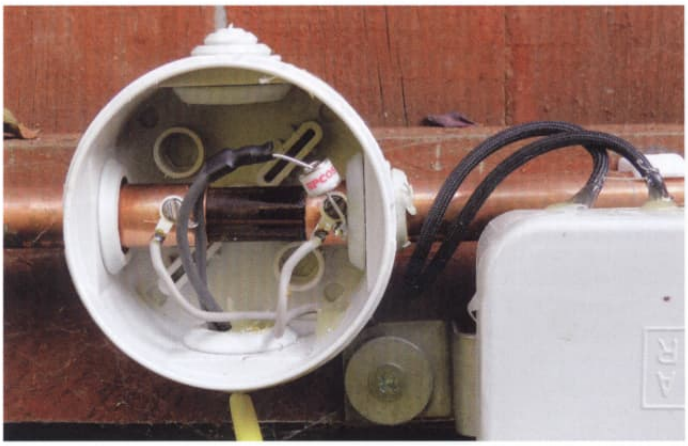
This is a very brief explanation but a more comprehensive description is given by S.A. Money, Practical Wireless, April 1973 (Reference 1).

The author also describes how the amplifier has to deal with the so–called Antenna Effect. "*Unless the aerial is exactly balanced electrostatically with respect to earth it will act as a normal vertical aerial. ... such an aerial picks up the signal at equal strength from all directions in the horizontal plane. Now when the aerial is broadside on to the radio wave the vertical components will cancel out as before but the horizontal components will remain constant. ... This results in the loop not having a perfect null pattern.*

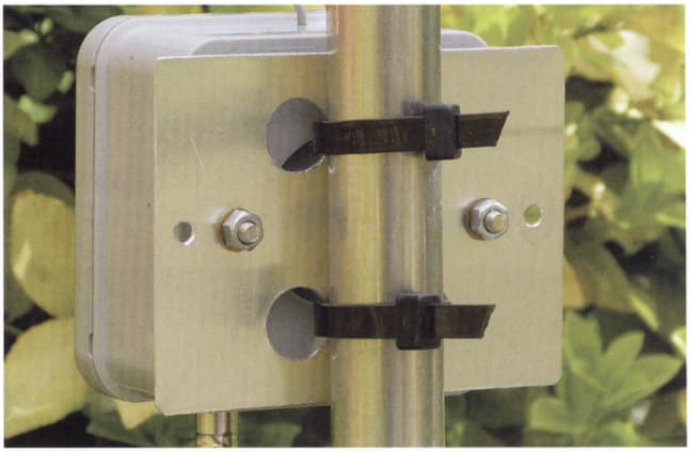
For a deeper and mathematical treatment of loops, single and multi-turn, then see the article at 'SID Monitoring Station', Reference 2. The expression for loop output voltage shows that the things we can influence are: area, the number of turns and also frequency. For a magnetic loop there will be only one turn and the frequency will depend on the waveband being used. Note that the cross sectional area of the material used for the loop is not part of the equation.

My first loops and amplifier

The design of the amplifier is given in Reference 3 and the circuit repeated here. It's very simple to construct and I made mine using the Manhattan technique, a construction method not requiring a through-hole printed circuit board and well described in Reference 4.



inside the junction box



Possible pole and fence mount

The first loop ("Test Loop") was made using just a length of 20 SWG wire strung around a metre square frame leant against the window pane. For a first crude attempt I was astonished at how good it was; with refinement it would make a good Den aerial. The best direction to receive LW R4 was with the flat side of the loop facing north which fortunately is the same direction as that of the window.

The next permanent loop ("Big Loop") was larger and made from 15 mm copper tube, used for plumbing, with solder ring fittings for joining the ends. The horizontals are almost 3m and the verticals 1.3m. I decided to go away from the window frame entirely; as it almost certainly contained metal bracing. The loop top is supported by a curtain rail. The curtains are only dressing for the ends; the good ladies touch. But they hide the vertical pipe runs. At the top of these I have included compression couplers so undo these and the top section can be lifted free and the whole loop can be dismantled in minutes. From the theory the Amplifier needs to be connected to either side of a break in the centre of the bottom or top tube of the loop. The bottom is the most practical and I cut out a one inch section, joining them with a piece of Paxolin tube and self-tapping screws. These, with shakeproof washers under the solder tags, also secured the connections from the amplifier (design unchanged). It was mounted below the wooden window sill. Also from the theory I could more easily have made the loop in say 2mm cable.

The performance is very good with a lot more output as expected. Interfering noise was minimal compared to the piece of wire although it could be improved by going around the room switching off local sources such as a broadband cable modem, bench light, temperature controlled soldering iron and of course the computer.

Also on the GVR Thread was a suggestion, by a member, that a ferrite toroid wound as a matching transformer, to the variable but higher input impedance of the radio might be useful and I tried this. It made an improvement on signal level depending upon the radio used from 5 valve Supies to EMI sets with an RF stage and two IF amplifiers. At this stage I was just comparing differences using the magic eye valves on the sets used.

How the Amplifier works

The first thing to notice is that power is fed along the coaxial signal cable. The choke L1 at the radio end stops the signal disappearing into the power supply. For my indoor application I didn't bother with this and just fed 12V separately using Banana plugs and sockets from a regulated 'Wall Wart' supply. Note that there is a shunt diode D2 in case of inadvertently applying the supply with the wrong way polarity.

The DC conditions of the amplifier are set by the base resistors with R4 and R5 returned to the collectors giving negative feedback. This counteracts voltage changes due to say temperature effects and the variation in current gain of the transistors (for my later design I did match these).

The loop, with its difference signal output, is connected to a difference amplifier, better known as a differential amplifier. When the signal on one base goes up the other will go down. This will be the same at the collectors but in the opposite sense for each. If the circuit is exactly balanced one emitter will pass more current and the other less by an identical amount. Thus the voltage across the emitter resistor R8 won't change and it is said that the "emitters will be at AC earth". For the purpose of theory this is just as if they were connected to the negative supply rail. The gain of each transistor will then be the value of the collector resistor divided by the intrinsic emitter resistance *re*. Old hands have a rule of thumb that *re* equals 25/ I where I is in mA. So with the transistors passing 30 odd mA then *re* will be roughly 1 Ohm. The gain will then be 100/1 = 100 or 40 dB. Thoroughly modern designers will say the gain equals Gm (a measure of conductance) times the collector resistance but it comes to the same thing. Gm is given by I in mA divided by 25 mV, the thermal voltage of a transistor at room temperature. For me though it is nicer to visualise a tiny resistor in the silicon comprising the emitter.

The gains of each half will be combined in the primary of T1. Is the gain really as much as the above has indicated? Well it is theoretical, the transistor will heat up so Gm will fall, and there are likely to be other losses and the matching to the coaxial cable is poor and the circuit is loaded by this, which is not a problem for short cable lengths for an indoor aerial. However, for long cable runs of 30 to 50m then the gain is less (by later measurements of around 10 dB). The cable will appear capacitive and in a worst case example a 50m length of cable measured 3 nF whereas a 2m length measured 100 pF. There is no point in trying to get a perfect match to the 'coax' (although I did have a short experiment with this) as it's not matched at the other end and unless you have a communication's receiver with a 50 Ohm input, it will be completely mismatched into a domestic radio. Reflections, at the frequencies of interest, should not be a problem so my eventual aim, for further development, was to get the greatest signal level into the radio aerial input along with the least noise (interference and noise generated by the amplifier which will be dominated by that from the transistors).

At this time and later I made and tried a number of output transformers for T1. There was no difference between 10 or 15 turns bifilar and only a little, just the odd dB, between these and a 16 to 8 turn transformer for possible better matching to the cable. But I would reconfirm this later.

Working with smaller frames for outside aerials

I love a project and so it was irresistible to me to see what I could achieve. Could the basic amplifier be improved to give more gain, to make up for the loss from a smaller loop and that from long lengths of coaxial cable? Reasonable dimensions would be 1m long sides to make a square, to be mounted in the garden, as far away from sources of mains borne interference as possible. At this size it should be feasible to pole mount with a rotator if desired. Or, accepting a couple of dB loss, someone clever could bend a 3m length of tube to make a circular loop.

In Reference 1 the circuit uses a constant current 'tail' in place of the emitter resistor R8. This is beneficial as it makes the amplifier more immune to the common mode signal (signal common to both bases) from the 'vertical antenna' effect mentioned earlier.

From here to boost gain I did try experimenting with a single ended second stage, followed by an emitter follower, which

would allow matching to the coaxial cable but this immediately had problems with high frequency oscillation. Emitter followers are notorious for this especially with ultra fast transistors. It can usually be stopped by a resistor close up to the base but I wasn't happy about it and kicked it out. Better to play safe and anyway I had lost half the gain so I reverted to another differential amplifier similar to the first but without the transistor tail as common mode signal shouldn't be present here.

The two stage amplifier (amp) design and circuit in more detail

Some resistor values have been changed to allow the use of the constant current tail Tr3. Back in the 70's a current mirror circuit would have been possible. This used a dual transistor and being on the same piece of silicon the characteristics would have been identical and remained so with temperature. Now these transistors are virtually unobtainable, in leaded format anyway. This is true of many items, also called "Through hole", which seem to be drying up as the industry moves more and more to surface mounted components. The alternative is Tr3 with its base returned to a low impedance voltage source formed by three diodes. Its voltage won't remain constant with temperature, although the affect of one diode is cancelled by a similar change in the base emitter voltage of the transistor. For the application it's good enough and sets up an emitter current in Tr3 of about 50 mA; less than the original circuit but with two stages I needed to keep the dissipation down.

What I wanted was enough gain, with stability and low noise. The second stage gain had to compensate for the reduction in loop size, about 10 dB plus the loss caused by the cable, another 10 dB. A standard way to achieve low noise is to use a first stage with low gain so this has been reduced by resistors R7/8. Instability happens, particularly with transistors that have gain into the GHz region, and several times I had tell tale signs like hand effects when touching the test equipment I eventually was using (more on that later). The Manhattan construction with an earth plane will help and I included a ferrite bead on the base lead of Tr3 as it is a little like an emitter follower. This acts as tiny choke and adds some loss at very high frequencies dissipated in the bead as eddy currents. It may be unnecessary.

The second stage is much like the original circuit but again has been tweaked to reduce the total emitter current to about 50 mA. A small amount of degeneration has been added by resistors R17/18.

I was now feeding the amplifier power down the cable from a small box with two BNC sockets and inside it the choke and signal coupling capacitor to the radio.

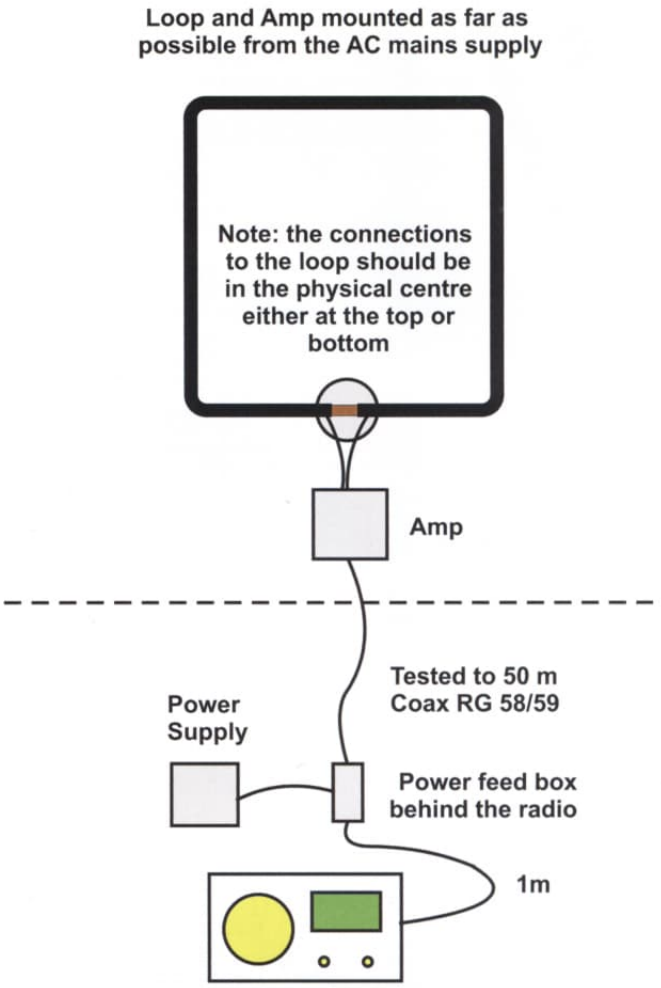
Frequency response and noise (generated by the amplifier)

The parameters governing these on transistor data sheets are called "The small signal characteristics" and they can be confusing and difficult to tie down for an application.

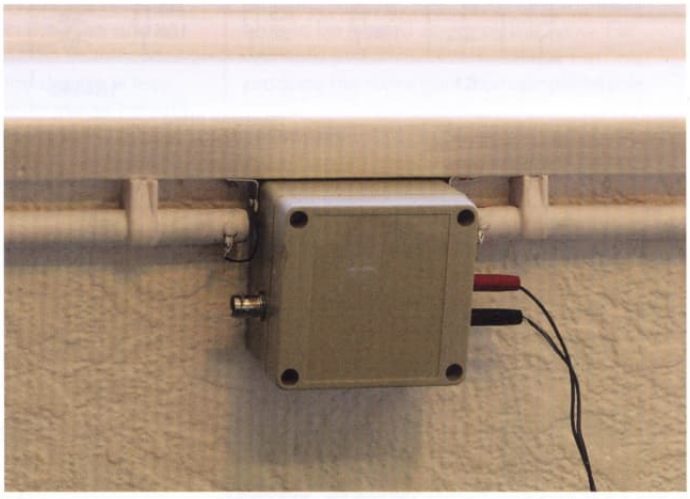
Look at data sheets, for the same device, from different manufacturers and they may use different terms and some are sparse and others a little better. A very good write up on basic transistor theory can be found at Reference 5 by Paul Harden, AmQRP.org. It is soon seen that *Ft* or sometimes *ft* is the important thing to get a feel for and whether the transistors, and how they are being used, makes them suitable for the amp. *Ft* is where the gain of the transistor under specified conditions, which may not be the same as the application, has fallen to zero. A graph, from a Central Semiconductors data sheet for the 2N5109, shows it varies with collector current reaching a maximum of say 1.3 GHz at 50 mA but is only 300 mHz at 5 mA. This is why the circuit uses the transistors at a relatively high collector current.

Most domestic radios cover short wave reception up to a maximum of about 25 MHz and the transistor gain at that frequency can be estimated as *Ft* divided by this. At 25 mA collector current this is about 1 GHz, giving a gain of 40 which sounds reasonable so it was a good device to select and is still available.

Noise figure is given as 3 dB "Typ" with no mention of "Max" (the manufacturers liked to be vague) and is at a collector current of 10mA and 200 MHz, so nothing like the conditions used here but the main thing is they work well in this application. The noise figure in dB is the noise added to the signal, and amplified along with it. The noise is due to random variations of current within the transistor and usually referred to as shot and thermal noise.



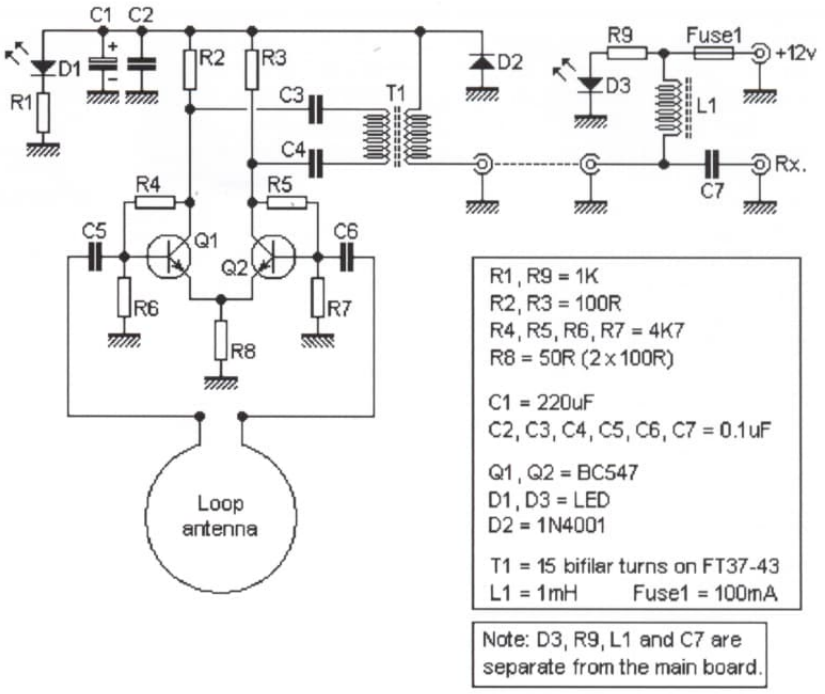
Intended configuration of the Magnetic Loop and components **GNT 31/05/2016**



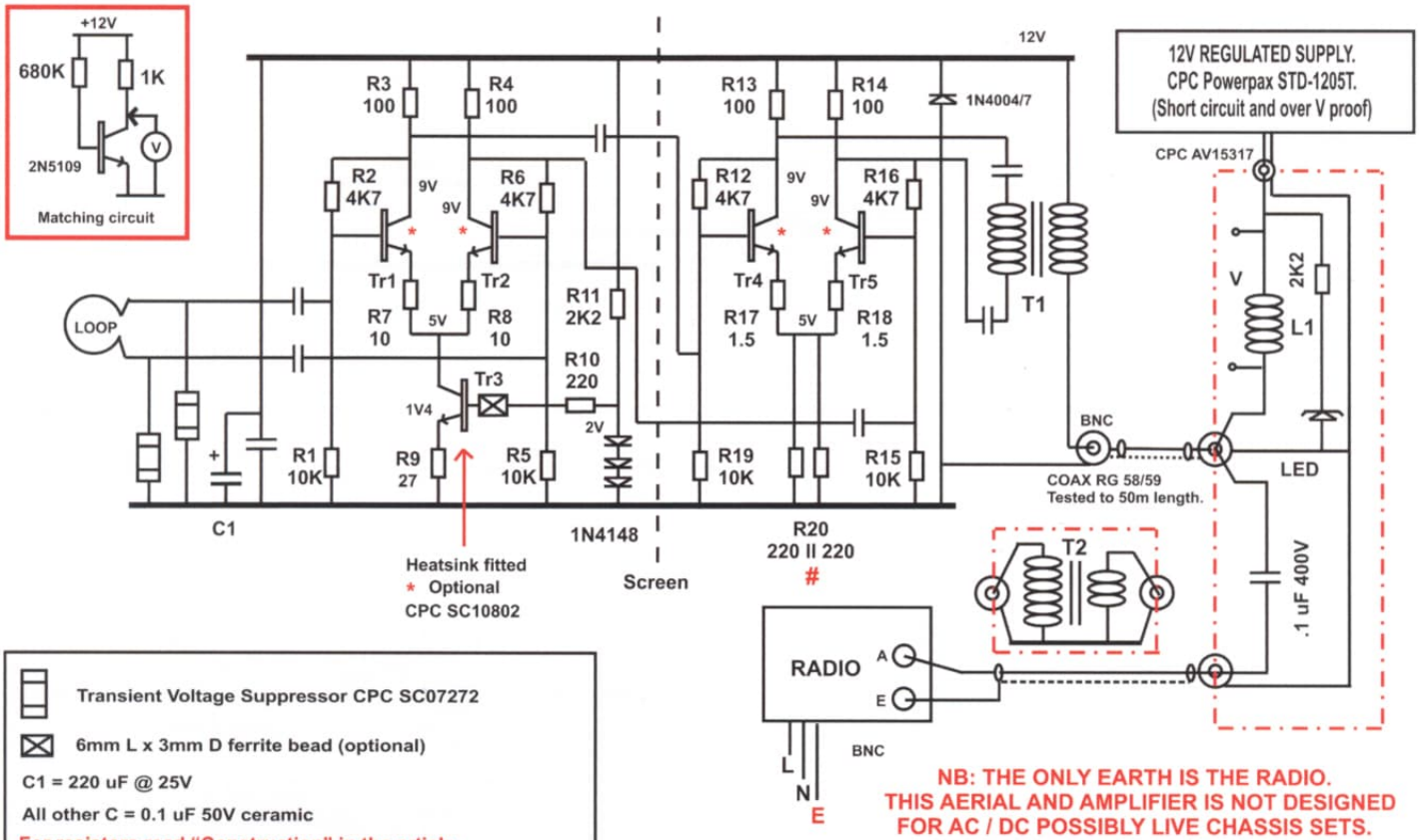
Big loop amplifier mounted in the bottom tube run

Big loop top pipe to run above the picture rail

Big loop vertical runs behind the curtains



Basic loop amplifier circuit



NB: THE ONLY EARTH IS THE RADIO.
THIS AERIAL AND AMPLIFIER IS NOT DESIGNED FOR AC / DC POSSIBLY LIVE CHASSIS SETS.

Transient Voltage Suppressor CPC SC07272

6mm L x 3mm D ferrite bead (optional)

C1 = 220 uF @ 25V

All other C = 0.1 uF 50V ceramic

For resistors read "Construction" in the article

All resistors, excepting R17 & R18, recommended from Spiratronics. Metal film 600 mW, 1%. In 10 packs
Two used for dissipation.

R17 & R18 from CPC, Carbon 250 mW 5%. In 5 packs

T1 15 bifliar turns, 27 SWG Enam. Cu on FT-43 ferrite

T2 Pri 8T. Sec 20 T. 20 SWG Enam. Cu on FT-114D-31 ferrite

L1, I mH choke CPC FT00799

Transistors 2N5109

AM Radio Magnetic Loop Amplifier. Outdoor version.
Needs encapsulation, all components de-rated accordingly.

Includes optional matching transformer (see Article)

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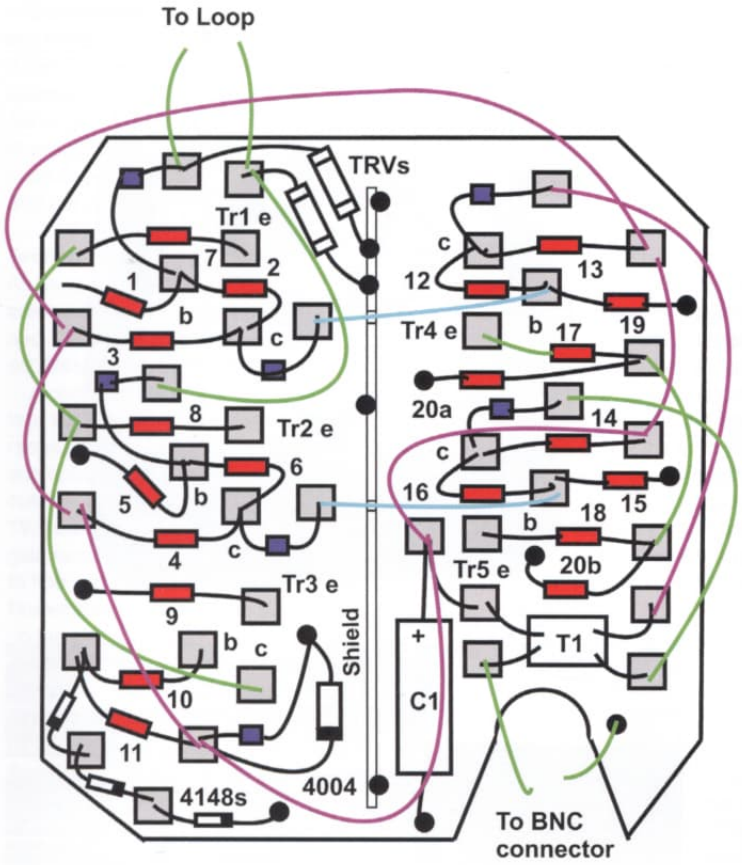
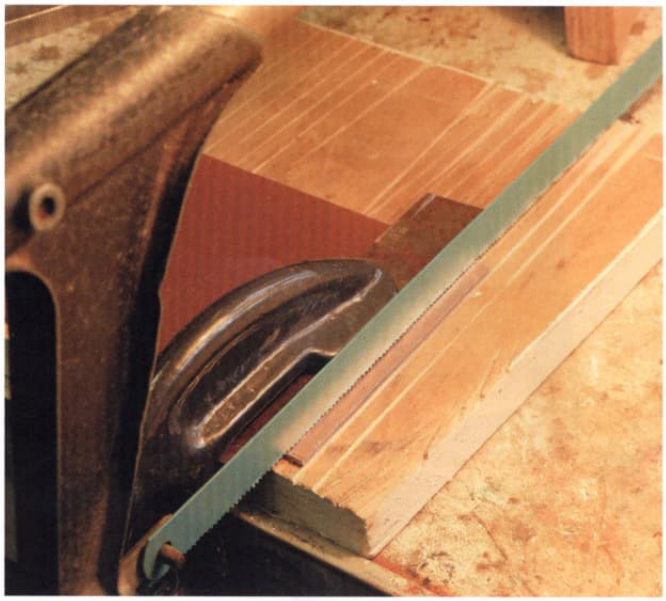


AM Radio Magnetic Loop Amp Layout. Transistors and heatsinks not shown. Fit these last.

GNT 10/06/2016



Making tile strips

Cutting off the tiles

Intermodulation distortion (I.D.)

This could occur if a large signal were to swamp the amp, driving it into a non-linear region so that small signals are affected with mixing occurring. This would show up as whistles as the radio in use is tuned across the bands. A possible situation would be having Droitwich, home of LW R4, as a neighbour. For me it's 180 miles distant and so not a problem but if local then it could be. Fortunately, I have a BVWS friend, who lives just 30 miles away and made him an Amp and power feed box to try on a 1m loop. As usual, with anything to do with propagation it's complicated but "Free space path loss" (see Wikipedia) is proportional to the square of the distance between the transmitter and receiver and so the signal could be many times greater than first thought.

Well, I've had phone calls from Bill Taylor and he has no sign of I.D. and sounds ecstatic with the performance. On LW and MW, stations come in so clear, that on the brief silent passages, he can now hear the tiny hum from a Marconi 561 that he has never noticed before. On SW there isn't a lot of difference to his long wire but I'm told SW is bad at the moment due to 'the layers' and lack of sun spot activity. He finds that he doesn't have the directional properties from the loop that he thought should be there. My experience is that often the nulls are quite sharp in position and can be missed. Or maybe for this aspect the design is less than perfect. It doesn't bother me as I shan't be DXing with it and the direction I have it is good for all the stations I'm likely to listen to.

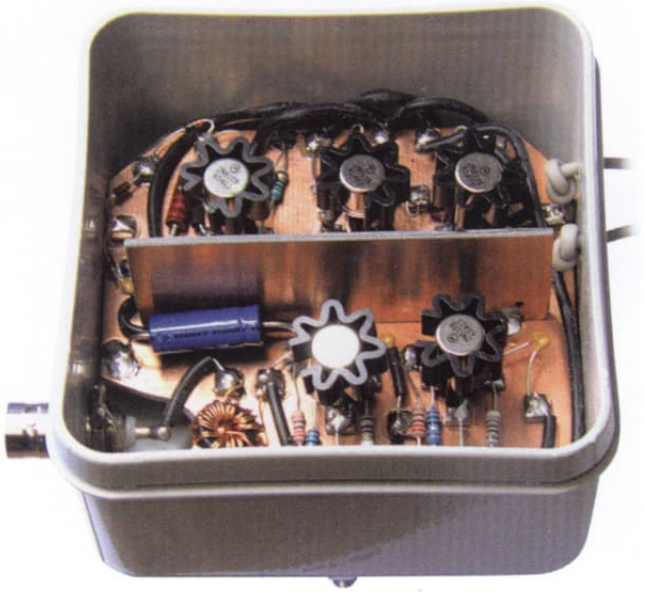
Of course if someone else makes this project and can see Droitwich from a bedroom window, or another high power transmitter, and it is a problem, then two solutions come to mind: firstly move (smile) and more realistically use a front end filter. But of course this isn't easy to design.

Bill had a couple of experimental ideas. One was a 10 sq m loop, made from 2mm wire, on the side of a shed. But this was pushing things too far and he had overload from Absolute Radio who has a transmitter close by; I wasn't able to find what power it uses. Oddly R4, which puts out 105 kW, was not a problem. He asked me would it be beneficial to have more than a one turn loop and the theory says that it must work and two turns should give another 6 dB of signal. But for fixed installations it would be simpler just to make a bigger loop, within limits of course. For pole mounted loops such construction would be more difficult, with a rotator, and have a greater area to be moved about by the wind. Far easier to just stick with the single turn and produce the extra gain from amplification.

Lightning

At the input I have added 10V Transient Voltage Suppressors (TSVs) which undoubtedly would not prevent destruction from a direct strike but may protect against a near one and consequent high field strength. There are two but I guess one would have been enough as the loop is so low resistance but I didn't want to spoil the symmetry (smile). Also I like belt and braces in design, one might fail and the other hold up for another time.

I was sceptical about adding a 90V Gap Surge Protector (CPC FT00211) but it may just help and costs very little. For my final fence mount of the loop I fitted the Protector inside a junction box used to connect the loop to the Amp. To me there was no need to encapsulate as there is no heat generated and so hopefully no condensation. Testing is easy with an insulation tester: at 50V it measures G Ohms but dives to zero for 100V. It was suggested to me that as it's a



The amplifier wired and boxed up

Captive 2BA fixing bolts through the box

The encapsulated and finished amplifier

The bench setup

balanced system the top of the loop could be earthed in the physical centre. But this may not be the same as the electrostatic centre and could make the "Antenna effect" more pronounced with a greater common mode signal. Besides commercial magnetic loops don't do it so I didn't either.

Fortunately magnetic loops don't need to be mounted far off the ground and for my case, and I expect for others who build the design, there are neighbours two gardens away with trees 40ft high or more, and lots of things to get a direct strike first such as TV aerials. Worse case I would just make another one; not that difficult and easily built in a day with coffee breaks and lunch.

Measurements

Improvisation was needed here as I had little of the test gear that would have been around in the industry labs I worked in. The setup comprised the 1m square loop on the Den window sill, a GEC B.C.3950 radio with the bottom removed, an oscilloscope and an un-modulated house transmitter some distance away. The carrier was at about 300m or 1 mHz. Also used were coils of 30m of 50 Ohm (RG58) and 50m of 75 Ohm (RG59) coaxial cable between the Amp output and the power feed and radio input.

I couldn't make any absolute measurements only relative and even for this I needed the radio with the AVC disabled. From the Radio Designers Handbook, by Langford Smith, it is shown that the gain of a radio will rise in linear fashion for low level signals and then start to compress, due to AVC, by as much as 60 dB of input into a 10 dB increase in gain. This is also why using a radio with an eye tube is not the best indicator of making improvement in the design.

Having refined the two stage circuit it was easy to wire out the second stage connecting the primary of T1 to the collectors of Tr1 and Tr2. A potential divider was needed at the input to the radio (100 Ohms aerial to Earth and 220 Ohms in the feed from the Amp) to prevent overloading when using two stages. Measurements were made of the carrier level at the radio detector anode and of the DC filtered output from its cathode. The measurements were not quite identical but close enough to say that the second stage gives around 25 dB of gain compared to the single stage used with 30m or 50m of coaxial cable.

There is an interesting and unexplained effect that occurs in that there is roughly a 10 dB gain loss between a 2m length of coaxial cable and a 30 – 50m length with the single stage that fortunately is not there with the two stages. Perhaps the second stage acts as a buffer to things like Miller effect that degrade the first stage more with the low level loop signals.

I had another look at T1 the 15 turn bifilar transformer, using a larger wire gauge, against a 16: 8 turn transformer with and without the matching transformer to the radio. Without it the gain was about +1 dB more with the 16:8 but with it identical. Really now I was unconcerned about getting any more gain, as I had enough, and so stuck with the bifilar.

Various turns ratios were tried for the matching transformer T2 and an 8 turn primary and 20 turn secondary seemed about right. It added about 2 dB of gain in this measurement setup. In practice this may not always be the case depending upon the radio used and the length of cable to the amp.

Testing

As always I was constantly sniffing around the circuit with the 'scope' and X10 probe looking for any HF oscillations but none were found.

A good thing to do with any early design is to see how it performs over a voltage range and what happens when it gets hot and cold, which it will do when mounted outside. Over a voltage change from 16V to 7V, from a Farnell variable bench supply, the gain remained constant. It seems impossible to find a linear 'wall wart' unit now but the Powerpax switched mode supply shown on the circuit diagram was tried next. On the 'scope, the supply noise, looked very low and listening to a radio sounded no different than when connected to the Farnell. Of course if there were any fine spikes then 50m of coaxial cable would probably make a reasonable filter. With this cable length I measured 11.5V at the amplifier.

There was no change in gain at temperatures of 49C and -7C. I did manage to quickly measure some transistor collector voltages at these temperatures and nothing unreasonable had occurred.

It may appear that I hadn't been testing the setup for real, with the loop remote and into radio sets, with and without the matching transformer. But I can deny this as I was wearing out the stair carpet trying configurations with the loop and amp hanging from a tree at the bottom of the garden. Briefly, for now, performance into an HMV 650 was: LW R4 shuts the eye valve and the audio was clear and with no noise that I can hear when listening to speech. On MW many stations were received at good strength and quality. On SW, in daytime, I did receive stations and some at good power and quite listenable to, one such being Radio Rumania International at around 22m.

Construction of the amp

It was now time to build some more amps as my prototype was too tatty to consider for further use and I wanted a couple for friends for evaluation.

Sources for most items have already been given on the schematic. The boxes came from CPC and are IP55, EN82322, 90mm x 90mm which are excellent value but do distort a little when filled with potting compound.

BNC sockets are needed as is a suitable lead. For me it was far safer to buy this with the plugs attached as I find them difficult to do and they can be a source of intermittency. At the time of writing CPC are doing these in RG59 at bargain prices in a range of lengths to 50m.

I tried to use all branded resistors, at least de-rated by more than a factor of 5. This means that if the resistor was dissipating say 100mW I would use and specify a 1/2W type. This may seem over cautious but ratings, usually at 70C, are in free air. Of course we never use them like that and they are normally below chassis in trapped air. What conditions would they experience once encapsulated? The makers of the potting compound do have a website but I was unable to make much sense of the thermal conductivity data; you probably need a good physics degree. The help desk drew a blank and could not find anyone who could suggest what de-rating should be given to various resistor wattages for different thicknesses of material. To me, it shouldn't be hard to come up with some guidance using a thermocouple and before and after measurement of surface temperature. On the circuit diagram it was becoming messy with several different power ratings and David (see the following Review) suggested I specify small 600mW, metal film types throughout (excepting R17 / R18), available at low cost from Reference 6. R20 is shown as two of these in parallel as it has about 250mW inside it and 5 times gives 1.25W.

If you have resistors in stores then you may chose to use them but I suggest you de-rate as I did. The amp would obviously be a throw away item for a failed component once 'potted'.

The ferrite items came from Ebay as did the transistors ("mc-manager"). However, should they have run out Mouser in the US had a stock of over 2000. For the first stage it may well be beneficial to match them for DC current gain and I did this. When fitting, the leads weren't cut down but sleeved and just the ends bent over enough for soldering. They needed good tinning because some oxidisation seemed to be present from all their years in storage. Adding a heat-sink (CPC SC10802) to Tr3 is essential once encapsulated and to fit them to all was just a few pounds more.

Of course printed circuit board was needed and mine came from Maplin and Spiratronics, (Reference 6). Single sided SRBP will work but the 'tiles' used in the Manhattan construction and fixed with Super Glue do sometimes come off during soldering. This rarely happened with double sided fibre glass, probably because copper was being stuck to copper. Before cutting tiles it paid to scrub both sides of the piece of board with cellulose thinners (or probably IPA) and fine wire wool. The dust is nasty stuff and I had the workshop vacuum cleaner standing by and in constant use. At first I didn't have an easy way of cutting tiles but now needed one. The two pictures show how I did it; the large frame hacksaw needs a sharp fine blade. Once the approximately 3mm wide strips were cut they were de-burred of any slivers of copper. Then one end of a strip was pushed into a 3.5 to 4mm hole, drilled to the right depth in a piece of wood and the tiles cut off with a junior hacksaw. A fine pair of tweezers was used to pull out each piece. Then, sitting at the bench with a 'mag light', the remaining edges were trimmed of any copper slivers with a fine file. If all the slivers are removed the tiles withstand a 1000V on my insulation tester but I don't think I would want to use the method for a valve design.

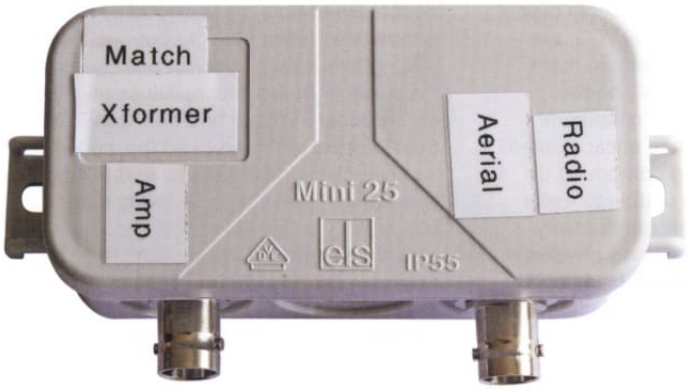
The board layout was done on a piece of paper and then the tiles glued down by eye with no exact measurements being made. Again the side of the board was cleaned, as before, to get rid of any protective varnish which could spoil the bond. The shield, between stages, was a personal whim

Cold environmental testing

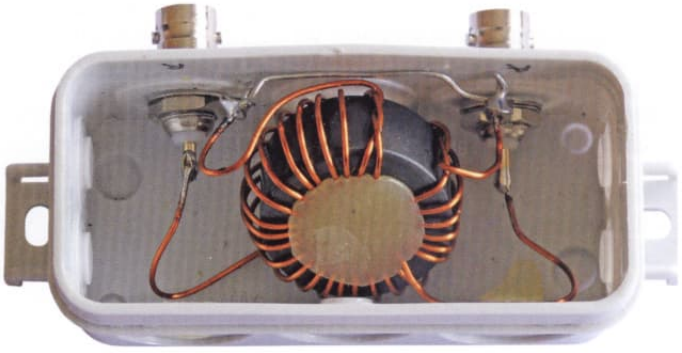
Hot environmental testing

Inside the power feed box

The power feed box with voltage monitoring holes



The matching transformer



Inside the matching transformer

that easily fitted; well you can't have too much stability, and it was an anchor point for the TSVs. Leaving an end clear of the potting compound means they can always be snipped off if they fail short circuit.

After testing the final step was filling with encapsulation and I used Robner PX700K from Spiratronics (Reference 6). Once the separator is removed, the 'mix in the bag' of the resin and hardener is clean and easy. About 300g is needed to completely cover everything.

A firm mount for the boxes was essential before filling and a length of 4" x 2" timber, with holes bored for the fixing studs and underside bosses, was used. The holes for the loop wires were sealed with hot melt glue before potting. It was best to carefully fit the lids after filling as some distortion of the box happens and doing this minimises it. It's natural to want to check later and final fitting of the lids was done with a smear of silicon sealant. Possibly some condensation could build up in the space left in the box which is less likely if it is left powered all the time. But just in case I drilled a 'dribble' hole and sprayed around the outside with ant deterrent spray.

Installation of the loop and amp

Fitting the loop to a pole and with a rotator was not required by me; all I needed was fence mounting to use the aerial for the dining room in place of a wire down the garden. Of course I knew the direction I wanted it facing. For mounting, I made a plate which would be suitable for pole or fence mounting. For the pole, weather resistant tie wraps or jubliee clips would be best, and for fence just wood screws and spacers. However, for my final installation I made a "U" bracket with bent ends.

The cut out section, in the physical centre of the bottom tube, was again joined by a piece of Paxolin tube and it and the self-tapping screws were inside the previously mentioned junction box. As before, shake-proof washers were put under the solder tags from the amp to ensure a good connection. If the connection box was slid right to one side, of one of the tube arms, then with a big enough soldering iron it might be possible to make soldered connections. The box could then be slid back leaving the two wires exiting from one of the side cable entries.

My connections were covered with hot melt glue but a sealant could have been used. The BNC connector was bound with self amalgamating tape and given a wipe over with silicon sealant.

Construction of the feed box and matching transformer

For the feed, a small box from CPC (EN83938) was just right as it sits behind a radio easily. The choke measures just over 1 Ohm and was mounted, on a piece of double-sided PCB, with the middle cut away and the ends of both sides joined together. This allows meter probes to be put through a couple of holes to measure voltage and hence know the current drawn: a simple health check you could say.

Details of the matching transformer are given on the schematic. The number of turns quoted earlier and the wire gauge wasn't critical and I started off by just hooking it in with croc' clips. Later it was mounted in another small box and connected with a short coaxial cable when used.

Performance with various radios

Many were tried and compared to a 40 foot length of wire to the bottom of the garden. In all cases performance was vastly better. As an example the Murphy A98, not a spectacular performer, came alive with really good R4 on LW; clear and with no background noise. Even RTE in Ireland was quiet listenable to. Of course into an HMV 650 performance was even better. All radios performed excellently on MW and the 650 pulled in a few reasonable quality stations on SW in daytime. After dark there were many more stations and some at reasonable to good quality not that I would want to listen to any for long with my limited linguistic skills! My night time experience was very different from Bill's; the 40 ft long wire would receive many of the stations that the loop would but at a much worse signal to noise ratio.

Now I have become a genuine radio listener again, who each morning is tuned, on an 82 year old Atwater Kent, directly to R4 rather than hearing it after re-transmission from an FM station.

My comments

The configuration of having the loop, Amp and radio all close together took me by surprise. I had not envisaged anyone using it in that way but it is valid and I appreciate that he tried it for me. Of course he won't get the advantage of the loop being away from UK mains and equipment in the workshop may produce interference. But he has a bigger loop and so more gain and a better S/N ratio so it is obviously working well for his needs.

A simplification, if using this set up, could be to have the amp mounted inside the workshop and the loop wires run through a hole avoiding the need for encapsulation. It may even be possible to extend the loop ends into the building thus having the connections out of the weather.

Conclusions

I'll start with thanks to 73' Thomas (Reference 3) for kick starting the design and the GVF for bringing it to my attention. I'm not urging anyone to build this project as I can't guarantee how well it will work in your location with or without high powered transmitters close by. But there are two happy users, besides me, so I'm fairly confident, for not too big an outlay, most should get good results. It's necessary for me to add this caution as in the past I received an abusive Email by someone who accused me of wasting their time and money on another project. But if some 'do a build', it would be good to receive an Email of how it worked for them. To me it beats any long(ish) wire aerial hands down and makes radios play again as they might have done 70 or more years ago. Back then aerials were often 100 ft long and 30 ft high in almost a noise free environment compared to now. Of course if the loop is to be static then its size can be larger than the 1 sq m I used; depending upon location. Personally, and just a gut feeling, I wouldn't go much bigger than David's 4 sq m.

My considerations have only been for AC powered radios and mostly those having a permanent chassis earth. As part of my restorations, wherever possible, I fit a replacement 3 core mains lead. There is some contention about this possibly stressing the insulation of the mains transformer but my take on it is if it's so weak then let it fail and I will get it rewound. It's never happened to me yet and the safety provided by an earthed chassis must come first. Some radios have a plug and socket, for example Ekco and Philips, but a 3 core lead can still be used with a fly wire and suitable plug, to the earth socket of the radio which is normally chassis. Alternatively, if the power socket is close then a separate earth wire, taken from the plug, can be used. If the Amp is left powered without being connected to an earthed radio then it will float from earth. There shouldn't be any danger from this as the power supply has a plastic earth pin and kV isolation.

The amp is not difficult to make if you can use hand tools and are deft with a small soldering iron. Don't cut the components too short, put in some bends as the layout allows. A printed circuit board could be made, possibly double sided to maintain an earth plane. Maybe someone will make some for sale? It's certainly not something I want to do.

For the four amps made by me, they and the prototype had a gain spread of less than 1 dB, with no sign of high frequency oscillation, so it shows that it should be a repeatable design.

It was a very enjoyable project which, although still a relatively simple circuit, was interesting with a lot to think about and ended with "the sweet smell of success". It has been a long time since I have considered transistor circuit design in detail.

References:

1. DXers MW Loop Aerial by S.A. Money G3FZX. To be found here:

www.americanradiohistory.com/Archive-Practical/Wireless/70s/PW-1973-04.pdf

2. Loop Antenna Theory
http://sidstation.loudet.org/antenna-theory-en.xhtml

3. PA1M Simple Active Receive Loop Antenna:
http://www.pa1m.nl/pa1m/simple-active-receive-loop/

4. Manhatten construction technique
www.k8iqy.com/construction/ConstructionMethods.htm

5. www.aoc.nrao.edu/~pharden/hobby/HG_DS1.pdf

6. http://spiratronics.com/

An evaluation of the Gary Tempest amplified magnetic loop receiving aerial

by David Taylor

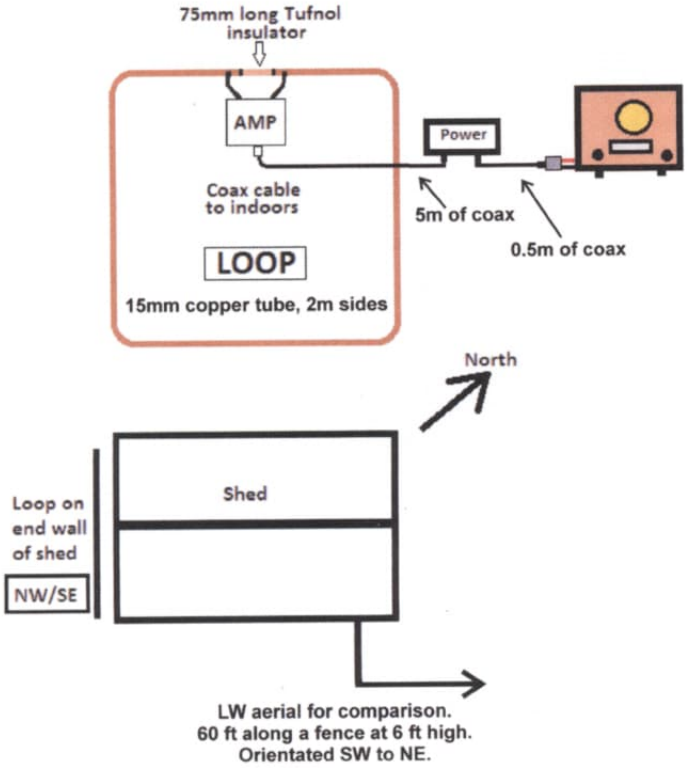
Some months ago, Gary mentioned his intention to research, develop and construct an amplified magnetic loop aerial, and kept me informed of how things were progressing. I was keen to build one as soon as he had finalised and tested his design, and was delighted and surprised when – at the NVCF - he presented me with a completed amplifier to evaluate at my location near Hull, East Yorkshire.

I was amused to note the label fixed on the lid of the box: "Lid sealed – nothing to see inside", knowing - I'm sure - that I'd have had an irresistible urge to take the lid off and peep inside! Gary had potted the amplifier to make it impervious to weather when erected in an outside location, so there was nothing to see anyway.

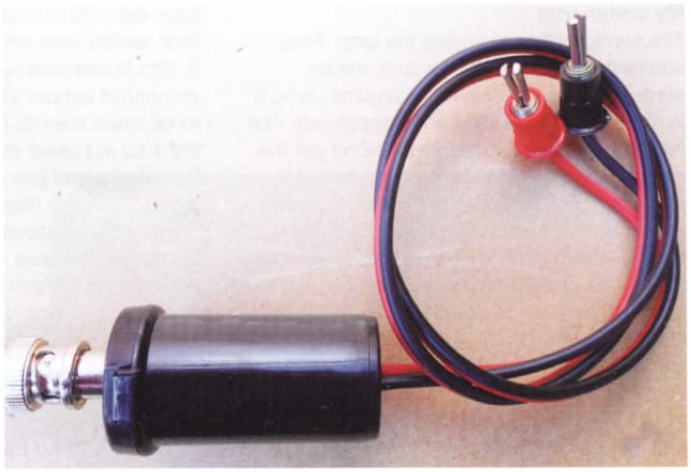
When in my workshop - a 10ft x 8 ft wooden shed - I always have a restored radio from my collection to listen to. So that the radios in my collection get a regular 'airing' rather than just gathering dust on shelves, I alternate them each month or so. Most of my radios need an external aerial, though some have a plate aerial – usually foil applied to the rear of the back panel, or a wire threaded through a few holes in the panel. Good enough for strong local stations, but not for much else.

For reception, the aerial that I had relied upon was a 20 metre length of wire attached to a 2 Metre high garden fence. I hesitate to call it a 'long wire' because I was taught that for an aerial to qualify as such, it needs to be at least 1.5 wavelengths long, so for example, on 300 metres, the aerial would need to be 450 metres long. What most people mean by 'long wire' is the longest length of wire that can be accommodated in their small suburban garden. This where the loop aerial scores, because not only does it not

The loop at the end of the workshop



David Taylor's loop amplifier setup



BNC to radio wander plugs in a film canister

need a large garden, it doesn't even need to be outdoors! I guess that compactness is a key selling point of commercially made magnetic loop aerials, but the 'GNT Loop' can be built for a fraction of the cost, and from my experience, with a marked improvement over a wire aerial.

I decided that a convenient location for the loop would be on the outside end wall of the workshop, where a 4 metre square loop of 15mm copper tube would just fit, mounted on plastic stand-off clips. The coax lead from the amplifier to the radio and power supply is about 5 metres, but if need be, could be much longer with no loss of performance, and Gary has tested, and is using, the amplifier with 50 Metres of coax with no discernable loss of signal strength. (Rather like TV masthead amplifiers, the coax is used to provide DC power to the amplifier at the loop, and to send the amplified signal down the coax to the radio).

Prior to having the loop, I'd assumed that my wire aerial gave reasonable reception of such stations as are transmitting these days, and to an extent, I'd fallen for what seems to be a common perception - 'there isn't much to listen to on MW and SW and on L.W. there's only really Radio 4'. The magnetic loop has been a revelation. The first thing I noted when unplugging the wire aerial and plugging in the loop was the almost complete absence of background noise - what's often called 'static'. Secondly, stations that are inaudible or weak on the wire aerial become loud and clear on the loop. One is an Irish station which I'd thought was Radio Eireann, but that closed down in 2015 on LW. In fact it appears to be RTÉ Radio - a division of the Irish national broadcasting organization Raidió Teilifís Éireann, which broadcasts on 252 KHZ. It was inaudible on my wire aerial, but is loud and clear on the loop. Its ERP is 300kW during daytime and 100kW at night time: BBC Radio 4 on 198KHz is audible on the wire aerial, but signal strength is far greater on the loop.

There are two French stations on LW, but I've yet to hear any station I.D, and on a broadcast radio the dial settings aren't really accurate enough to be sure of the transmitting frequencies. However, I note that 'France Inter' broadcasts on 162 KHz from Allouis with 2 MegaWatts. The French broadcasting service has called itself RTL for many years and still broadcasts on 234 kHz long wave using the Beidweiler Longwave Transmitter, so I guess that will be the other station. Both are barely audible on my wire aerial but excellent on the loop.

On Medium wave I logged some 18 UK stations at good signal strength. Scores of UK stations use MW, but of course many are 'local' community broadcasters using low power:

On Short wave, later in the evenings, many stations were received on the magnetic loop on all the short-wave broadcast bands - 49, 31, 25, 19 & 16M. Quite a lot of Asian music, and on 25M, a broadcast in Cantonese, but of course, we've no idea where the stations are broadcasting from – quite possibly relay stations located in Europe. Also, there were lots of Eastern European sounding stations - some Russian maybe? Others were from Europe, including the Netherlands, and Scandinavia. In contrast, on the wire aerial many of those stations were either very weak, with high background noise, or were inaudible, down in the noise. Most domestic radios are hampered on short waves due to the lack of bandspread, but my Ekco A22 has a rudimentary slow motion drive which helps to separate the stations. I've had the opportunity to try several of the domestic radios in my collection to compare and contrast the performance of the magnetic loop with that of my wire aerial. In addition to the Ekco A22, these include an HMV '1122', Pilot '754', and a Murphy A168M.

Using the magnetic loop has made listening much more pleasurable, and will, I'm sure, repay the effort in building one. I'm indebted to Gary for having saved me the trouble!

Links:
RTÉ Radio - a division of the Irish national broadcasting organization Raidió Teilifís Éireann:
https://en.wikipedia.org/wiki/RT%C3%89_Radio
RTL – French Radio:
https://en.wikipedia.org/wiki/RTL_(French_radio)
Long Wave Station List:
http://mediumwaveradio.com/longwave.php
Medium Wave Station List:
http://mediumwaveradio.com/uk.php

Early British valves 1905–1919

Photographed by Carl Glover, captions by Phil Taylor

At the Cinema Museum swapmeet in June earlier this year I had been asked to photograph a small collection of important early valves. An improvised backdrop was made from two sheets of A4 paper and the valves photographed on the owners stall, the reflections of the main hall in the museum are quite visible but hopefully not too distracting. All valves are in scale to each other.

Carl Glover

JA Fleming developed Edison's diode-effect lamp, patented in 1884, as a demodulator or detector for a Marconi-Fleming receiver in use around 1905-1906.

HJ Round of the Marconi Wireless Telegraph company developed a soft triode around 1913. It was used throughout much of WWI and manufactured by Edison Swan.

BTH made a replica of De Forest's Audion soft triode around 1917. It was used by the Royal Navy but was discontinued due to reported manufacturing problems.

The BTH tape A was a hard valve modelled on the original French TM hard triode of 1915. It was mass produced for the war effort in France and from 1916 in Great Britain. The design formed the basis of all bright emitter triodes and valves such as the Ediswan and MOV V24 in the early days of broadcasting.

GW White developed a soft triode at the Cavendish Laboratory in 1917. It was used as an RF amplifier in the Mk III tuner.

The GEC R2 was made to replace the BTH Audion, at first with a nitrogen fill and later helium. It was the last soft triode to be developed in WWI.

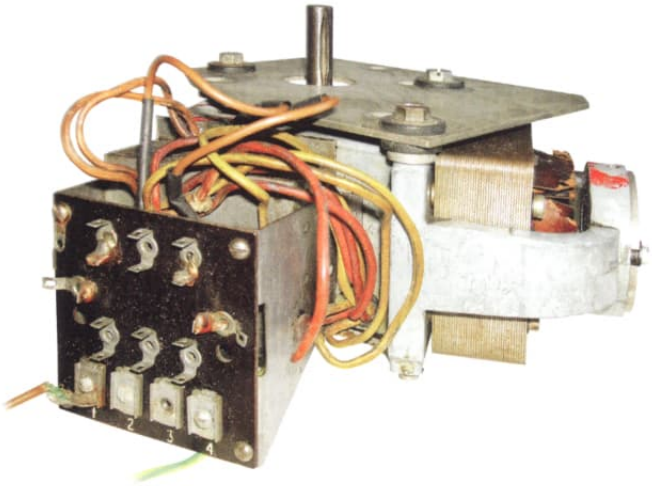
The Post Office Valve, Amplifying No.2 was made c.1919. This example has a sheet nickel anode. Some samples have been seen with a wire spiral anode. It was manufactured by BTH.

Restoration of a 'His Master's Voice' Table Model Radiogram Model No.1604

by Ron Harbidge

This story goes back to 1954 when I was living in Rushall, a suburb of Walsall. We had an HMV table model radiogram Model No.1604 which my father bought in 1948 and this was the first radiogram I became familiar with from the age of two and a half. This I will refer to HMV Table No.1604 No.1 for reference in this article. In 1956 the record player developed a fault. The pickup seemed to be short circuiting with low volume when the volume was turned up full. Also the needle didn't appear to be tracking at the correct angle. The most likely cause of this type of damage would be an autochange malfunction with a record dropping onto the tone arm. We stopped buying records but continued to use the radio for a number of years. The last record we bought was Johnnie Ray's *Just Walking In The Rain* on Philips PB 624 UK No.1 September 1956.

Beautifully waxed and polished HMV Table Model 1604 No.2



The original electric motor which is beyond economically viable repair

Going forward to 1961

At the beginning of 1961 I suggested to mom to try the gram and both me and my sister tried to persuade dad to get the radiogram repaired and modernised with a 4 speed record changer. In 1963 the HMV Table Model No.1604 No.1 bit the dust. I removed the innards which were thrown on a council tip and the cabinet was broken up for firewood. By that time we had a new radiogram. This I regretted very much because for a short period of time I had the record player working at full volume by loosening the nuts to the needle armature and moving it slightly then tightening them up. Although the connection was better the needle was still tracking at a flat angle with no definition in sound and rapid record wear. It was my mother's decision to dispose of it because in her words "It's old fashioned and not safe to use".

Going forward to 1979

At this time the nostalgia bug happened big–time and I was replacing golden oldies on both vinyl and shellac. My interest in old record players and gramophones never waned. Around this time I had a longing ambition to restore an HMV Model No.1604 radiogram to full working order. Over the years I have seen several in different locations. A second–hand shop in Worcester, stalls at Portobello Road, and Petticoat Lane markets, London, and the Vintage Communications Fair which commenced in 1991 at the National Exhibition Centre Birmingham.

Some of them had the original record changers which I really wanted, and others had been modernised with 3 and 4 speed record changers. At the time that was the most sensible thing to do as not only were the miniature needles and suitable sapphire stylii becoming increasingly difficult to obtain, vinyl was replacing shellac. Coarse grooved 78 rpm records were being replaced with microgroove records with playing speeds of 33$^{1}/_{3}$ rpm Long Playing 10 inch and 12 inch diameter records and 45 rpm single and Extended Play seven inch diameter records. For a very short time 16$^{2}/_{3}$ rpm extra long playing records became available but this speed was soon abandoned due to its low fidelity. For years I have been trying to find one these discs.

The 1604s which had the original record changers; no power points were available to try them out except the shop in Worcester; it didn't work and luckily I wasn't electrocuted. Just a word of caution! don't ever plug in an old electrical appliance unless you have it checked out by a qualified electrician first. Each time I saw a HMV Model No. 1604 radiogram, I was without transport but this could be arranged if I were very determined. My main obstacle was my mother complaining of (in her opinion) me bringing more junk into the house.

Going forward to 2005

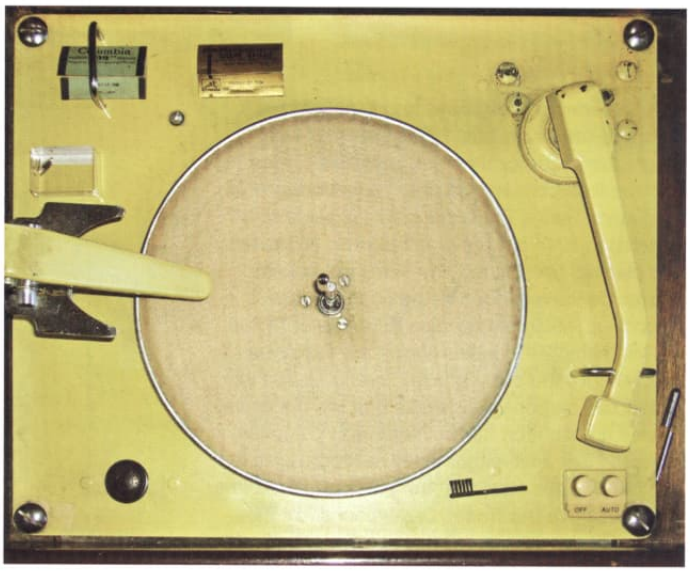
After moving to Llandudno to be near my family, I made a positive decision to advertise for an HMV Model No.1604 radiogram in the City of London Phonograph & Gramophone Society's quarterly magazine (For The Record Issue No. 4 Summer 2005). My advertisement was successful. Society member John Hart, from Plympton near Plymouth responded and I bought the machine for £25. Not withstanding a previous offer of transport which remained very uncertain, I arranged *UK Sameday Delivery Solutions* to collect and deliver HMV table model No.1604 No.2 for reference in this article. The package arrived late January 2006. It was now time to start work by removing the record changer and its cumbersome squirrel electric motor to be examined by several motor specialists.

The motor's drive shaft had a wheel mounted on secured with a screw. This wheel was the same diameter as the wheel which the turntable is mounted which is 47 mm. This turntable is driven by a rubber idler that transfers the motion from the motor to the turntable. At a guess, the motor which is geared down through a worm gear, the shaft would be rotating at 79 rpm allowing for a slight reduction to 78 rpm playing records. The opinion of all the motor specialists was this motor was unrepairable and it would cost more to rewind than buy a new motor.

After taking measurements inside the cabinet, I decide on a suitable modern alternative electric motor with a geared down speed of 81 rpm +10% efficiency. The new motor was from *Anglesey Rewinds*. With the help of a local precision engineer,

Figure 1 (below, left): The ten inch diameter record stacking ledge in position. No provision is made for manual operation as pressing the autobutton is so simple. To stop the mechanism before all records have been played press down fully OFF. The arm will return to its rest as the mechanism disengages and the motor switches off without dropping the next disc. To resume playing press down fully AUTO and the next record drops. Also AUTO can be used to reject onto the next record

Figure 2 (below): The twelve inch diameter record stacking ledge in position. The record stacking spindle slots into a cam and is lifted off to remove a selection of records that have been played. The switch from Radio to Gram on in the front left hand corner.



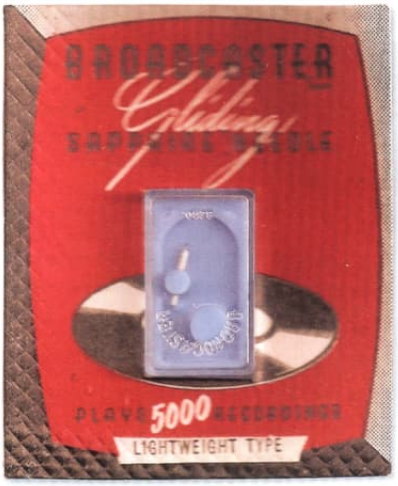
the hole in the drive wheel was increased in diameter to fit the drive shaft of the new motor. Also new holes I marked out to fix the motor to the old motor's fixing plate underneath. My next task was to remove the innards of the cabinet with careful attention to the wiring and restore the record changer to working order. The record changer was stripped down and necessary adjustments were made to make it run smoothly which included oiling the turntable ball bearings and improving the autochange tripping mechanism to trip on records with very short run out grooves.

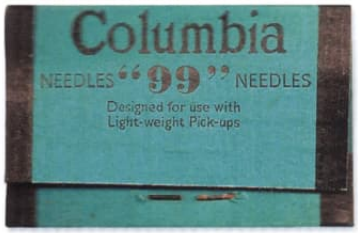
Next I removed all the other innards from the cabinet with very careful attention to the wiring. The cabinet was stripped down entirely and the wood work was restained and finished with Sanding Sealer and Wax Polish. Also the turntable was refelted with new felt. To get the colour right I bought some very light fawn coloured felt and darkened it slighly using a mild solution of coffee with salt in the water. The armature of the gram pickup was readjusted to track at the correct angle with the help from a soldering iron. This had to be done with great care with the naked eye through a magnifying glass to get the angles correct. 90° across the groove and 90° flush on the springy support assembly which screws onto the pickup which is slopped to track at approximately 35°. When I screwed this back onto the pickup this backs onto a soft piece of rubber with a hole in the centre for the needle armature. This acts as both damping and shields the audio coil near the magnet. Also care must be taken to ensure the sleeve does not touch the magnet, otherwise the armature would not have the freedom to movee as it follows the modulations on records. The insertion hole I made slightly smaller so that the needle does not waggle loosely inside the sleeve. The next task was to rewire the gram pick-up to the radiogram switch and wiring the mains to the new electric motor as the old wires were very brittle. Now was the time to insert all the radiogram innards with more careful attention to wiring. By connecting certain connections of the radiogram switch switched to gram to the input of another amplifier all seems ok when I hear a sound coming through my hi fi speaker as I run a needle brush across the needle. So far so good, but what next.

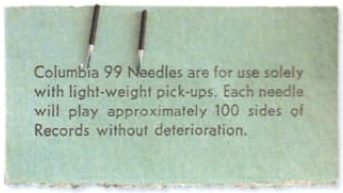
Now is the time to play a record. The disc I use is Doris Day's *On Moonlight Bay* 81 rpm plus 10% efficiency, not on your life! Doris Day sounded squeaky like an odd character in a children's cartoon. Something had to be done. Using a record without a run-out groove that has a click at the end which I play until the end, then count 98 clicks per minute. Without going into detail this put my mathamatical skills to the test. Using the services of the same precision engineer, I have a new drive wheel made to my own specifications calculated for an accurate playing speed of 78 rpm. Bingo! The final step is to send the fully assembled HMV Table Model No.1604 No.2 to Stephen Ostler proprietor of *Radiocraft*, Sedgeberrow, Worcestershire. The only concession to the present day is AM/FM radio has been added and a new electric motor was bought to work the record changer. At a guess the new motor would have a lot more torque to work the record changer but even more so being geared down to get the correct playing speed. Not at all high fidelity by todays standards but an average sound for 1948. An original sound of Long and Medium wave radio and gramophone with a light weight pick-up that does not incorporate the needle securing screw using miniature needles or styli. Also HMV table model No.1604 No.2 should last many years with care taken. One record that was one of my favourites played on this gram was Frankie Laine There Must Be A Reason b/w Some Day (From "Vagabond King") on Philips PB 306 UK Chart No.9 October 1954. When HMV Table Model No.1604 No.2 was returned from Stephen Ostler's workshop it was possible to get Radio 2 on Medium Wave. Since the digital switchover it is no longer possible. At present the radio is set on *Radio Kent* Medium Wave. HMV Table Model No.1604 No.2 is my pride and joy.

Just a few words about the needles, styli and technical jottings

At present I am using a miniature sapphire because not only does it last longer playing severel hundred sides of records with care taken, the sound is much clearer. The reason why is a .0025" radius stylus makes contact







Left: The miniature needle packets; HMV Silent Stylus, Columbia "99" Needles and Broadcaster Sapphire needle.

Below: The original instruction manual which came with HMV table model No.1604 No.2

with the sides of the groove and is able to track the modulations on later 78 rpm records with far greater accuracy than steel needles. Decca was the first recording company to introduce Full Frequency Range Recordings ffrr (50 Hertz to 14 K Hertz) in 1944 but the gramophones (acoustic and electric) used at the time were not able to reproduce the extended range on these new recordings. Miniature needles (HMV Silent Stylus or Columbia "99" needles (which are the same needle) have the same groove contact profile as a standard carbon steel needle that fills the entire groove but are a bit harder made with chromium steel and last a bit longer. They never did play the number of sides stated on the packets. Remember we didn't have the Trades Descriptions Act then. The maximum number of sides I have played with a miniature needle is between 15 and 20 records maximum. More than that can cause extensive groove damage to records as they wear very flat on the bottom of the groove. There is a calculation that can be done to work out the size of the wave length at any frequency on any part of a record recorded at any constant speed but I will leave that one out as it is complex to explain. The sapphire stylus was introduced in 1947 for light weight pick-ups. This was made possible with improved cartridge design reducing the tracking pressure down to 28 grammes. This was done by attaching the stylus tip to a cantilever which doesn't apply to this pick-up. The tracking pressure on my vintage radiogram I have calculated as being in the region of 38 grammes which is a bit heavy for a sapphire but it is safer than using miniature needles which wear out quickly.

Acknowledgements

Many thanks to the proprietor of *Anglesey Rewinds* for tracking down a suitable modern electric motor and also to Stephen Ostler proprietor of *Radio Craft* of Sedgeberrow, Worcestershire, for restoring the radio and amplifier, and the precision engineer who drilled the holes in the motor's fixing plate for the new motor and making a new drive for it made to my own specifications for an accurate playing speed of 78 revolutions per minute. And finally John Hart member of the *City of London Phonograph & Gramophone Society* who sold me HMV table model No.1604 No.2.

THE GRAMOPHONE COMPANY LIMITED

BY APPOINTMENT

INSTRUCTIONS

for

INSTALLING AND OPERATING

MODEL 1604

TABLE AUTO RADIOGRAM

for

A.C. MAINS

"HIS MASTER'S VOICE"

INSTALLATION

Aerials

Normally this receiver will not require an external aerial since a built-in frame aerial is incorporated. However, where reception conditions are difficult, for example, in heavily screened metal-framed buildings or in areas very remote from broadcasting stations, an external aerial may be required.

An aerial located *outside the building* and well above possible sources of electrical interference is recommended. It should be erected as high as possible and should be not more than 60 feet total length. An adequate lightning switch should be fitted. Your dealer will advise you in case of difficulty. The aerial should be terminated in a plug which should be inserted in the " aerial " socket at the back.

Earth

An efficient earth should be connected to the " earth " socket at the back. A copper plate buried in moist ground or a rising water main provides a good earth. Never use a gas pipe, a telephone cable or hot water pipe as an earth.

WARNING

THE EARTH SOCKET IS CONNECTED TO THE METAL MOTOR BOARD ONLY. NEVER ATTEMPT TO CONNECT AN EARTH TO THE CHASSIS OF THE RECEIVER.

Part No. 34513 Issue 4

In support of the museum by Peter Brunning

This article recounts events that started around 1998. In Those days the Chairman of the BVWS was David Read and Carl Glover had only been editor of the Bulletin for three years.

Gerald and I were close friends and I spent much of my time chatting to Gerald while he had his breakfast of two boiled eggs. The museum's fortunes were at a low ebb due to insufficient wireless repairs which were the mainstay of the museum's financies and we thought of making a video for sale at the museum and various swapmeets. I agreed to spending some weeks at the museum rigging and lighting various locations for the production of the material. It was to be done at full broadcast standard so it could be edited to VHS cassettes to sell. I provided the broadcast camera and Hi band U-matic recorder as well as lighting, radio mics, condenser mics and ancilliary equipment. I did all the recording, I am not a cameraman by profession but you can't work closely with professional camera operators without some of it rubbing off.

You may wonder how I came to have all this gear worth arguably many thousands of pounds, and the story is as follows. When I was working I was employed by the ILEA in their Mobile Video-recording section. We had 2 scanners at the time with three Link cameras and we recorded on to Ampex helical scan 'C' format. Our latest aquisition was a Sony BVP300 camera, the subject of this article.

We were merrily employed doing recordings, mostly in school classrooms, for use in teacher training when Maggie Thatcher decided that the GLC was too left-wing and she closed it! We were told to stop work at once and all production, editing etc. was closed forthwith. The ILEA set up some kind of department to pay people their redundancy money and people either accepted this or hung on for a better deal. I got my full pension as a lump sum and at 58 I never worked again.

This is not quite true as some staff at the studios formed a consortium and either bought or hired the studios intending to run it as a commecial venture. I was able to freelance for them for I believe a £100 a day. When you freelance it is your responsibility to put in bills for work done. My wife kept saying I should submit my bills but I had some silly idea I would allow it to mount up to a substantial amount when I could buy something I wanted. I cant remember the amount but it was probably in the region of £2000.

You can guess what happened next, the consortium, Battersea Studios, went broke and I and several others in the same position lost our money. The Chief Engineer, John Caig was very sympathetic but, of course there was nothing he could do. He said I could help myself to anything in the studios before the liquidators came in.

I brought my car in and loaded up several VHS machines, lighting gear, U-matic recorder, various mics, and the BVP300, enough to set up my own recording operation, and this was the gear I used for making Geralds videos. I previously said 'single handedly' earlier on, but Gerald and Dave Adams had a pivotal role of course. Eileen cable-bashed for me on the garden shots and also fed me throughout the whole procedure.

We had planned for me to hand-hold the camera but it quickly became apparent that I was not up to this physically so Gerald agreed for me to hire a set of legs from Battersea Studios which was still operating despite going broke.

Having recorded all the material it was then necessary to produce the VHS cassettes. For this I made a VHS cassette, crudely edited, which I called the 'VHS Master' It included music from Gerald's 78 collection and lots of unecessary black. In order to dub the retail cassettes I built a rack incorporating five VHS machines so I could do multiple duplications and bought ex-rental cases and produced the 'artwork' for the finished product. The recordings were about 90 mins long. We sold the cassettes for £10.00, Gerald got half clear for the museum. I got the other half and was responsible for the cassettes, the cases, the dubbing and the artwork.

I can't remember the details but we made over £1000 from the enterprise (this includes the 2nd recording 'The Man in the White Coat').

There was also a spinoff for Gerald and it occurred like this. I had sold some recordings to a lady who was taking them back to Australia where her husband was a member of a group of wireless enthusiasts. They showed Gerald's videos at their weekly meetings. and one of them spotted a Cossor that he needed to complete his collection. He contacted Gerald and asked to buy it. Gerald said no, but when he was offered £1000 for it Gerald said "Give me a fortnight to make a replica, and it's yours".

We sold the cassettes at swapmeets and the museum for some years and when sales were dwindling we agreed to take them off the market. Gerald said to me later "That was a nice little earner!"

I hung on to the VHS master but I gave the raw material to Gerald and the U-matic tapes lay in Geralds bedroom for years. I have a friend,Edwin Parker who works at the BBC transferring all their archive material to DVD or some solid state medium and he agreed to transfer all our Hi-band U-matic material to DVD, which he duly did and I passed the DVDs to Mike Barker. I notice that,on our Christmas DVD he doesn't get a mention for this valuable work. So, now Gerald has passed on and the hobby is changed somehow.

I am gratified to have played my part in support of the Museum.

Letters

Dear Editor,
My thanks to those readers who voted for me to receive the Pat Leggatt Award for best article of 2015. This was for the Philips D57 Monoknob with all its fascinating features. I have won awards before and a cynic might say I write so many articles I'm bound to win now and then but this one was the most special. There was just so much enjoyment trying to puzzle out the circuit details and solve the mechanical problems. At this time the chassis is again out of the cabinet, for a complete refinish, as I had issues with it. Happily it's coming along well and soon the radio will be displayed with the Award alongside it.

Gary Tempest

Dear Editor,
I've often seen it stated that large numbers of American radios, including many 'midgets', were shipped to the UK during the war, but what was the actual number? In May 1944, Hansard recorded a series of questions by Sir Leonard Lyle (then the MP for Bournemouth) to Captain Waterhouse, the Parliamentary Secretary to the Board of Trade, about these imports. Captain Waterhouse informed the House: 'About 36,000 sets have now been imported, and a further 7,000 are expected shortly. It is unlikely that additional supplies will be got from the USA. About 12,000 have already been distributed and arrangements have been made to distribute a further 12,000. The remainder are being tested, and repaired where necessary, and will be released to the trade within a few weeks. Spare parts other than valves for these sets should be obtainable from British manufacturers. Most of the types of valves required are imported from America, and should be obtainable through the normal trade channels. The supply of spares for a few types is still uncertain and is being investigated'. In response to the follow-up question 'Is it not a fact that people cannot get spares for any of their wireless sets and that the new sets do not meet the demand?' the reply was 'I am afraid it is a fact that the repair position is extremely difficult and that the supply of new sets will not fully meet the demand'.

See: http://hansard.millbanksystems.com/commons/1944/may/10/united-states-radio-sets

I was surprised that the number of sets imported was relatively small: presumably a much smaller number was also arriving through the 'back-door', being carried by American servicemen arriving on transports from the US. I believe that very few of these imported radios reached the domestic market: most were supplied to factories (Music While You Work was introduced by the BBC in June 1940), schools, hospitals, etc. Other sources of information indicate that Emerson and General Electric radios were the most common types imported during this period. I'd be interested in hearing if readers have any more information on the numbers of these American radios actually reaching UK homes during the war.

Best regards
Stef Niewiadomski

Pictures from Royal Wooton Bassett July 16th by Greg Hewitt

Philips 930A

Philips console radio

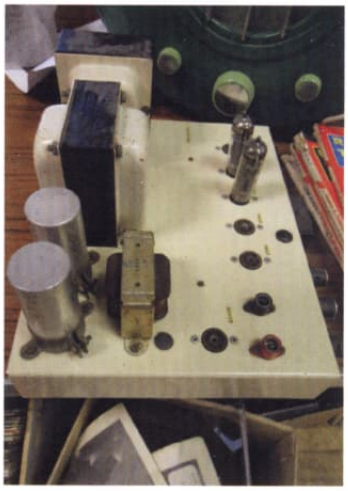
Zenith Transoceanic

Philips bakelite set

Two lonely record players

Quad FM tuner and pre-amp

Avo VCM163 valve tester



Edison ICS standard

RGD 535 Radiogram

Murphy A8 on stand

Vintage HiFi

'Wells coated' replica AD65

The BVWS Spares Dept

DeoxIT D5 contact cleaner / lubricant £16.50 aerosol can. Not cheap – just the BEST. Available at all BVWS events or by post for an additional £4.00

New manufacture high quality metallised polyester film capacitors to replace all old paper types in vintage equipment. Ideally sized for re-stuffing

All capacitors are 630 Volt working
All prices are for packs of 50 components and include postage and packing

Available in mix-and-match packs of 50 within price band by post.
Available in smaller quantities at all BVWS events.

0.001µF	Price band A	0.022µF	Price band B
0.002µF	Price band A	0.047µF	Price band B
0.003µF	Price band A	0.1µF	Price band B
0.0047µF	Price band A	0.22µF	Price band B
0.01µF	Price band A		

Price band A is £25.50 (inc postage)
Price band B is £29.00 (inc postage)

Electrolytic smoothing capacitors, standard 'old-fashioned' size, 500 Volt DC working

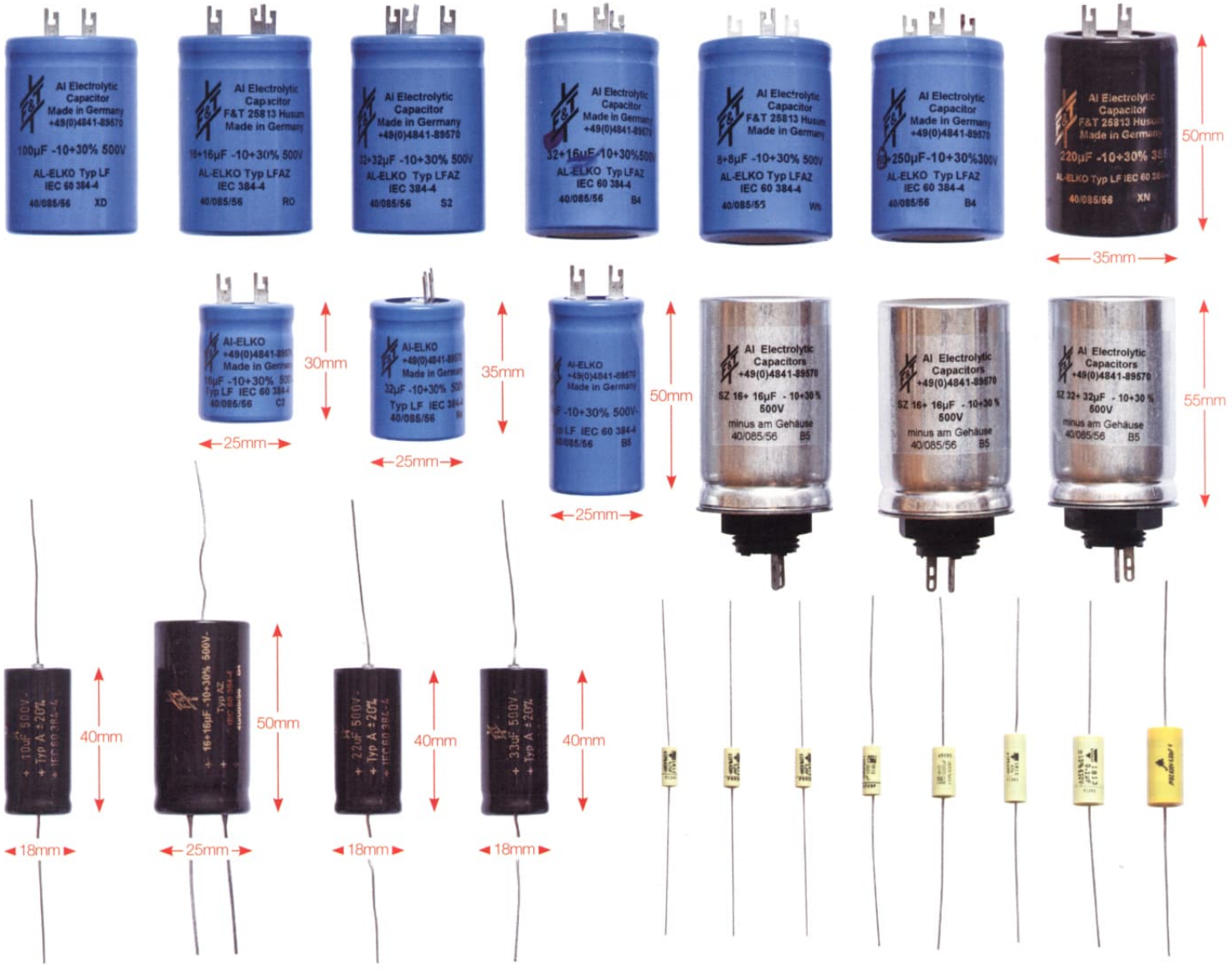
8/8µF, 16/16µF, 32/32µF £7.00 each
50/50µF £9.00 each
16/32µF for DAC90A £9.00 each
60/250µF for TV22 £9.00
8/8µF screw-type, 16/16µF screw-type, 32/32µF screw-type £9.00 each
16/16 µF tubular axial £6.50
10µF tubular axial £4.00
22µF tubular axial £4.00
33 µF tubular axial £4.00
47 µF tubular axial £4.50
70 µF tubular axial £4.50

NEW smaller 25mm can types for re-stuffing original single electrolytic capacitors

8µF, 16µF, 32µF, 47µF, 500Volt DC working £5.00 each

Postage and packing 1 – 4 caps £3.00 5 – 8 caps £4.50

All prices quoted are for BVWS members



For non UK addresses, please contact Mike Barker for prices, (see below). All orders should be sent (with payment made out to BVWS) to: Mike Barker, Pound Cottage, Coate, Devizes, Wiltshire, SN10 3LG. Cheques payable to British Vintage Wireless Society. Please allow 14 days for processing, but usually quicker! The above capacitors are supplied as a BVWS member benefit. Anyone found to be reselling these items for profit will be expelled from the Society

BVWS Books

Out Now! Tickling the Crystal index and supplement

80 pages of GPO No. era British crystal sets. including comprehensive index listing sets in all five volumes of *Tickling the Crystal*
£11.95, £9.95 to BVWS members.
(+ £2.50 p&p UK) £3.50 EEC
(rest of world £5.50)

Shareholders of the British Broadcasting Company by Lorne Clark
68 pages. For the first time, a comprehensive listing of all of the companies, large and small, comprising the British Broadcasting Company - the forerunner to the British Broadcasting Corporation. Illustrated.
£10.95 (+ £2.50 p&p UK)
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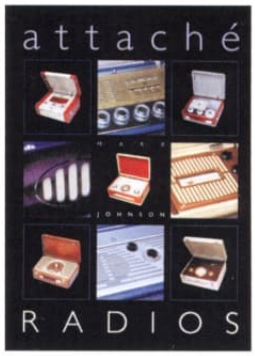

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by Mark Johnson
An 80 page colour paperback guide to the Attaché portable
- Detailed specifications
- 140 radios in full colour
- Over 200 additional photos of sales literature, trade ads etc.

£12.00 (+ £2.50 p&p UK)
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Growing up in the 1930s, young Gerry Wells preferred wireless to toys. He had a postwar career as a radio and TV engineer designing and managing amplifiers, PA's and TVs. He founded the British Vintage Wireless and Television Museum from the home where he was born. This is the story of one man's dedication to wireless
£6.00 196 pages paperback
(+ £2.50 p&p UK)
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Tickling the Crystal
256 pages. Over 200 full-page photographs.
£14.95 for BVWS members plus £7 p&p for UK, £13 EU
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Tickling the Crystal 2
Limited, Only 750 copies printed. 208 pages. Over 125 full-page photographs. £29.95 (£24.95 for BVWS members) plus £7 p&p for UK, £13 EU
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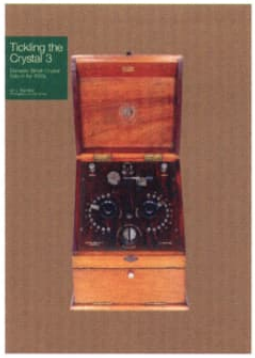

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(rest of world £19)

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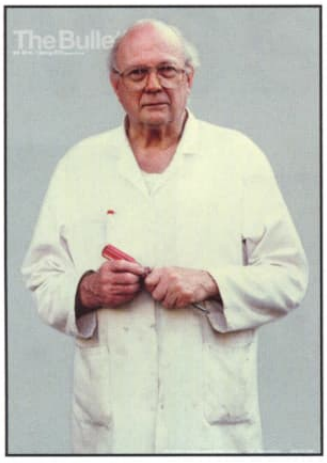
Slipcase to house the first three volumes of Tickling the Crystal £9.95 Buy all three and get slipcase free! (postage £12 UK, £35 EEC, £55 US) BVWS members buy two and save £12 (postage £9 UK, £24 EEC £28 US)
Cheques payable to British Vintage Wireless Society

Mike Barker, Pound Cottage, Coate, Devizes, Wiltshire, SN10 3LG

BVWS Books



The Bulletin back issues

All Bulletins and supplements are priced at £4.00 each + postage.

Postage: for individual Bulletins add £1.50, for all extra bulletins add £1 each.
Cheques to be made payable to 'British Vintage Wireless Society'.

Mike Barker, Pound Cottage,
Coate, Devizes, Wiltshire, SN10 3LG
chairman@bvws.org.uk

Events Diary

2016 Meetings

Sept 10th Television anniversary event at BVWATM
Sept 11th Murphy Day at Mill Green Museum
Sept 18th Table Top Sale at BVWATM
Sept 25th Harpenden
October 2nd Audiojumble
October 9th Special auction at Royal Wootton Bassett
November 6th Golborne
November 13th BVWS 40th Anniversary finale at the Writtle Hut, Sandford Mill Museum, Essex CM2 6NY
November 19th An Afternoon of Music and Museum Sale. at BVWATM
December 4th Royal Wootton Bassett

2017 Meetings

February 5th Special auction at Royal Wootton Bassett
February 19th Audiojumble
March 5th Harpenden
April 9th Golborne
May 14th National Vintage Communications Fair Warwickshire Exhibition Centre CV31 1XN
June 3rd Garden Party at BVWATM
June 4th Swapmeet at the Cinema Museum, London
July 2nd Royal Wootton Bassett
August 6th Punnetts Town
September 10th Murphy Day at Mill Green Museum
September 24th Harpenden
October 1st Audiojumble
November 12th Golborne
December 3rd Royal Wootton Bassett

GPO Numbers

Martyn Bennett is the custodian of the BVWS GPO Registration Numbers list. As many members know, the project of assembling this list was started in the early days of the BVWS and was carried on by the late Pat Leggatt. Members are strongly urged to help build the list, whenever they get the opportunity, particularly as it is something that will help with the identification of vintage wireless in years to come. The list is by no means complete and the GPO no longer have a record of the numbers granted to wireless manufacturers. The BVWS Handbook contains the current listings - one in numerical order and one ordered by name. Please let Martyn have any additions, or suggestions for corrections, by mail or over the phone.

Martyn Bennett, 58 Church Road, Fleet, Hampshire GU51 4LY
telephone: 01252-613660 e-mail: martyb@globalnet.co.uk

The British Vintage Wireless and Television Museum:
For location and phone see advert in Bulletin.
Harpenden: Harpenden Public Halls, Southdown Rd. Harpenden. Doors open at 9:30, tickets for sale from 09:00, Auction at 13:00. Contact Vic Williamson, 01582 593102
Audiojumble: The Angel Leisure Centre, Tonbridge, Kent. Enquiries, 07873 862031 info@audiojumble.co.uk
NVCF: National Vintage Communications Fair
See advert in Bulletin. www.nvcf.co.uk
Royal Wootton Bassett: The Memorial Hall, Station Rd. Wootton Bassett. Nr. Swindon (J16/M4). Doors open 10:00. Contact Mike Barker, 01380 860787
Golborne: Golborne: Golborne Parkside Sports & Community Club. Rivington Avenue, Golborne, Warrington. WA3 3HG
contact Mark Ryding 07861 234364
Punnetts Town: Punnetts Town Village Hall, Heathfield, East Sussex TN21 9DS (opposite school)
Contact John Howes 01435 830736
Mill Green Museum: Bush Hall Lane, Mill Green, Hatfield, AL9 5PD
For more details with maps to locations see the BVWS Website: www.bvws.org.uk/events/locations.htm

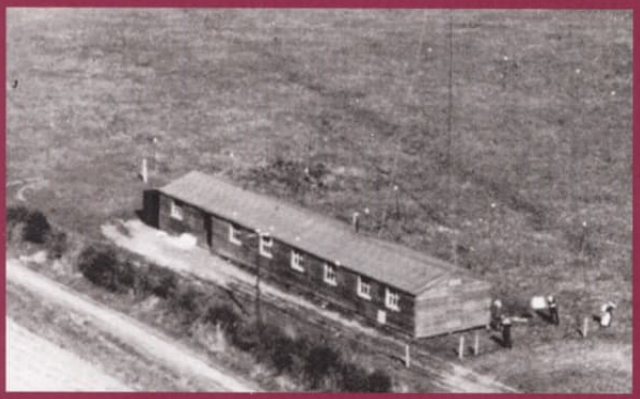
November 13th 1.00 to 5.00pm

BVWS 40th Anniversary finalé

Writtle Hut, Sandford Mill Museum, Sandford Mill Road, Chelmsford Essex CM2 6NY

Free refreshments • 45 minute talk by Tim Wander on the history of 2MT Writtle • Bring your own item to display

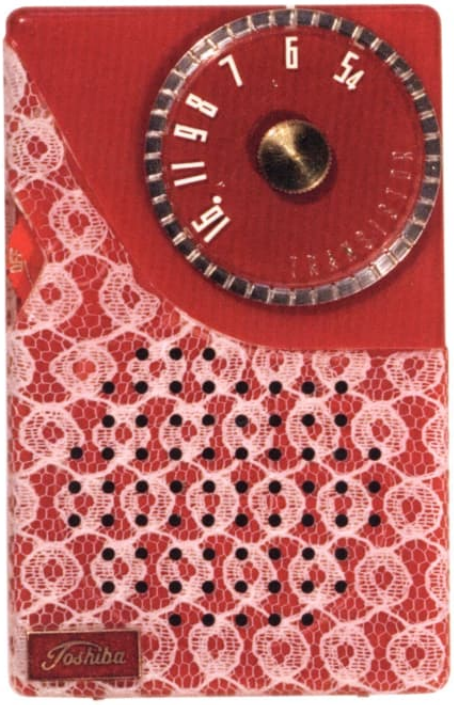
To complete our 40th Anniversary Celebrations we will be holding an event at the Writtle Hut at Sandford Mill Museum on the 13th November. We hope to recreate the historic photo of the BVWS 1977 first AGM which was held at the Writtle hut with as many people who appeared in the original as well as current members. Do please come along for a very interesting afternoon.



Notice is given of an Extraordinary General Meeting of the BVWS Committee to be held at 2.30pm in the museum.


VISCOUNT
V-I-P


GLOBAL
TRANSISTOR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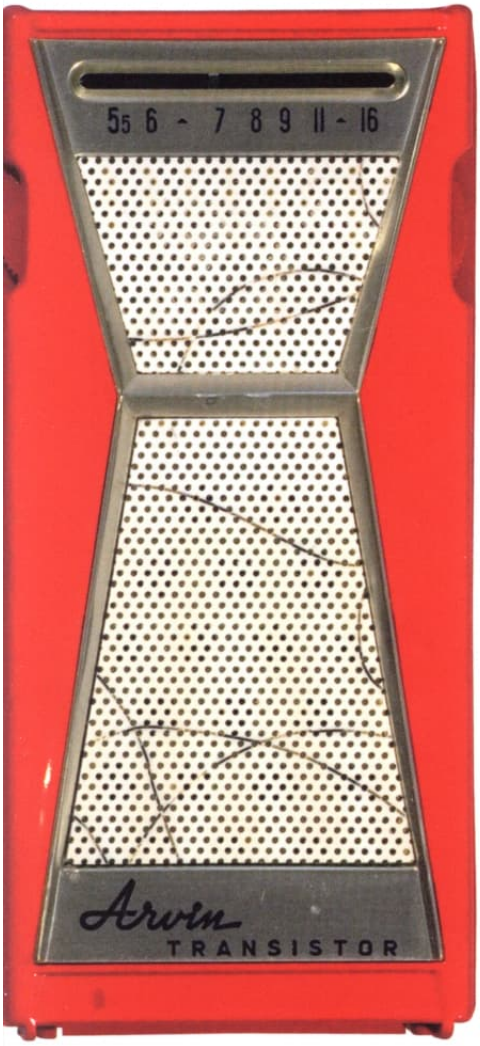
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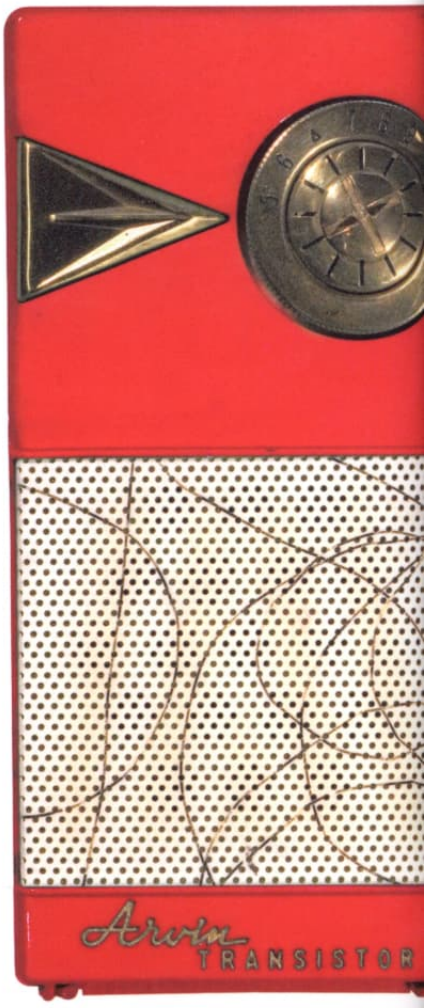
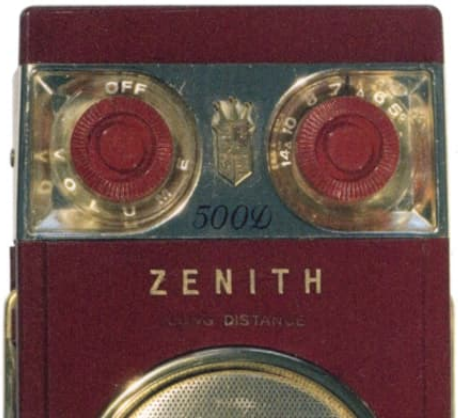
Arvin
TRANSISTOR


Arvin
TRANSISTOR


SONY


HITACHI
TRANSISTOR 6


500Z
ZENITH