The Bulletin

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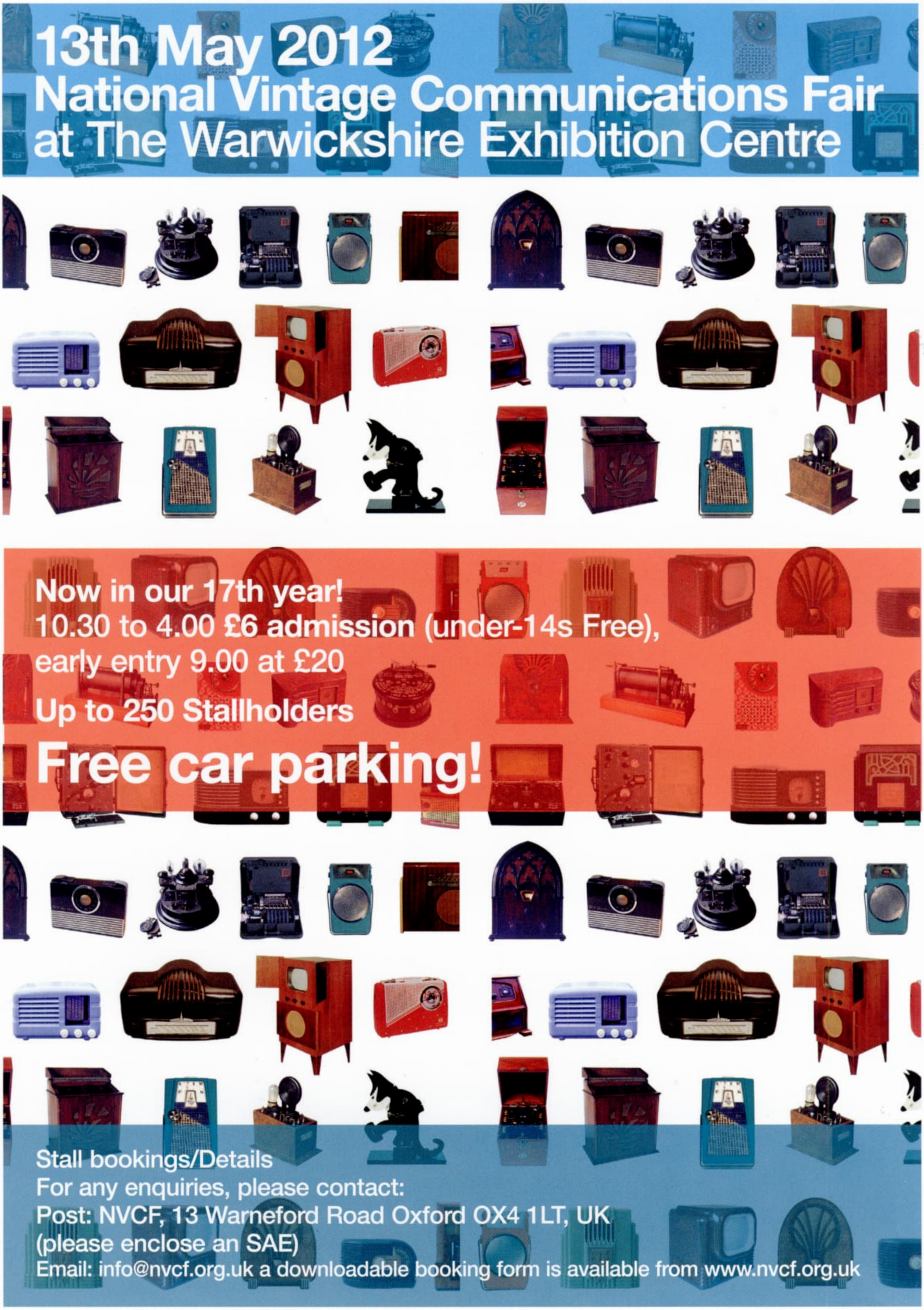
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Bulletin of the British Vintage Wireless Society
Incorporating 405 Alive
Volume 36 No.3 Autumn 2011

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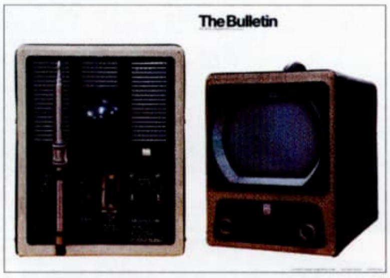


Front and rear cover: Ekcovision type TMB.272 portable television receiver, 1955.
Photographed by Carl glover

Graphic design by Carl Glover and Christine Bone
Edited by Carl Glover. Sub-Edited by Ian Higginbottom
Proof-reading by Mike Barker, Ian Higginbottom and Peter Merriman

Contents

From the Chair - Alexandra Palace event cancelled!

It is with significant regret both on my part personally and that of the entire BVWS Committee that I inform you all that the planned NVCF at Alexandra Palace (AP) on the 6th November 2011 is CANCELLED.

Those who pre-booked tables should all have been contacted by this time.

We have found the whole process of working with the commercial company that deals with hall bookings and delivering facilities and services at AP difficult. The above commercial company must not in any way be confused with the charity that runs the Palace or any other body concerned with the historic television studios. These are completely separate entities.

The Charity has given its full support in our plans to celebrate the 75th Anniversary of the beginning of a public broadcast television service. The television museum organisation 'Alexandra Palace Television Society' (APTS) has also been very supportive in making the studio/museum available to us. I would personally and publicly like to thank APTS and the Palace charity for their support.

All problems have been in connection with the commercial company. The initial contact and setting of dates etc. in 2010 went as expected and plans were made and prices discussed, everything seemed fine and affordable.

Later on, we were informed that another event would be held at AP on the same day, but we were assured that it would not affect our booking. Further investigation showed that the other event was an Indian Wedding Expo, which would run for several days with an expected attendance of up to 5000 (mostly on Saturday and Sunday). There would also be significant amounts of loud music. This would also have a huge knock-on effect on public transport, road traffic and car parking availability at AP, let alone catering etc. on site. We were also asked to give up some of the space allocated to the TV display to this other event. Mindful of the effect on our event we opted to move the date, which ended up being a better one for our purpose – the 6th November which we had originally been told was unavailable, hence the sticker in the BVWS Bulletin with the new date.

At about the same time problems arose with the hire costs. Negotiated prices stated by the Account manager began to change and we no longer had an affordable event. The increases (except for the addition of the Restaurant hire, which we added) seemed to be fluid and no two received documents bore any relation to each other.

A draft contract was received, but this differed significantly to what had been discussed and agreed on our visits.

At the BVWS Committee meeting of the 2nd July this matter was discussed and it was agreed that our trust in the commercial company had been damaged. It was agreed to send a letter to the account manager of the commercial company stating terms acceptable to our continuation of the event and requesting an early reply with answers to some questions. After some days, no written response or answers to our questions had been received and so a letter of termination was sent.

I feel this is a great shame and a lost opportunity for the Palace to have celebrated their History with us.

Mike...

Below: The letter to the company responsible for events at Alexandra Palace

Mr. Adrian Guthrie Account Manager, Alexandra Palace, London. 14th July 2011

Dear Adrian,
I hereby give official notice that the above mentioned organisations have decided to terminate all current negotiations with The Alexandra Palace commercial Company in respect to the hiring of halls for the staging of an NVCF event and Television Celebrations.

We therefore relinquish all rights of reservation for the dates of the 5th & 6th November 2011.

This decision is final and we will not consider any further negotiations.

It was agreed in Committee that the whole process of hiring halls at the Alexandra Palace was exceedingly difficult, far beyond any other venue we have ever had connection with such as the NEC (11 years), NMM, WEC (6 years), Harpenden Halls (33 years) and various other Council-owned and run establishments over the last 35 Years of the BVWS.

From a customer's point of view we have found the lack of openness and clarity on costing (no published price list) and continual price variance after your holding weekly profit & loss meetings untenable.

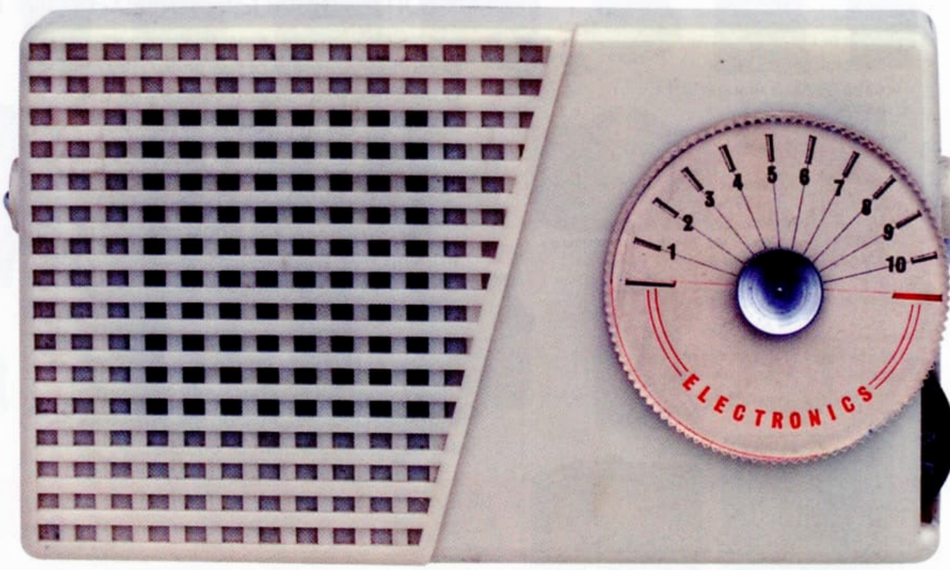
We have now reached a time where we are no longer happy to continue with the event.

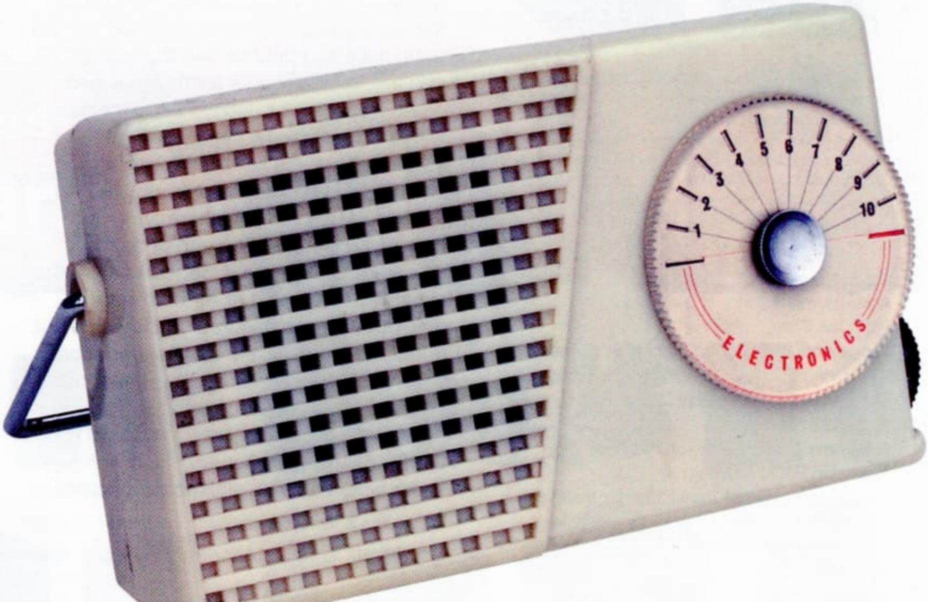
Very Best regards, Mike Barker. (On behalf of the BVWS Committee)

The infamous 'Personna' pocket 5, kit radio

By Roger Grant

It was 1961 and I was still at school, most evenings I would listen to pop music on radio Luxembourg while doing my homework and like most teenagers, I longed to own one of the pocket transistor radios just starting to appear on the market. During the school summer holidays some of the kids in my class had been given £3 each to play as extras in the film *The Young Ones* starring Cliff Richard, while being filmed on location at Ruislip Lido in West London. The money was spent on trying to satisfy this latest craze, Cliff Richard at this time was promoting the Fidelity Coronet at £9/19/6, a tanner short of a tenner, a bit expensive and way beyond most people's pockets including mine.





The £3 was nowhere near enough to purchase one, so the solution was to by a kit set from the nearby surplus electronics shop "Electronic Precision Equipment" on Windmill Hill Ruislip Manor, they like other surplus electronics shops advertising in Practical Wireless were offering a kit set, the Personna Pocket 4, at 52/6 (£2.62p) using three transistors and one diode, this being one of the best of them, driving a speaker and not requiring a long aerial and water pipe earth.

I already owned one of these, purchased a few months earlier by my Dad for my twelfth birthday. This three transistor reflex regenerative set used one of the moving iron type ex-military earpieces about 2" diameter with a corrugated aluminium diaphragm, very popular as a speaker with kit sets at this time and with this, the set produced a very low level scratchy reproduction of the Home Service, barely discernible Light Program and no Radio Luxembourg, making the set very disappointing to say the least, and left me still wanting.

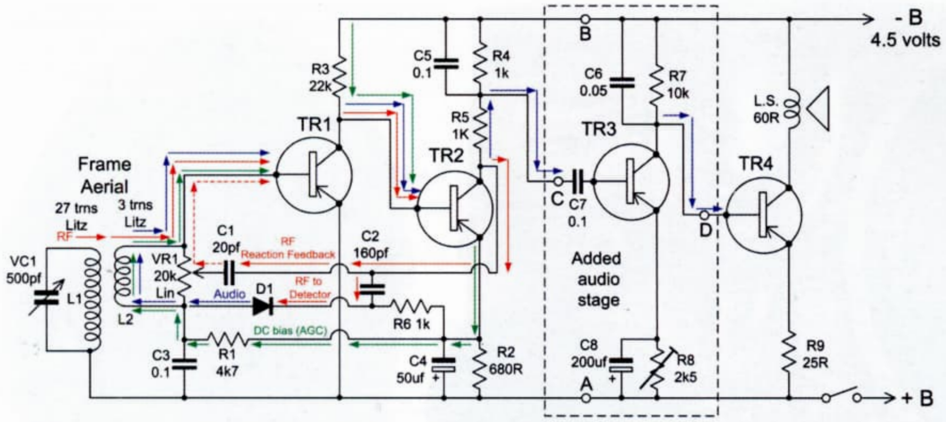
For another 14/6 (72p) you could buy an extra transistor stage including a three inch moving coil speaker, this allegedly improved the performance to get Radio Luxembourg at a reasonable quality and level. This extra stage consisted of a single transistor, a 60 Ohm moving-coil speaker and a half dozen or so surrounding components, these were assembled on a piece of folded cardboard, wedged inside the cardboard box chassis, making it now the Pocket 5.

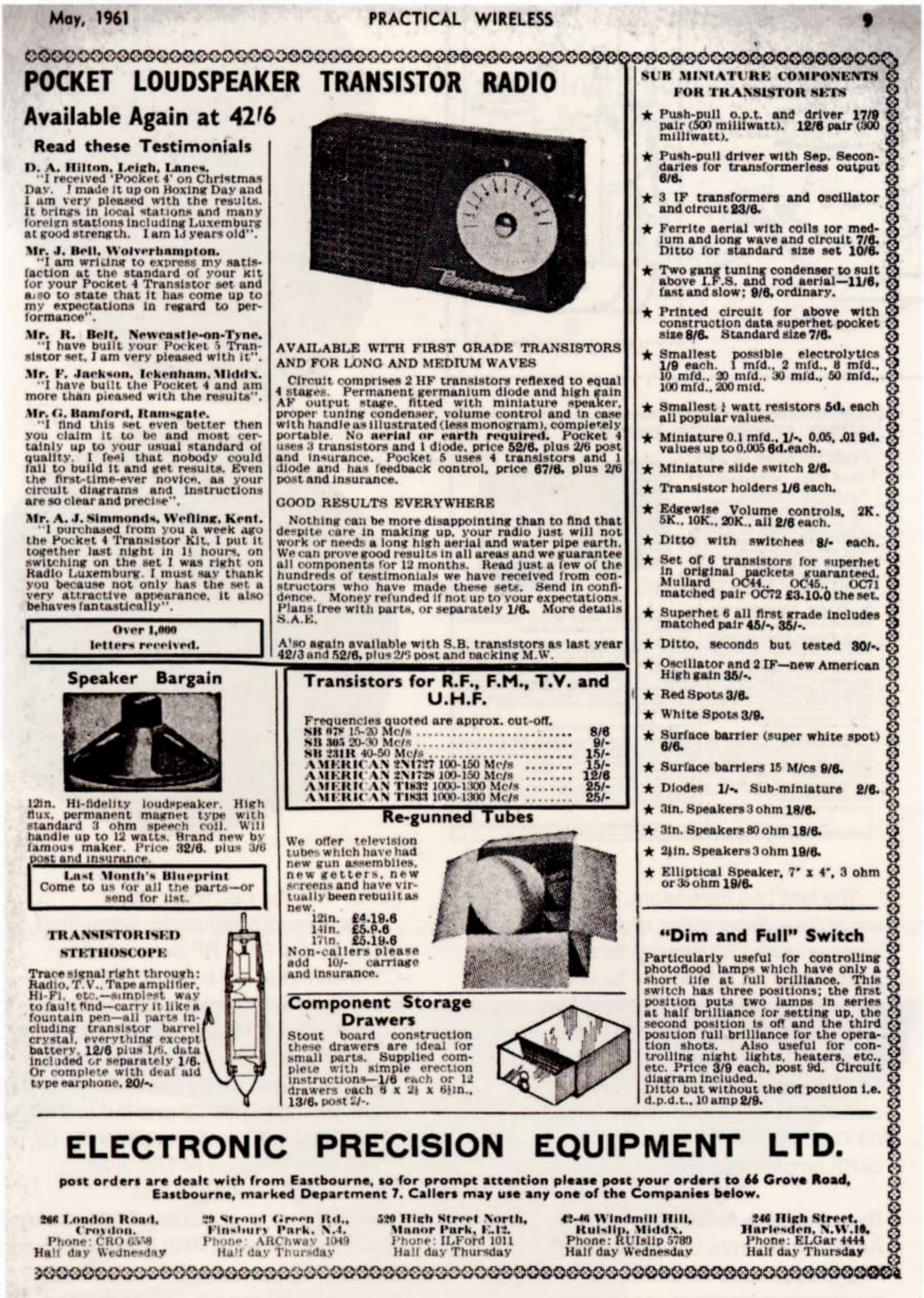
This increased the level and improved the tone of the scratchy noise and brought up the level of the Light program to an almost listenable level, but still very deaf to Radio Luxembourg. This prompted a trip back to the shop for advice (one of many), where it was suggested that the frame aerial coils were not wound very accurately and we should remove one turn of this litz wire coil, this increasing its frequency to cover the Luxembourg end of the band. This seemed a bit drastic and having now spent many hours trying to improve this set and keeping it working, with many pitfalls along the way, Dad decided that a second opinion might be in order and a knowledgeable neighbour was consulted, he suggested making a tapping so this modification could be reversed if it didn't work (words of wisdom I have treasured and applied ever since). This didn't work immediately as one turn appeared not to be enough but did move the tuning band in the right direction, much experimenting with more tappings and we did eventually get it to receive Radio Luxembourg albeit on the peaks of the fade, probably less than ten per cent of the time at a listenable level.

As far as trades descriptions were concerned, it did just about live up to the advert, this contained several testimonials saying how well it would receive Radio Luxembourg. I had already suspected that these were a bit ambitious.

At this point Dad and I had decided that the set was now as good as it was ever going to be and I just used it for quiet bedroom use, Family Favourites on Saturday morning and Saturday night theatre in the evening, but the big wooden set in the living room was still required for Alan Freeman's Pick of the Pops on Sunday and Luxembourg evening listening.

Even for bedroom use the quality of the Personna was not very good and constantly needed attention, the brass strip on/off switch needed constantly re-tensioning and the cardboard battery carriers were permanently intermittent, not helped by the U12 batteries' negative connection being the raw zinc casing and not staying bright





May, 1961 PRACTICAL WIRELESS 9

POCKET LOUDSPEAKER TRANSISTOR RADIO

Available Again at 42/6

Read these Testimonials

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"I received 'Pocket 4' on Christmas Day. I made it up on Boxing Day and I am very pleased with the results. It brings in local stations and many foreign stations including Luxemburg at good strength. I am 13 years old".

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"I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1½ hours, on switching on the set I was right on Radio Luxemburg. I must say thank you because not only has the set a very attractive appearance, it also behaves fantastically".

Over 1,000 letters received.

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GOOD RESULTS EVERYWHERE

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very long, and of course, every time you took it apart wires would fall off, I vaguely remember a simple modification, if you had to keep re-soldering the battery wires to the battery carriers you may as well solder the wires directly to the batteries, eliminating the intermittency of the carriers.

It had other annoying habits like constant regenerative drifting and due to a lack of a key in the tuning condenser shaft, the tuning dial would move out of calibration, this looked awful with the tuning dial sometimes upside down.

Given half a chance I would borrow my aunt's KB Rhapsody, the valve version and not fully portable as she wouldn't buy the expensive batteries, but it wasn't long before Dad purchased a six transistor superhet, a Dansette 111, so the Personna was put away and eventually disappeared in the annals of time. (A couple of years ago I came across a Dansette 111 at a boot fair, it was even the same colour as the one Dad owned, and for £2.50 I couldn't leave it there).

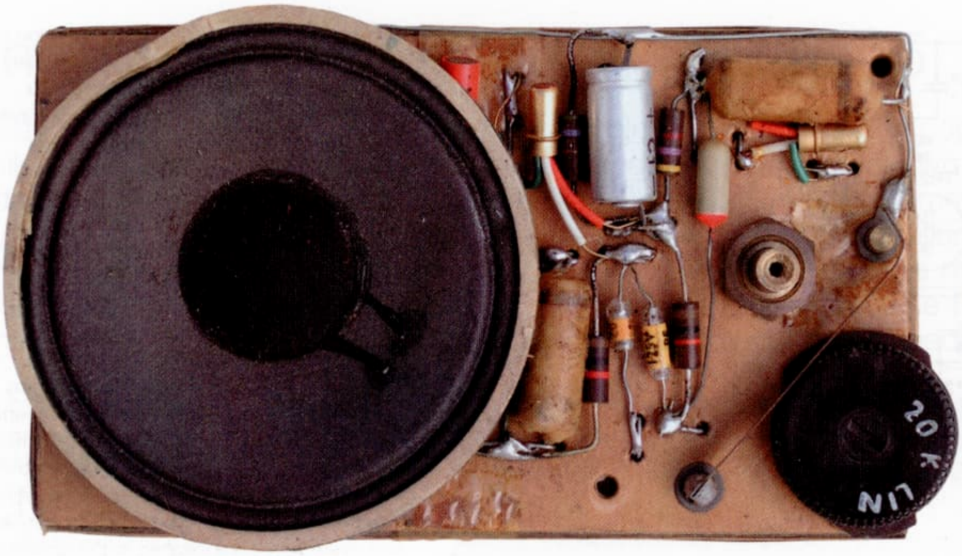
In the light of this experience I was now considered an expert among my school chums and when their sets didn't work they were brought to me for fixing, by now I had become quite good at soldering and knew where all the bits went. Despite its reputation, the Personna was quite popular and this task went on for months and mainly consisted of sorting out miswiring and dry joints, some of the sets were soldered using Bakers soldering fluid – an acidic liquid flux that made the cardboard chassis conductive. These sets were never going to work, (another gem learned from Dave our knowledgeable neighbour). Some of the kids took their sets back to the shop where for a fee they would be repaired but many complained that the set had gone wrong again even before they got home and they all had a performance equal to or less than mine.

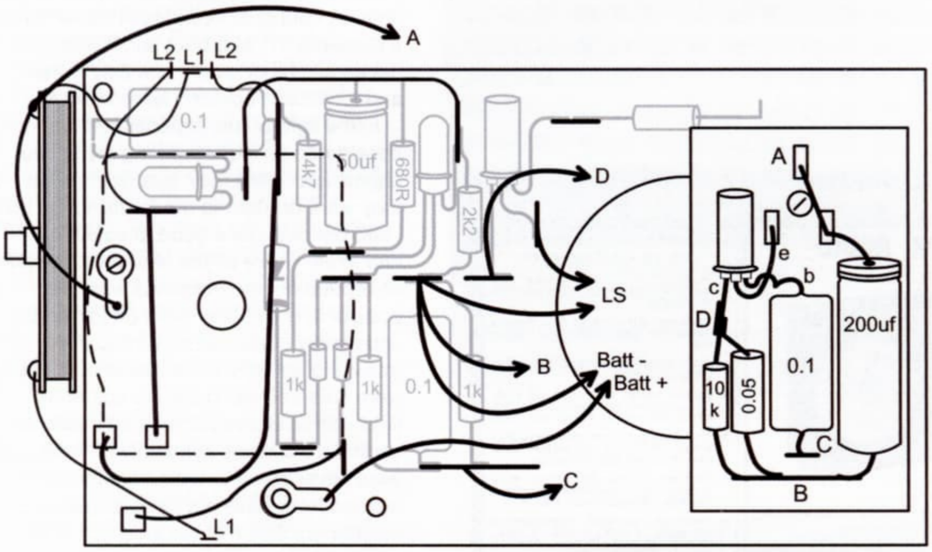
2011, almost exactly half a century later and while sorting out items to take to the March Harpenden I discovered a Personna Pocket 5, I remember buying it a few years ago and putting it away for when I had more time to get in among it, then completely forgot all about it until now (as one does).

Removing the cabinet the cardboard chassis looked exactly as I remembered it from the 1960's, even the transistors looked the same, the memories came flooding back and this trip down memory lane had begun.

Looking around the set the only thing that appeared to be missing were the battery holders, all the solder joints appeared to be ok, I noticed one of the legs had broken off the added amplifier emitter bias pot, this was easily repaired by soldering the transistor emitter wire directly on to its copper rivet at the end of the track.

The set is constructed on a cardboard box chassis with the frame aerial wound in Litz wire round the outside, Litz wire is used to give the coil a higher "Q" narrowing the band width for better station separation, the main tuning coil L1 has 27 turns, tuned by a single 500pf solid dielectric tuning capacitor and the secondary winding L2 has 3 turns. All of the component connections were short



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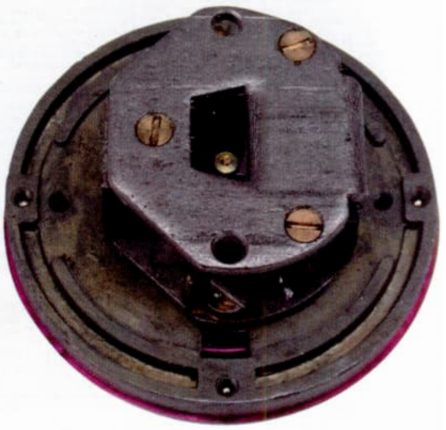


lengths of 22swg tinned copper wire pushed through holes in the cardboard chassis and folded over underneath like a staple, the components were soldered to these. The on/off switch, a 2" length of 1/8th wide brass strip pushed against a brass pillar by the reaction control, this brass strip drops into a flat filed across the edge of the reaction control and in the off position breaks contact. Unable to find any information on this set other than the adverts in Practical Wireless, I traced out its circuit and drew a schematic to see what was going on and work out how it all hung together, this took some sorting out as it was not instantly obvious.

The first two transistors, TR1 and TR2, are quite a clever reflex regenerative receiver, with TR2 serving three separate functions. This is followed by two stages of audio amplification TR3 and TR4.

RF from the tuning coil L1 is impedance matched to TR1 base by L2, then amplified by TR1 and TR2, the output from the collector of TR2 is fed to the detector diode D1 Cathode via C2, providing two stages of RF amplification before the detector.

Regenerative feedback

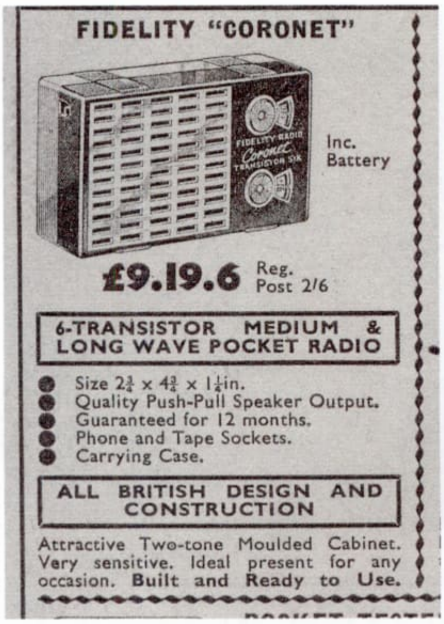
Amplified RF from the collector of TR2 is applied to the base of TR1 as regenerative feedback via C1 and level set by VR1 the reaction control.

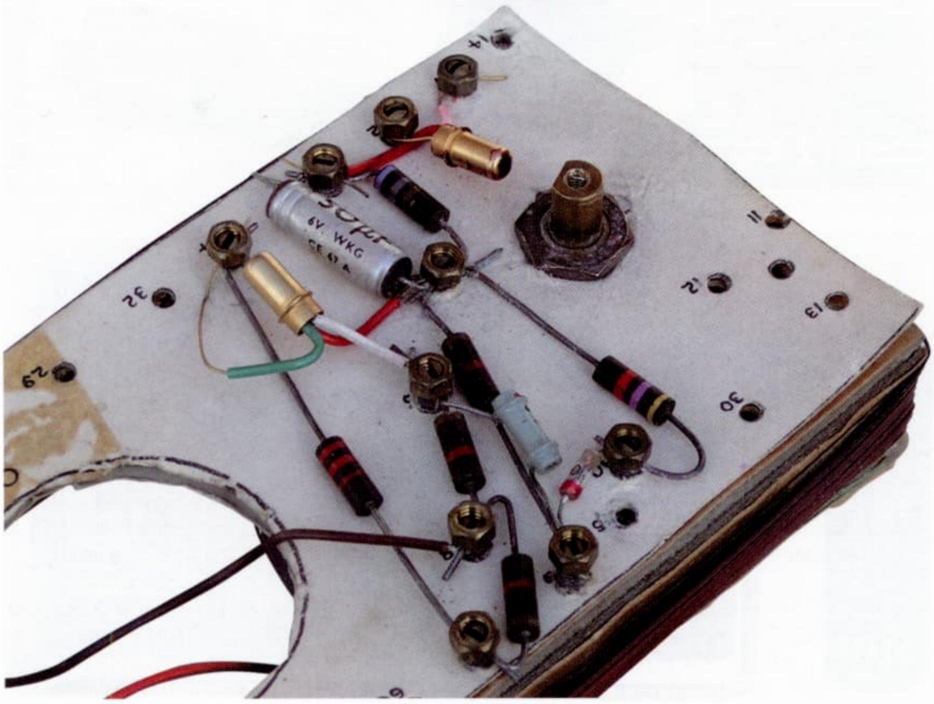
The demodulated audio signal from the anode of D1 is RF decoupled by C3, then fed to the base of TR1 and simultaneously amplified by TR1 and TR2 with the RF signal, now equalling a total of four stages of amplification.

The audio output from the collector of TR2, is RF decoupled by C5 and fed to the base of TR3, the third audio amplifier via C7.

The third function of TR2 is as AGC emitter follower to TR1.

Standing bias is applied to TR2 base via R3 (TR1 collector load). TR2 is biased on and a voltage appears on the emitter of TR2, developed across R2. This voltage is RF and





Audio decoupled by C4 and applied to the base of TR1 via R1, this DC voltage biases TR1 on and sets the quiescent current of TR1 and TR2, determined by the values of R1,R2 and R3. Audio output from the detector diode D1, being negative going, drives TR1 harder, reducing the voltage output on its collector to TR2 base, this reduces the current flow through TR2 and the DC voltage on its emitter (decoupled by C4) reduces, thus reducing the DC bias on the base of TR1, reducing the gain of TR1.

TR3 the third stage of audio amplification appears to have no standing bias applied to its base, I assume this relies on the collector/base leakage through this Germanium transistor, (usually anything from about 50k up) and the negative feedback developed by R8 decoupled by C8. R8 is made adjustable to balance the unknown collector/base leakage for the best bias level.

The audio signal on the collector of TR3 developed across R7 is "top cut" by C6 (to make it sound less tinny) and fed to the base of TR4 a very basic single ended output, feeding the 60 Ohm speaker.

At this point I realised that as a schoolboy my repairs to these sets was based on what you could see and pure guess work, as I remember, any blown up transistors and the set was referred back to the shop as they were quite expensive and there were no second hand or salvaged spares. This Personna Pocket 5 was found in a box with two other sets using the same cabinet, one just a cabinet with a few spare parts inside including one of the ex-military earpieces, the other, a two transistor version of a very similar circuit without the two audio stages and reaction components. This was a "no soldering" version using brass screw terminals with a "Starlux 208" transfer on the front of the cabinet. This was an earpiece only set and the coils were wound with ordinary solid enamelled copper wire, a much lesser kit radio.

This set still had its folded cardboard battery carriers the same as I remember in the Personna, so these were copied and fitted to the Personna.

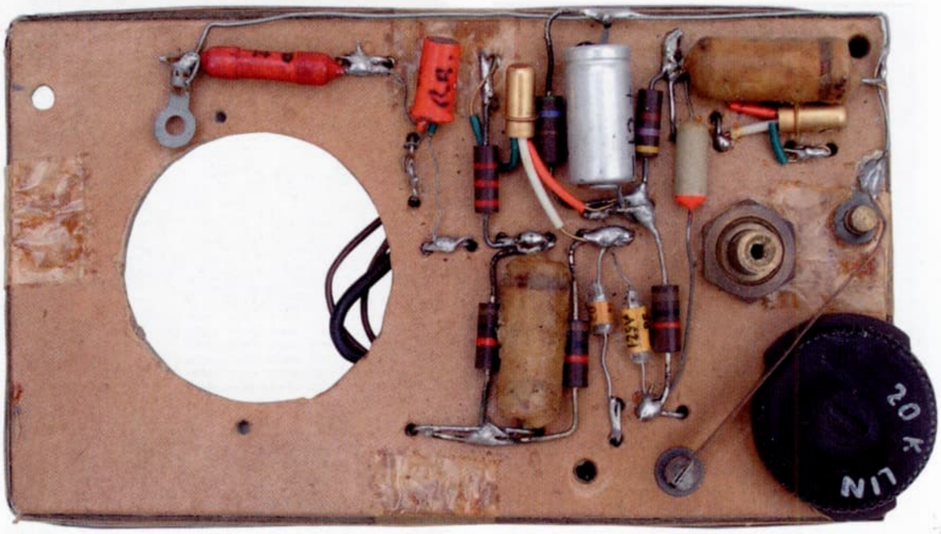
After tightening the on/off switch anchor pillar to stop it rotating and re-tensioning the brass strip, the set crackled into life with faint music in the background, what a surprise! this set still works! After fifty years, in the sixties you were lucky to get one to work after fifty minutes. It was just about brought to listening level by adjusting the tuning and reaction controls. I vaguely remember when the back was removed from my original, the chain of batteries would fall out, frequently pulling the connecting wires off, and there were three of them, so I fitted a third battery bringing the supply voltage up to 4.5volts, this improved the performance considerably, (the early transistors were rated at around 6 volts). Adjusting the audio bias pot (R8) in the added audio stage, just gave you the choice of more volume or less distortion, there seems no happy medium.

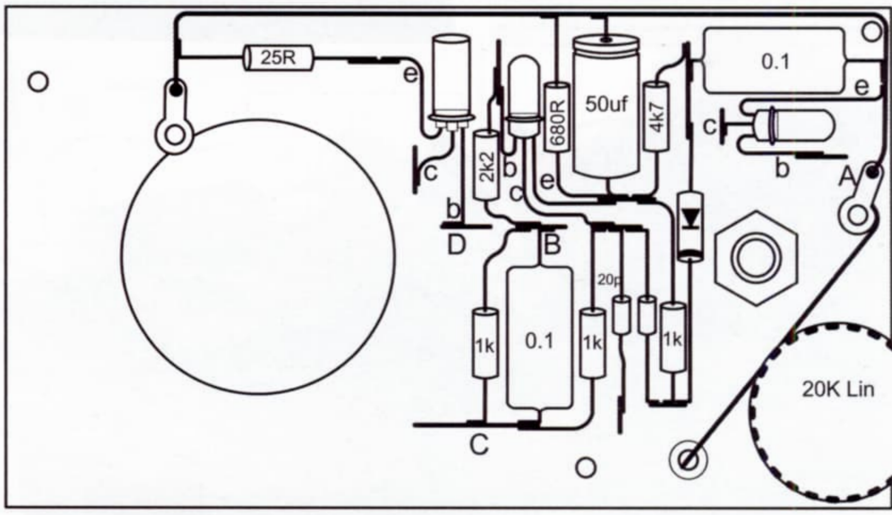
On the whole this set performs much better than my original, it would be ok to catch the news or latest cricket score but you wouldn't want to listen to it for too long and music is really out of the question. In the early sixties I never got to own a pocket superhet and most of my listening was done on a big wooden 30's set, so perhaps my expectations of one might have been a bit higher than their actual performance, and at the time with no experience of listening on a 3" speaker with only milliwatts of output, perhaps my disappointment with the Personna a little unjust.

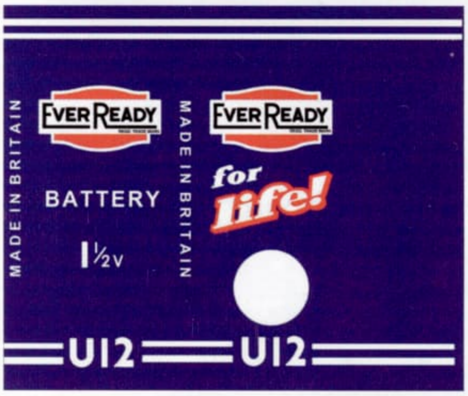
To my surprise it easily tuned into Capital Gold on 1548 kc/s, a lot higher frequency than Radio Luxembourg on 1442 kc/s with still room at the end of the tuning capacitor. Perhaps they got the tuning coil windings right by the time this kit was made. Just out of interest I checked its tuning range with my signal generator the set tunes from 510 kc/s to 2 megs. Despite its poor quality and performance this has been a very interesting set to restore, being one of many second generation kit sets from the 1960's that will always have a place in history, just like the first kit sets in the 1920's.

Finally, the photograph of the inside of the set with Duracell batteries just didn't look right, so I couldn't resist making some new paper sleeves for these AA cells. The internet provided several photo's of U12 Pen cell batteries of the day and reproducing battery covers now a standard restoration procedure.

Having now finished the Personna, I fired up the lesser set, this didn't work at first as the earpiece I was using was of too low impedance, the set only had power enough for driving a very high impedance crystal earpiece, I discovered the crystal earpieces I had in stock were all open circuit, so I used a pair of 4k crystal set headphones and later fed it into my bench audio amp. Its performance was very similar to the Personna, the lack of regenerative feedback didn't make an awful lot of difference to the set's sensitivity, but probably increased the output level to the audio amp in the Personna. The Litz wire used in the Personna coils did improve the station separation.

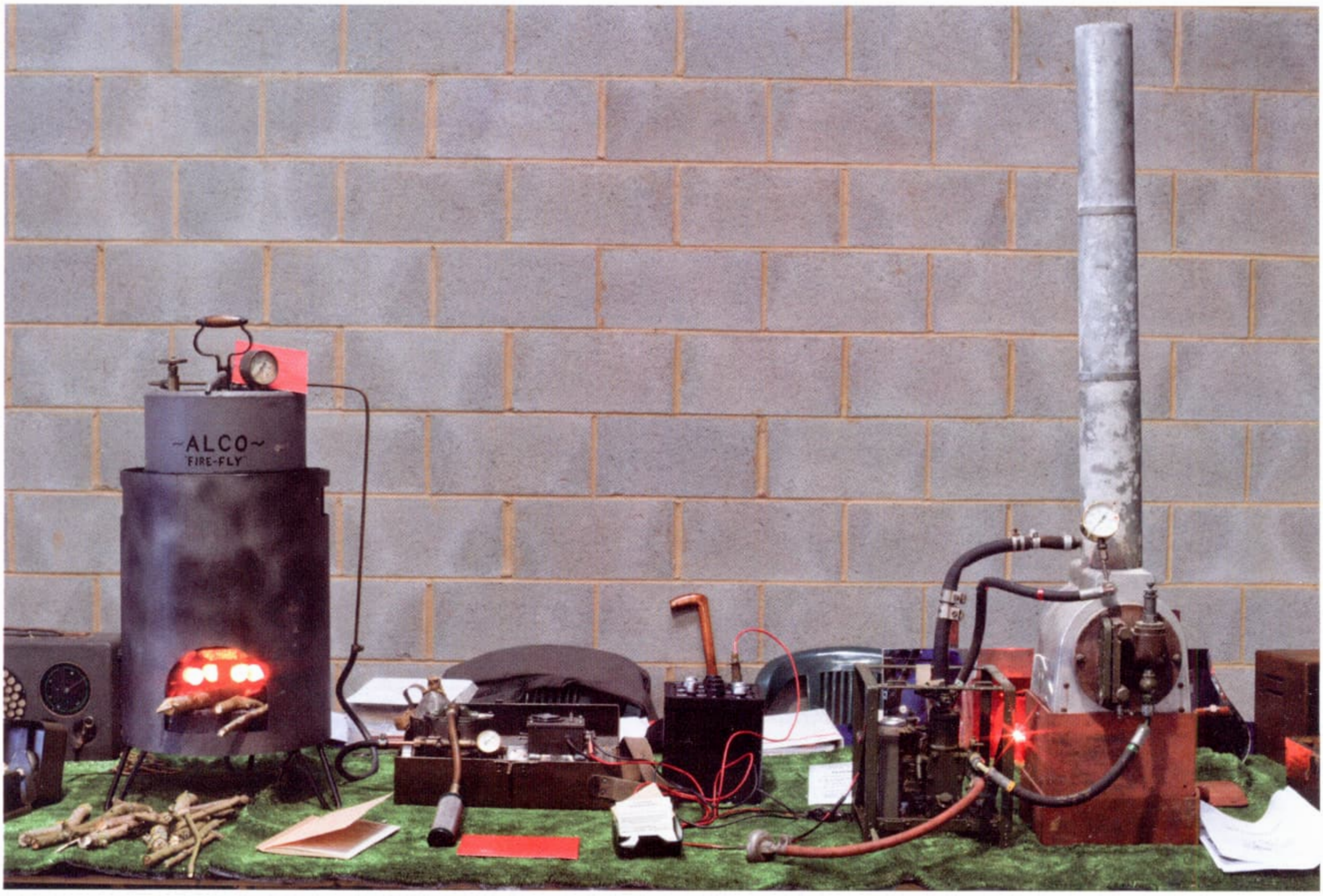


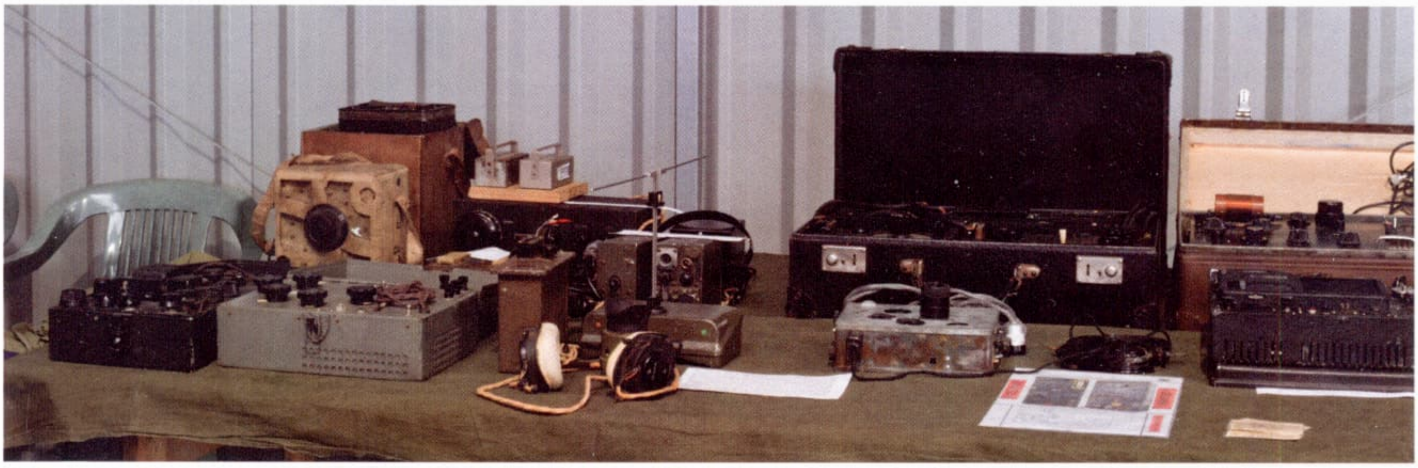


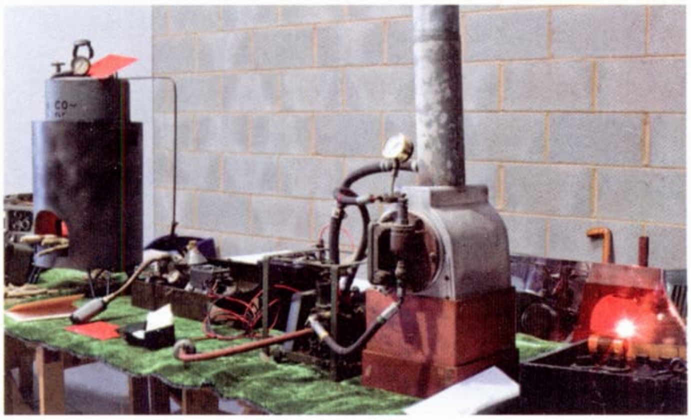


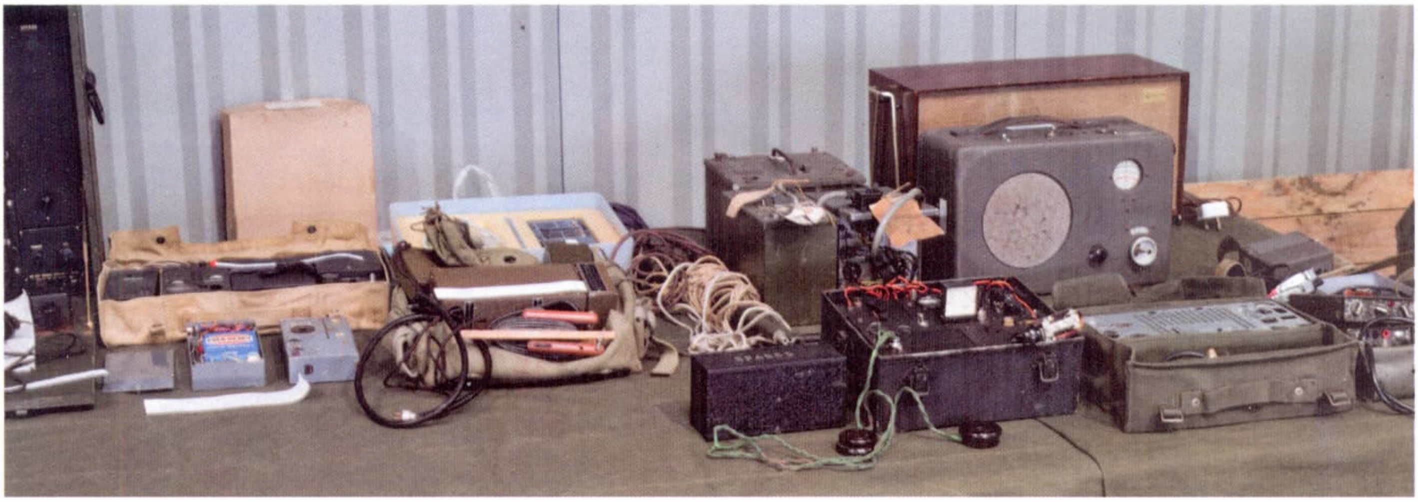
Exhibition of John Elgar–Whinney collection of covert equipment at NVCF

photographed by Lorne Clark


~ALCO~
FIRE-FLY

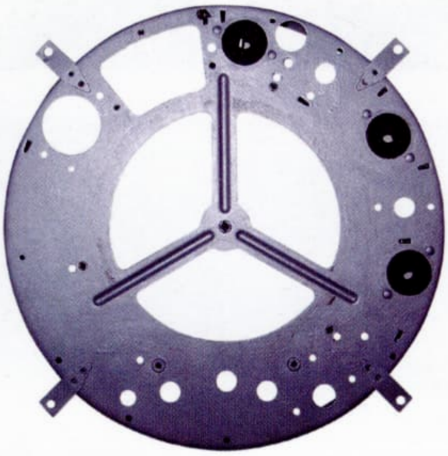
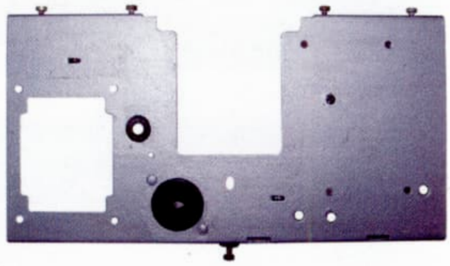


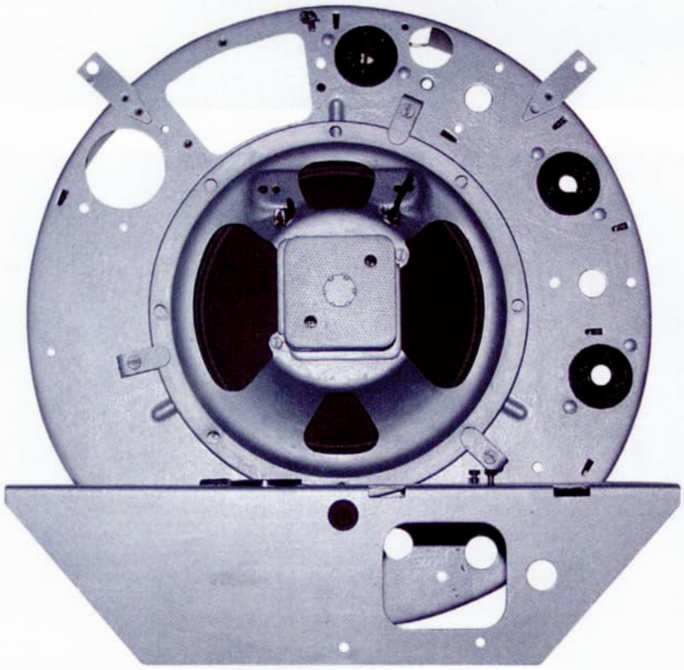
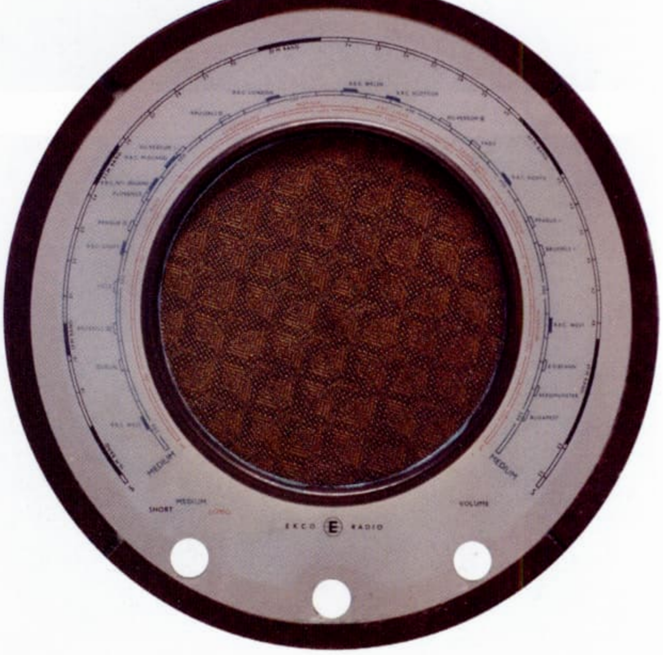




Ekco A22 rebuild by Robert Darwent (robert.g0uhf@gmail.com)

A few years ago now, I was fortunate enough to find locally an empty walnut brown Ekco A22 bakelite case. It was in excellent condition, no scratches or cracks, and I immediately bought it. My intention was then to look out for an A22 chassis or a complete set with a damaged case that I could pick up at a hopefully much reduced price and combine. For several months that looked very unlikely to happen and I did serious work instead using parts from scrap Ekco A23 and A28 sets to construct a reproduction chassis to fit my empty case. Then unexpectedly the real thing turned up!

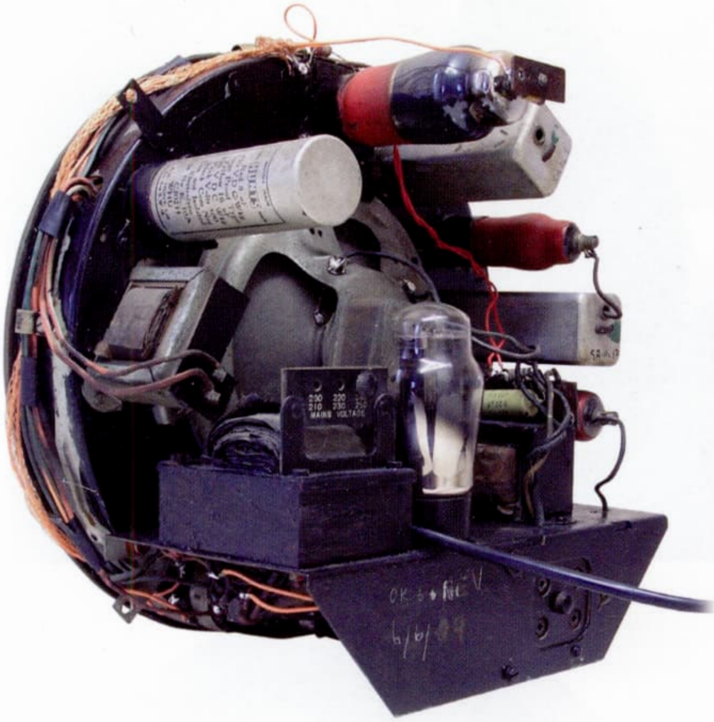



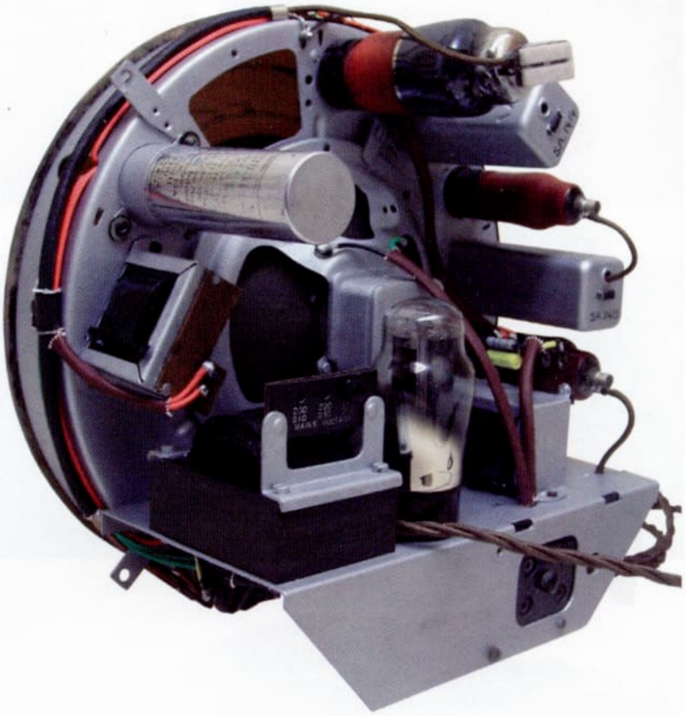
When I collected the set the seller told me that when he had purchased it himself it had been damaged whilst being delivered and he had repaired the resulting broken case with Araldite. Apparently he had also "comprehensively overhauled" the chassis and it was in "superb working order". A quick look at the damage to the case showed it to be not as bad as I had first assumed and I thought I could much improve on the copious amounts of glue that had been used. But since I had always intended to transfer the chassis to my unblemished case it was not a real issue for me. I also noticed the set had a rough board as a replacement back cover, the original obviously having gone missing at some point.

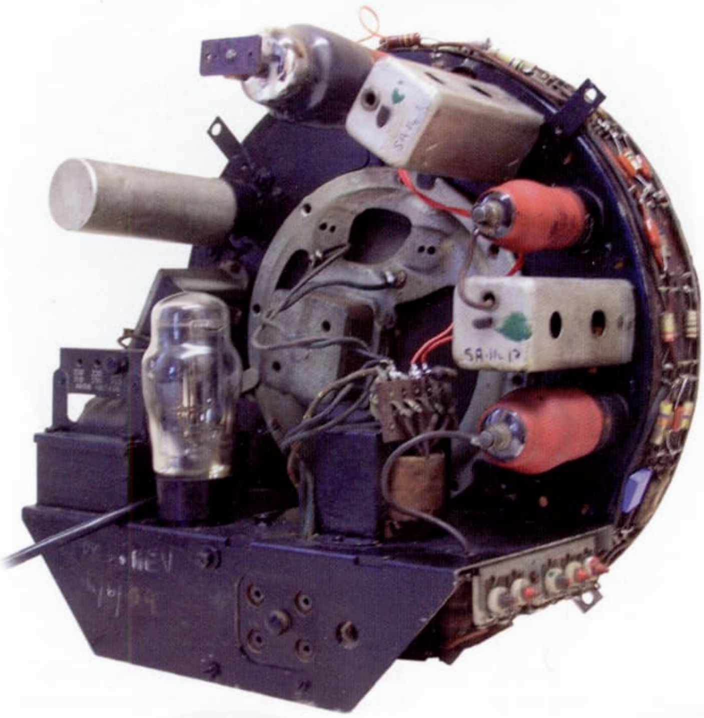
Upon getting the set home I plugged it in to try out. After a bit of a warm-up the medium wave range brought in the local station loud and clear even without an aerial connected, but little else. The addition of a few metres of wire as a temporary antenna and the medium waves were much more lively. The short wave range too was very good with stations all over the dial. But ominously the long waves were just a steady background hiss.

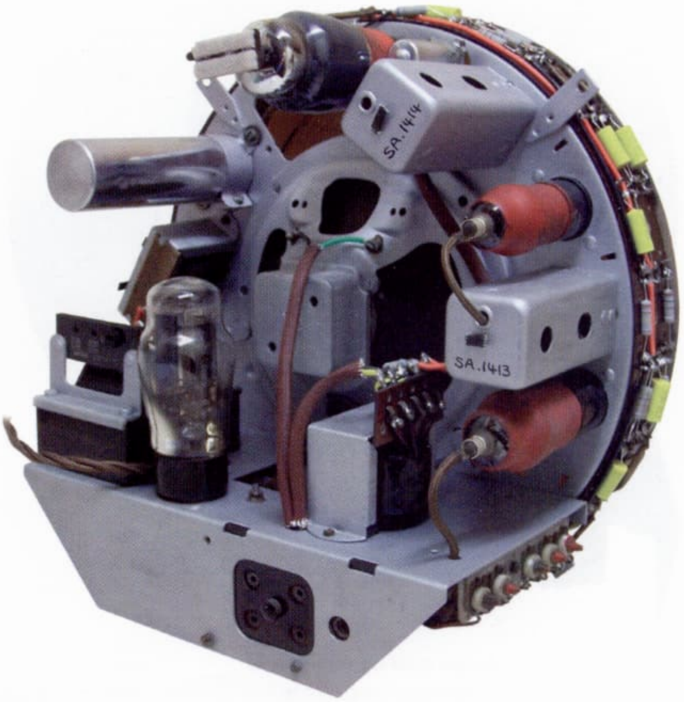
At this point I unplugged the set and removed the back cover. What a sight! Virtually the entire chassis had been daubed with black paint that looked more like hardened black treacle in places. I removed the chassis and was again shocked by what I saw. The state of the wiring was terrible! A few wires had obviously been renewed by modern red and orange, but most was original, hard, brittle and flaking, showing exposed wire. If I'd have known this beforehand I would have never applied power. So much for the comprehensive overhaul! I was really surprised the set worked as well as it did in this condition.

Further investigation showed the 'overhaul' to have included replacement of all but one of the wax capacitors with







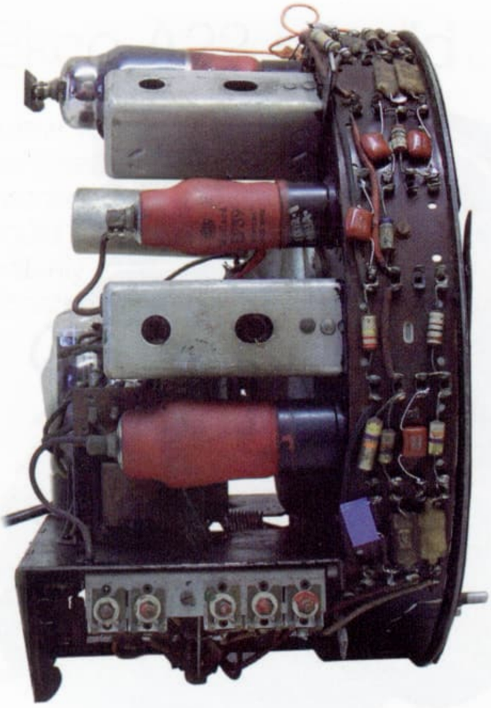


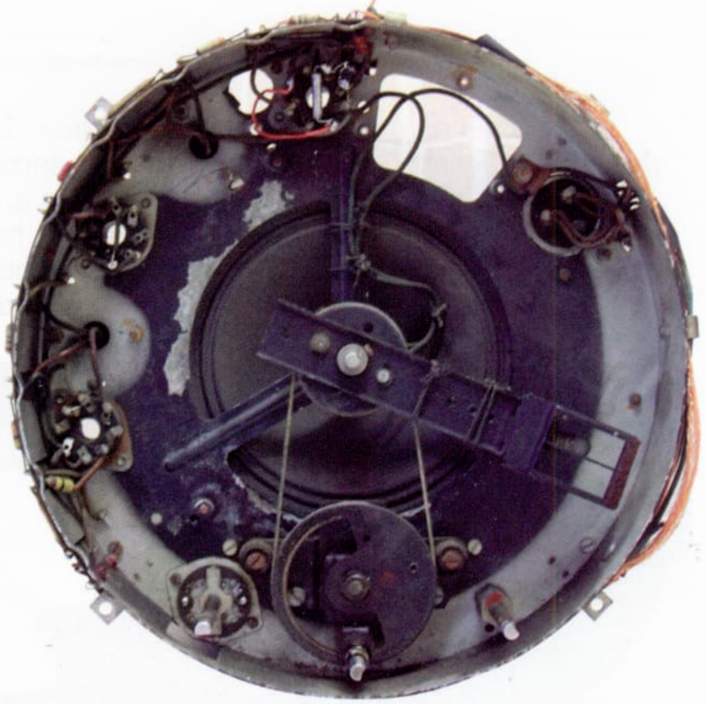
apparently whatever type and value was to hand at the time. Some of the resistors had been changed as well, again seemingly with whatever was to hand. But the 'new' wiring really was something! Most obvious a crude screening braid made from what I assume was the outer layer of a piece of co-axial cable. I'll leave the 'before' and 'after' images to illustrate in detail and speak for themselves here.

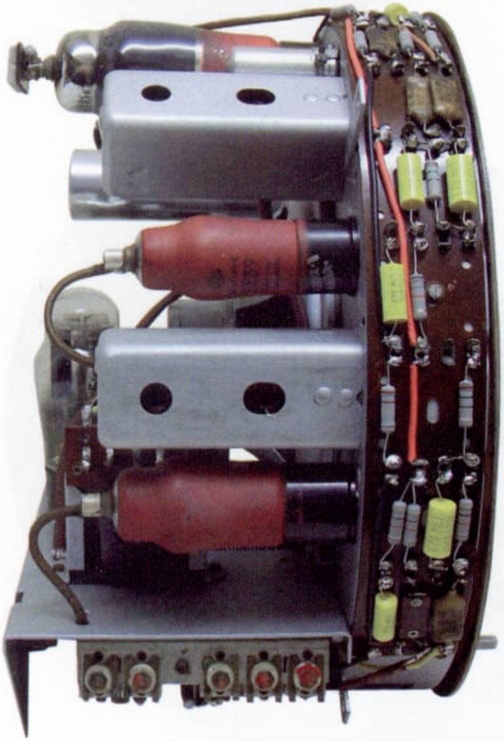
Well there was nothing for it really but a complete restoration. My thoughts were that since I had already been deprived of the preferred option of carrying out a sympathetic restoration by the previous owner, I would instead restore the set to be as reliable as possible. I needed to get rid of that horrible black paint and I could only do that properly by completely stripping the chassis. Obviously all the wiring needed replacing too, it was just downright dangerous.

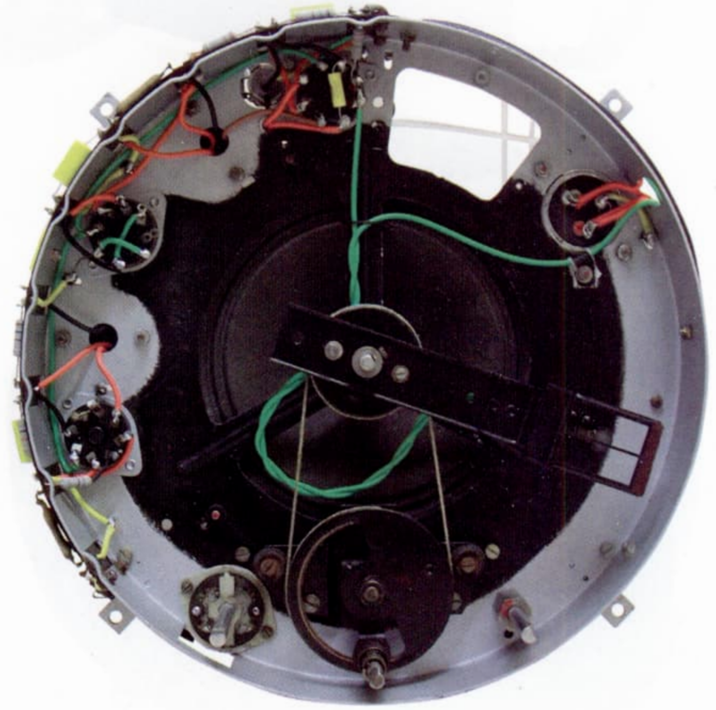
I spent quite a while carefully dismantling and stripping down the metalwork. Once I had a bare chassis, I removed the black paint quite easily thankfully with a jelly-type paint stripper applied to small areas at a time. The chassis was quite discoloured underneath due to light rusting in places and was the reason for the coat of black paint I assume. I repainted with silver Smoothrite for most of the metalwork, with black Smoothrite on the underside, as per the original finish.

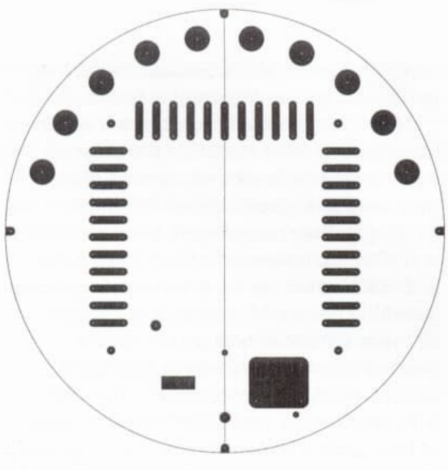
As for replacement capacitors, I would have liked to have restuffed the original wax components with modern versions if they were in a good enough condition to do so. But as they had already been removed and were no longer an option, I replaced with 630V rated yellow polypropylene types instead. I decided I may as well change all the resistors as well, since several needed changing anyway or had been caught with that horrid paint. I replaced with modern 2W metal film types because of their similar dimensions to the originals. The two can-type electrolytics were both

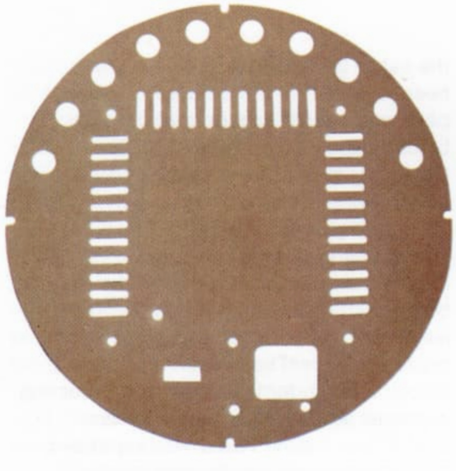













EKCO
ALL-ELECTRIC
RADIO RECEIVER
TYPE A22
A PRODUCT OF
E.K.COLE LTD.
EXT L.S.
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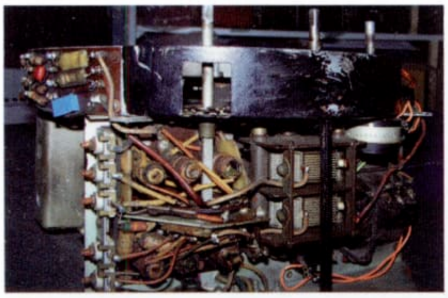
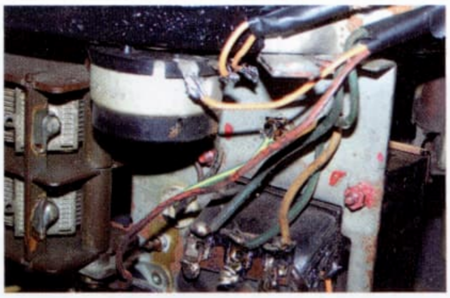
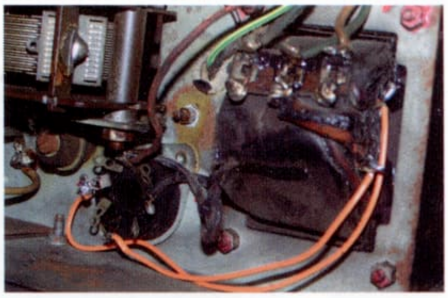
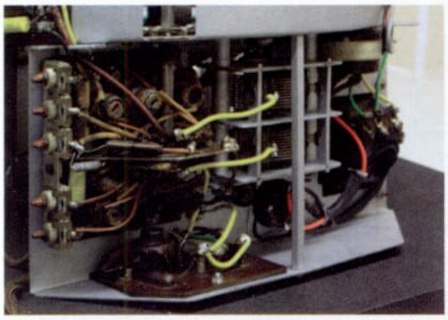
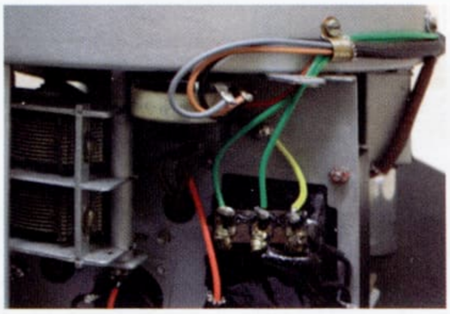
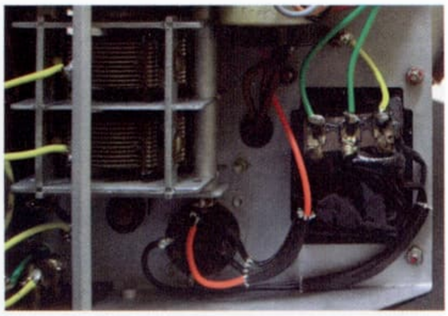
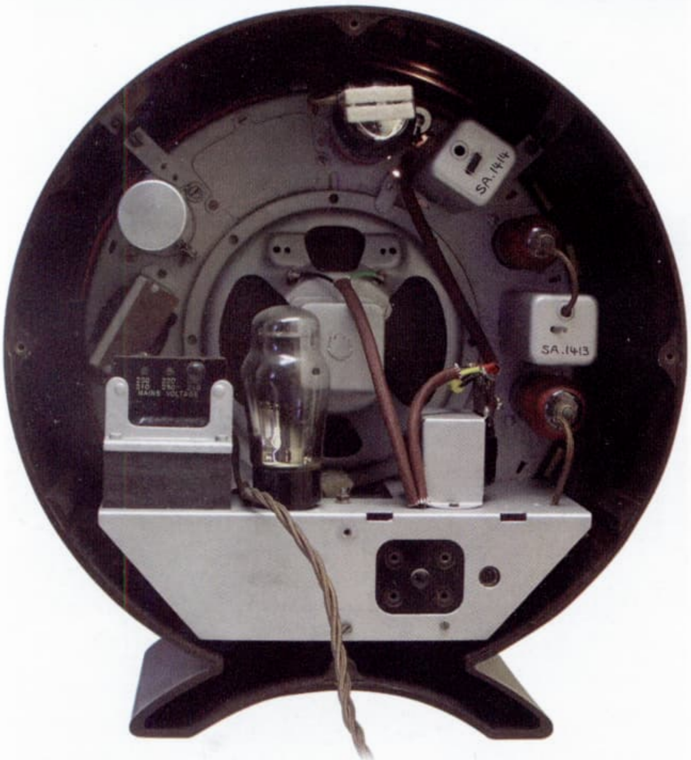

restuffed with modern components and refitted at this time also. At least the set now had a consistent type of capacitor and resistor fitted of the correct values and in my opinion looked much better for it even if a little more of the remaining originality had been lost by doing so.

I now turned my attention to making a reproduction back cover for the set. Using measurements taken from the case and appropriate images of original A22 backs, I arrived at a full sized paper template for marking out some 3/16" mdf board. This was cut, drilled and smoothed until I was happy with the finish, then given a coat of acrylic matt black paint. I made up some graphics again from images of original A22 backs, carefully cut them out, and glued them on in the correct places. The entire back was then given a couple of coats of acrylic clear satin lacquer. This sealed the graphics and gave the back a similar textured finish to that of an original A22 back cover.

I eventually got to the bottom of the long wave problem when I noticed in both the antenna and oscillator coil cores for that band, what I had originally took to be just sealing wax, was actually Araldite. After careful removal of the glue I discovered the two original slugs were missing and broken pieces of ferrite rod substituted in their place. I can only assume the originals were knocked out and lost in the delivery accident that damaged the case. Fortunately I had several of the correct type of slug to hand, fitted two, realigned the band, and was rewarded with excellent reception.

I envisaged having to carry out very little work on this set after being informed that the chassis had already been overhauled. I assumed it would largely be a simple switch of the chassis to my unblemished case. As it transpired I couldn't have been more wrong. This was a good example of the well known Latin phrase 'caveat emptor' (let the buyer beware) and a lesson not to blindly accept the word, or indeed the standard of workmanship, of others as satisfactory. However, that same poor standard gave me the opportunity to virtually rebuild an A22 from scratch. Something which I enjoyed enormously at the time and still continue to get a sense of great satisfaction from every time I use or even look at this particular set in my collection.

An Aussie Treasure – the story of an Australian Radio Museum

by Richard Shanahan

My son found this 'gem' during our trip in 2008 for my daughter's wedding in Sydney NSW.
I'm one of those people that like to search out items or places of interest relating to my hobby whilst abroad. It's only fairly recently that I have been using the internet to help in my endeavours. In 2008 I was still a beginner, my son Peter, who is doing a PhD, has been using PCs for years!

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The Kurrajong museum is housed in a large, well lit, purpose–made building. There is excellent wheelchair access, and a toilet suitably equipped. A small shop and café completes the excellent facilities.

Australia is a vast country with a large amount of interested radio followers. Expect to travel some distance for your interests. In an earlier visit to Australia I discovered a 'disposal' site which had one or two very old megger instruments. In Gympie, Queensland which is my wife's home town, I was invited to address the local radio club about vintage equipment in the UK. Later, I was invited to choose something from their store. I chose a Radiola III and had to force the Chairman of the radio club to accept a donation. At Heathrow airport, customs waved me through with a strange look when I showed them the radio!

On other trips I've brought back compasses, a small galvanometer, and from an upmarket shopping mall in Broadbeach, near Brisbane a cream MW–only radio with call signs instead of wavelengths indicated on the dial which I had delivered by sea–mail. The latest trip yielded another compass and an early wooden cased ammeter (very accurate when tested).

If you decide to go off the beaten track instead of doing the normal tourist things in Australia you may be pleasently surprised. I have found interesting and varied people and things all over the place. If, like me you find a treasure like the Kurrajong Museum, your trip will be greatly enhanced.

Kurrajong Museum
842 Bells Line of Road,
Kurrajong Hills
2758
NSW
Australia

tel: 02 4573 0601
email vk2zio@yahoo.com.au
web: www.vk2bv.org/museum/

5

The photographs
1: Kurrajong Museum is about 70km from Sydney in a wonderful location at the borders of the blue mountains and the Wollemi national park. Kurrajong is a village. In my first visit in 2008 I took a train from Sydney to Richmond, then a bus. For the most recent visit in April 2011 I hired a car as there is no longer a bus service.

2: As in 2008 I was greeted with the warmest of welcomes by Ian and his wife, Pat. Between them they have over 60 years of teaching experience, something which has obviously been put to good use as the museum has been open for five years.

3 & 4: Ian and Pat present demonstrations, pre–booked talks and tours of the museum to groups of both adults and children as well as individual visitors. The subjects are not only Australian radio history but world communications also.

5: Booths accomodate an individual's learning requirements, whilst a small theatre is used for a group session. The static displays are all clearly identified in their respective sections. Equipment from most major countries is represented, ranging from domestic to military. There are also exhibits of early telegraph, telephones and test gear, both ancient and modern.

6: A visit to the museum by a Sydney–based vintage car club.

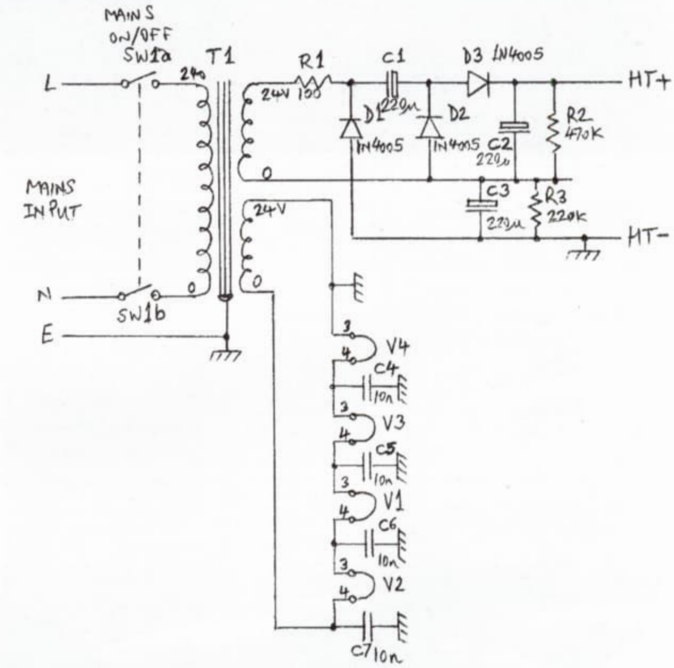
6

A Medium Wave AM Transmitter for the Home by Stef Niewiadomski

No doubt when the analogue radio switch-off happens in 2015 (or 2019 if you believe the latest speculation) there will be a boom in low power AM 'home' transmitters so that we can continue to listen to our favourite old radios. Even now it's useful to be able to transmit music and other material on the medium waveband inside your own home. This enables you to make your own very local broadcast station and listen to your favourite 'programmes' on your old familiar radios.

Figure 1: A line-up of a few different 'EF91s'.

Figure 2: Schematic of the AM transmitter's power supply and valve heater wiring.



The unit described here takes audio from the headphones output of an FM or DAB receiver, CD, tape or record player, or an MP3 player such as an iPod, and regenerates it in an AM-modulated format in the medium wave band. No modifications to the equipment generating the audio, or the radio receiving the output from the transmitter, are necessary.

Back in 2004 I built and published a transistor-IC version of such a transmitter (Reference 1), but this time I decided to use some good old 'hollow state' technology and base the design on that used in many amateur AM transmitters from the 1950s and 1960s. Maybe the radio amateurs among you will be inspired to adapt the design into a 160m or 80m AM/CW transmitter, which shouldn't be too difficult.

Valve Based

I chose to use four EF91s (or equivalent, see later) for the variable frequency oscillator, RF power amplifier, audio pre-amplifier and AM modulator stages. I'm sure when you look at the schematic of the transmitter many of you will say 'I could have achieved that with a couple of ECL82s', and that would be true. In fact if you have a couple of ECL82s (or similar) in your junk box, then by all means adapt the circuit to use them. I decided to use the EF91 'jack-of-all-trades' firstly because I already had a few, and secondly because they are very easily and cheaply available for anyone who does not have a stock of valves. Another factor is that building the four stages with four separate valves makes it easy to lay the stages out on the chassis in a logical flow and ensures that they are well isolated from each other.

The Humble EF91 and its Aliases

So far I have referred to the valve used in this transmitter as the 'EF91', which is certainly the generic name by which the valve and its many equivalents are known today in the UK. From this distance in time it's not clear whether it was the EF91 itself or one of the valves that we regard as being its 'clones' which appeared first: it may well be that the 8D3, the 6F12, or even the Z77 or 6AM6, was the first 'EF91' to hit production.

It's tricky to pin down the exact date of introduction for the EF91 and its equivalents, but judging from the 1948 first production dates of several TVs using the 6F12 and Z77, it must have been sometime in 1947 that the valve first appeared. It was probably the Murphy V114 TV that has the honour of being the first commercial set that used the 6F12, sometime in 1946. The EF91 itself was probably first used in the Philips 383A TV, launched in September 1948

The EF91 was designed as a high gain, high impedance, screened pentode, and became the universal valve of the 1950s and 1960s, as can be seen by the large number of manufacturers who made direct equivalents. Mullard described the EF91 as a 'Miniature RF pentode primarily intended for use as RF and IF amplifiers, or mixer valves in television

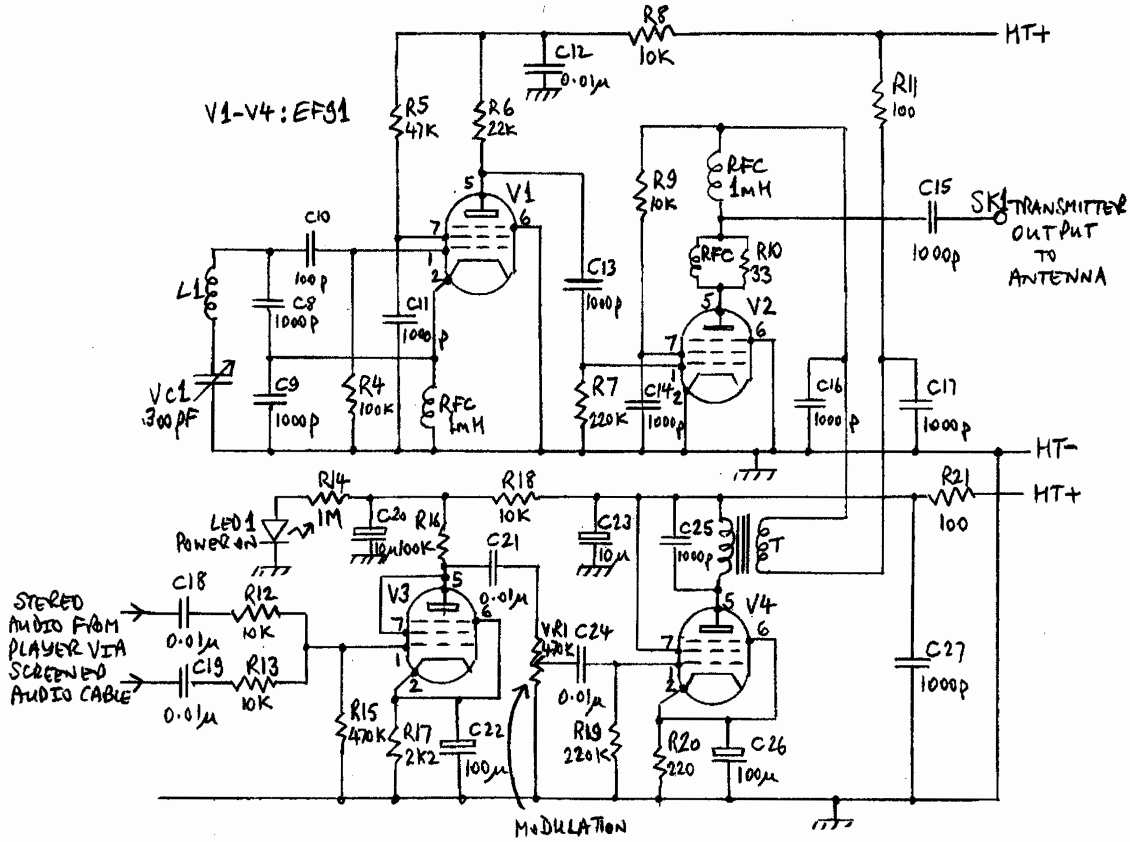


Figure 3: Schematic of the AM transmitter.

receivers'. In fact it could be used from AF to VHF up to about 200 MHz, and because of its versatility and low cost, quickly found itself designed in large numbers into most types of electronic equipment, especially in TV sets of course, its intended application.

In TRF and superhet radios it was used for RF and IF amplification, for oscillators, frequency changers and multipliers, detectors and audio amplifiers. The famous Racal RA-17 receiver, numerous pieces of professional test gear, some Eddystone receivers, and of course many TV sets designed from about 1947 onwards used the valve. Reference 2 is a useful way of searching for use of a particular valve (or transistor) in a radio or TV.

The valve is packaged in the compact all-glass B7G envelope, and is 17mm in diameter and 46mm tall, excluding the pins. This 'miniature' envelope was developed in the US in the early years of WWII, was used extensively for valves in military equipment, but wasn't used by European manufacturers until 1947.

The Many Equivalents

In Europe you are likely to find EF91s (and equivalents) manufactured by GEC, Osram, Mullard, Marconi, Cossor, Brimar, Mazda, STC, Chelmer, to name just a few. Consequently the EF91 has many aliases, including the Z77 (Marconi), 6AM6 (Brimar and many US manufacturers), 6F12 (Mazda), 8D3 (STC and Brimar, until they recoded the valve as a 6AM6), 6064 (Brimar special quality version of the EF91), M8083 (Mullard special quality version of the EF91) and 5A/189K (STC). There are several 'service' versions of the EF91, including the CV138, CV2195, CV4014, CV5377, CV10327 and maybe a few other CV numbers. There is even a CV2001, which is an EF91 (or more exactly a CV138 or similar) mounted in a socket with flying leads for soldering directly into equipment.

Figure 1 shows a line-up of a few different 'EF91s'. When you're looking for the EF91s for this project, any of these valves should do the job, and as you can see valves are often marked with more than one number. I particularly like the bluish colour of the glass around the anodes in the Mullard valve, and the reason for this is interesting.

Inside the EF91 (and similar valves) the anode runs round only part of the cathode/grid structure, and so a significant number of electrons pass through the grids and the gaps in the anode, and into the glass envelope. It was found that this gradually caused gas to be released from the glass, and over the extended lifetime of high reliability valves required by, for example the GPO, it was sufficient to impair the efficiency of the valve and to shorten its life. Therefore, the centre part of the glass envelope was coated (by vacuum deposition) with a chemical. This kept the electrons from the glass and thus reduced the gas released, and thus lengthened the working life. The actual colour of the coating varied with the temperature of the firing, and has no significance.

Some manufacturers of 'EF91s' use a different technique to protect the glass from these stray electrons. For example, I've seen some M-OV CV138s with what appears to be a metallised internal coating.

Because the valve is so ubiquitous and was made in vast numbers it is still easy to find and cheap to buy. Be warned: I've seen EF91s being sold on eBay for up to £20 each - don't be misled (for this project at least) by claims of high quality specimens, matched pairs, 'rare' versions with special markings, and so on. This valve is not in the same class as those used in 'classic' Hi-Fi and guitar amplifiers. You'll find it at radio rallies, vintage radio meetings, and on the www, and you should be paying about £1-£2 per tested, boxed valve. You'll always find a few EF91s sloshing around at the bottom of a box of old valves: try these if you wish, but don't pay much more than 50p each for them. I'm sure the TV restorers amongst you will have bucket loads of EF91s.

You can find many articles in the amateur press using the EF91. For example, Practical Wireless published 'The Versatile EF91' by K V R Bowerman in its February 1964 issue. This article described a 5-valve switched MW/LW superhet and a 4-valve push-pull audio amplifier, both using 100% EF91 line-ups. Another all-EF91 project was 'A Simple 3-Valver' by T M Bush in the December 1962 issue of Practical Wireless, as was 'A TRF Communications Receiver' by R H Wright in the September/October 1959 issue.

Producing Amplitude Modulation

There are many ways of producing AM with valves. It's commonly accepted that anode modulation of the RF output valve produces the best quality, though it has the drawback of needing a modulation transformer. A 'proper' modulation transformer is a tricky component to source these days. Occasionally transformers by Woden, the classic provider of these transformers, or surplus ex-MOD transformers, come up for sale, but such a transformer would be completely inappropriate in this application, it being too big, heavy and expensive for use here.

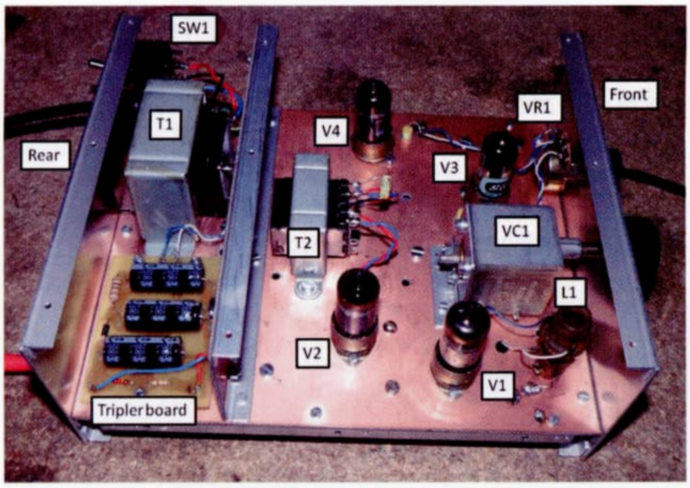


Figure 4: Top view of the transmitter with the wrap around cover off.

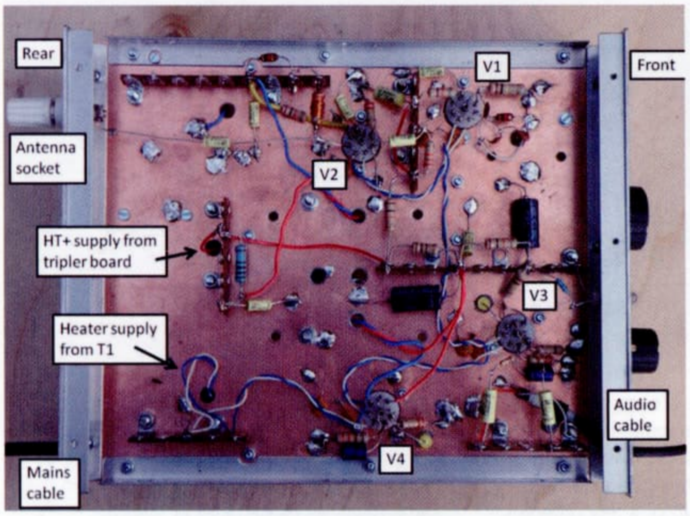


Figure 5: Bottom view of the transmitter with the bottom cover off.

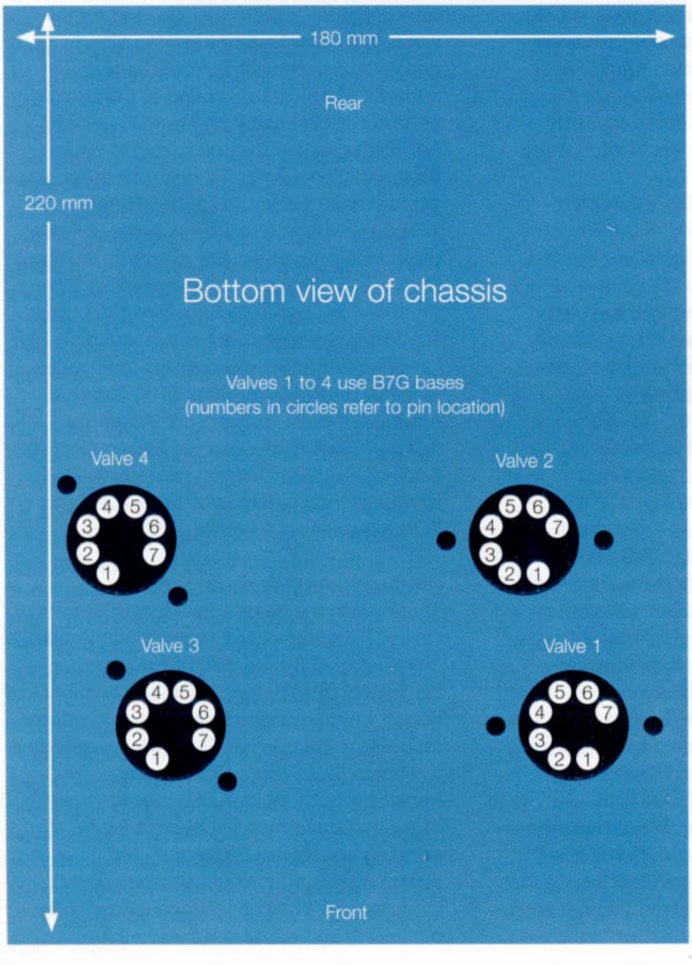


Figure 6: Under chassis sketch showing the orientation of pin 1 of the valves.

I used the mains windings (ie 0-115V + 0-115V) on a small 6VA mains transformer and this produced very good results. These split primary windings are intended for connecting in parallel to run the transformer off US mains, and in series for use in the UK and other parts of the world with 230V mains. This gives the opportunity to use the transformer's 1:1 ratio for non-mains applications. The usual argument against using a mains transformer as an audio transformer is that it is designed to handle purely AC, whereas in an AM transmitter both the modulating and modulated stages draw some DC current through the transformer windings to supply the anode current. With this design the anode current is very small, in the order of a few mA, and this doesn't seem to noticeably affect the transformer action.

The Power Supply

The schematic of the power supply for the transmitter is shown in Figure 2. I wanted to devise a power supply that didn't need a 'valve' transformer (ie one giving about 250V HT plus 6.3V for the heaters), which would have been big, heavy and difficult to source, unless you already had one to hand. Therefore I used a transformer with 24V plus 24V secondary windings: one 24V winding drives a voltage tripler circuit that gives about 90V at a maximum current of about 20mA, and the second 24V winding is used to supply the four 6.3V valve heaters connected in series. Because all four valves are identical, they all need 300mA and the four heaters in series neatly add up to about 25V, which is about what you'd expect from a 24V transformer winding when you are not running it at its full rated current. It's remarkable that the heaters of the four EF91s are happy with this arrangement: I measured the voltage across pins 3 and 4 of each valve in my prototype, and although they were from different manufacturers, they were all in the range 5.5V-6.5V. Clearly the heater resistance was well controlled in manufacture (unlike most parameters of a semiconductor device), and is pretty stable over the lifetime of the valve.

The mains input to the unit is switched by the double pole switch SW1 (MAINS ON/OFF), and fed to the primary of the transformer T1. The upper part of the schematic shows a conventional voltage tripler circuit which produces an off-load DC output voltage of nominally three times the peak voltage of the driving AC source (see Reference 3). With a nominally 24V source, this gives $3 \times 24 \times \sqrt{2} = 102V$. I measured the output voltage for various loads: with no load I got an output of 110V; at 10mA it was down to about 88V; and at 20mA the output was about 75V. I anticipated the four valves to take about 10mA in total, so this was fine. For applications that need better regulation you need to use higher value capacitors for C1-C3.

R1 helps limit the switch-on surge into the capacitors: once the circuit is operating it also drops a small voltage, which is insignificant in this application.

Safer HT Voltage

The HT voltage of about 90V makes this supply much safer to use than the normal 250V or so from which many valves circuits run. This allows you to poke around with a finger if a loose connection is suspected without risk of being 'bitten' – though of course you need to respect the mains voltage around SW1 and T1.

This low HT voltage also has the advantage that you don't need to worry too much about the DC blocking capacitor C15 going short circuit at some point in the future and a high voltage being applied to the antenna. This was a worrying prospect for most valve-based amateur transmitters (many of which run with 500V or so on the anode of the output valve), and precautions had to be taken in their design to prevent this from happening.

Circuit Description

That's enough about valves and AM transmitters in general, so let's take a look at my design. Figure 3 shows the schematic: here's how it works.

V1 is a series-tuned Colpitts variable frequency oscillator (VFO), tuned by L1 and VC1. I used a coil rescued from a scrap Sobell 615 radio chassis, with a measured inductance of about 280µH. This gives coverage of most of the medium wave band with the 300pF variable capacitor I used. Any coil in the range 200-300µH should be useable, so if you have a Denco, Wearite, Weyrad, etc coil, that should be OK. This oscillator circuit needs a coil with only a single winding and no taps, so that makes selection of a suitable coil relatively easy. The stability of this type of VFO is very good.

The anode of V1 feeds V2, the RF power amplifier stage. 'Power

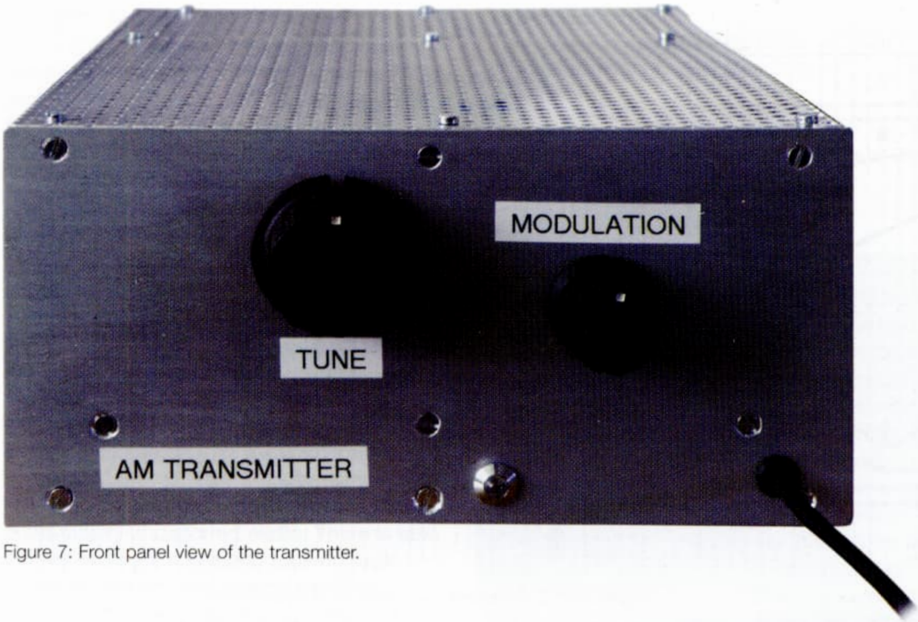


Figure 7: Front panel view of the transmitter.

amplifier' is probably a misnomer in this case as we are not trying to generate much power: the most useful feature of this stage is that it allows modulation of the RF output without adversely affecting the output frequency, which would be a distinct risk if the oscillator stage were modulated. The modulation takes place via the secondary of T2. RFC2 and C16 prevent the RF at the anode of V2 from attempting to pass through T2 and into the modulator stage.

A classic valve PA stage would have a combined matching network / lowpass filter to couple its anode to the antenna efficiently and with a low level of harmonics. In this case we are deliberately trying to reduce the power going to the antenna, to keep the effective radiated power (ERP) to a low level, to restrict the range of the transmitter.

RFC3 is a low inductance anti-parasitic choke, made from a few turns of wire wound on the body of R10, and discourages V2 from oscillating at a high frequency, which the EF91 is definitely capable of.

V3 is strapped as a triode and its grid is fed from the audio source via the combining network (C18/R12 and C19/R13) to cater for stereo inputs. The amplified audio signal at the anode of V3 drives VR1, the MODULATION control, which is used in combination with the volume control of the audio source to produce distortion-free, well modulated AM.

V4 is the modulator valve, fed from the wiper of VR1, whose anode drives the primary of T2. The secondary of T2 generates a varying anode voltage for V2, reproducing the audio source in the RF output.

The 100Ω resistors R11 and R21 serve two purposes: firstly in association with the decoupling capacitors C17 and C27 they help to isolate the power to the RF and audio sections from each other, and secondly they provide a convenient way of measuring the supply current to these sections, which was handy for me while I was developing and testing the circuit. For example if you measure a voltage drop of 0.5V across one of these resistors, this indicates a current of 5mA flowing through it.

LED1 is the POWER ON indicator: I used an extra bright LED here and this allows the current through it to be kept very small, limited by the 1M resistor R14.

Construction

Because of the presence of mains voltage inside the unit, for the sake of safety I strongly advise the use of a grounded metal case. As shown in Figure 2 the mains earth wire should be securely connected to the chassis (ground) of the metal case.

The prototype unit was built using double-sided printed circuit board (PCB) and sheet aluminium to create an H-shaped chassis, as shown in the photographs. If you only have single-sided PCB material to hand, this should still be OK. Use the material with the copper side downwards so you have a good solderable ground plane. The wrap-around and bottom covers were made from 1mm thick perforated aluminium sheet (see Reference 4).

The front and rear panels are both 90mm x 182mm aluminium and the horizontal 'deck' is 180mm x 220mm double-sided PCB material. The extra 2mm on the width of the front and rear panels allows the wrap around covers to fit inside the panel profiles. You need about 60mm headroom above the chassis and about 25mm below the chassis.

As you can see on the photos there is a screen between the power supply compartment and T2. I'm not sure if this is necessary but it helps to keep mains hum out of the audio modulation, and also stiffens the chassis.

PCB material makes a very good ground plane and of course the 'earthy' end of components can be soldered directly to it, without the need for any earth tags. The copper colour is also reminiscent of the material used for the chassis on Drake equipment. You can also use the printed circuit board material for the front and rear panels if you don't have any aluminium sheet to hand. You can see from Figures 4 and 5 that there is plenty of room on the chassis: I allowed for some experimentation with the size of the modulation transformer, and so made the chassis generous in size. You might want to make the chassis a little smaller.

10mm x 10mm aluminium angle was used to join the three pieces together to form the chassis. The valves, when mounted in their holders, and the former for L1 need at least 50mm of headroom, so make sure you allow for this when building the chassis.

I have not produced diagrams of how I placed the major components on the chassis, as constructors seldom follow exactly the same layout as the prototype. The general arrangement of my prototype can be seen from the photographs. In Figure 6 I have shown how the valves were orientated in my prototype to keep the grid wiring away from the heater wiring, and the anodes facing towards the grids they drive (in the case of V1 and V3) and towards T2 (in the case of V2 and V4). Remember that valve pins are numbered clockwise from the gap, when viewed from underneath, that is the end you are actually wiring.

Make sure you have all the components to hand before you start drilling the front and rear panels, and the deck: exact dimensions of controls and sockets from different suppliers may vary.

Two holes need to be drilled in the rear panel: one for the mains lead, passing through the panel via a rubber grommet and secured by a strain relief grommet or a nylon P-bracket, of course: and the second one for mounting the ANTENNA socket SK1.

The front panel needs four holes: one for the shaft of VC1; one for VR1; another is for the bezel of LED1; and the final one is for the audio cable to enter the unit. Again use a rubber grommet and a strain relief grommet or a nylon P-bracket to secure the audio cable. The exact layout is not critical and the photograph (Figure 7) show the front panel layout used on the prototype.

Building the Tripler

The power supply tripler was constructed on a small PCB, which is easy to etch at home. The layout of the tripler components isn't critical and you could use 'ugly' construction if you wish, or use tag strips. Figures 8(a) and 8(b) show the PCB tracking (at life size) and component layout for the tripler board as I built it. Take care to correctly orientate the diodes and electrolytic capacitors. I used 1N4005 (600V PIV at 1A) diodes for D1-D3 because I had them to hand: you can use diodes with a smaller PIV, such as the 1N4003 or 1N4004 if you have them 'in stock').

Insert 1mm terminal pins into the holes for the inputs from T1 and the HT+ and HT- (which is connected to ground) outputs to the board, rather than trying to insert wires into the board itself. Once the PCB has been fully assembled, it should be mounted on the chassis via stand-offs. I used long 6BA screws with nuts holding the board well above the chassis.

16mm holes need to be cut for the B7G holders for the valves. The neatest method is to use a Q-max cutter, but if this is not available simply mark out the appropriate circle, drill a series of 3mm holes just inside the line, join them up and then file to produce a neat circle. I used skirted B7G holders so that I could add shielding cans over the valves if needed. In reality I couldn't detect

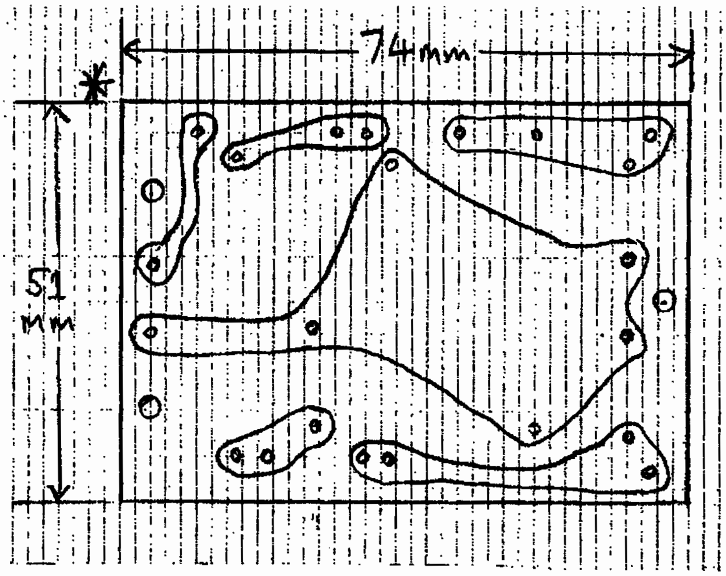


Figure 8: (a) Tracking for the tripler PCB (shown at full size).

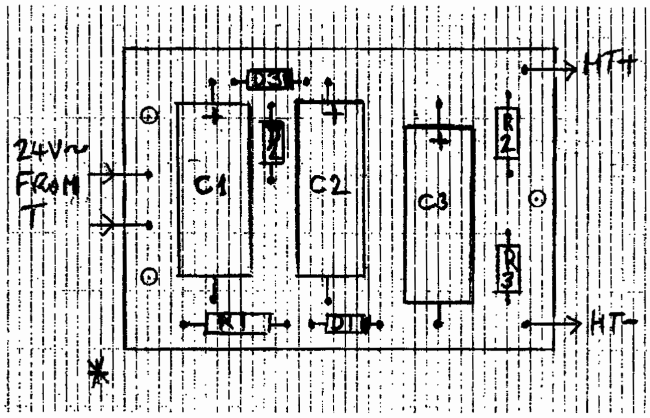


Figure 8: (b) Component placement for the tripler PCB.

any difference in performance (noise and hum) whether the cans were fitted or not.

You also need a few strategically-placed holes (diameter not too critical) to pass other wires between the upper and lower sides of the deck. It's best to cut and drill the holes for the main components on the deck first, mount these components, and then work out exactly where the few extra holes are needed.

I mounted a number of tag strips on the chassis to accommodate a few of the HT-associated resistors and decoupling capacitors. You should be able to see from the photos where these are. Maplin still sells 5-way tag strips, which can be used, or use any that you already have.

I used 1W and 2W rating resistors in the transmitter, depending on what I had available: I think they look 'chunkier' in valve equipment than smaller, lower power ones. None of the resistors dissipates much power, and so ½W components should be OK for all the resistors if you have them to hand and want to use them here.

The RF Chokes

The current flowing through RFC1 and RFC2 is just a few milliamps and so 1mH miniature radio frequency chokes can be used, which can be bought from several suppliers (for example ESR Electronic Components at: www.esr.co.uk). RFC3 was wound with 20turns of 28SWG (0.4mm) enameled wire on R10, with the ends of the winding soldered to the leads of the resistor. The diameter of this wire is not critical.

The tuning capacitor VC1 can be fitted to a mounting bracket made from another piece of PCB material, or aluminium sheet, and fixed to the deck with a short length of 10mm x 10mm angle aluminium. You will need to use whatever mounting method suits the variable capacitor you have to hand. It's probably a good idea to use a slow motion drive of some type, either integral to the capacitor, or external, to help accurately set the transmitter's frequency to a quiet spot on the band. The variable capacitor I used (a Plessey model) had a built-in 6:1 slow motion drive. The only drawback with a built-in reduction drive is that it's difficult to have frequency indicated on the front panel, unless you try to devise some kind of cord-driven dial arrangement.

Heater Wiring

Wire the valve heaters in series with twisted pair wires before you start the rest of the wiring. This allows the heater wiring to be routed close to the deck and is much less fiddly than adding this at the end. The order in which the valves are connected in the heater chain is not too critical but with my chassis layout and the connections shown in Figure 1 a neat arrangement was obtained. Don't use a loop of single wire as this is likely to cause hum pickup in the signal wiring. The decoupling capacitors C4-C7 are wired from the relevant valve pin to the chassis ground plane.

I mounted SW1 on the rear panel, just above where the mains leads comes into this panel: this meant that I didn't have to bring the mains lead and the connections to T1 back and forth across the chassis, with the risk of mains hum getting into the modulator stage. Make sure you use a rubber grommet for the hole where the mains cable enters the rear panel, and a p-clip to secure the cable so that it can't be pulled, with the risk of short circuits.

Don't insert the valves into their sockets until after you have soldered all the connections to their socket pins. The heat won't do the valves' pins any good, or more specifically the glass seal around the valve pin will possibly crack, destroying the vacuum inside the valve. When you think all the wiring has been completed, including the connections to the front panel mounted components, and the sockets and controls on the rear panel, thoroughly check the values and connections of the resistors and capacitors, and the polarity of the electrolytics. Take a careful look at the solder joints to make sure they all look good.

Most modern audio players have a 3.5mm stereo headphones socket and so the audio cable needs to be fitted with a compatible plug, which I always find a bit fiddly. You can finish off the transmitter by labeling the front panel and sticking four rubber feet onto the base.

Setting up and using the Unit

Thoroughly check the wiring of the unit, especially to the mains switch, T1 and to the tripler board. Plug in all the valves, switch on the mains input to the unit and check that LED1 lights and that the voltage tripler's output is close to +90V. If the output voltage looks OK, but LED1 doesn't light, the chances are you've wired it the wrong way round (as I seem to do every time) so simply switch off and reverse the connections. After a few seconds you should be able to see all the valves' heaters glowing. Note that because the valves' heaters are connected in series, all the valves need to be inserted for any of them to work.

If an oscilloscope is available check the output from the VFO: this should be about 10V peak-to-peak at the anode of V1. By measuring the frequency on a counter or monitoring on a general coverage or MW receiver, check that as VC1 is adjusted, the VFO tunes over a good range of the medium wave band. My VFO covered from about 650kHz to 1.4MHz. This will depend somewhat on the coil used for L1 and the value of VC1, but you should have a wide frequency range to which you can set the transmitter.

Now move the scope probe to the ANTENNA socket and the output waveform should be a sine wave at about 20V peak-to-peak. If you apply audio to the modulator stages you should now see the ANTENNA output change from being a pure sine wave to one where its amplitude changes in step with the audio input. The depth of the amplitude changes should vary with the volume control of the audio source and the setting of the MODULATION control VR1. Of course it is difficult to judge how well the modulated output is following the music, but you can certainly see the amplitude changing in sympathy with the bass notes. With my transmitter the output waveform was mainly modulated at its upper portion, rather than being symmetrical as with an ideal AM signal, but this did not seem to affect the quality of the received audio. For most of my testing I used a GEC BC5445 radio, and this produced rich audio from the transmitted signal.

Using the Unit

The unit is very simple to use. You need simply to connect about 1m of insulated wire to the ANTENNA socket, set the MODULATION control to about half way, plug the unit into the mains and switch it on and wait for 10 seconds or so for the valves to warm up. Plug the transmitter's stereo plug into the headphones socket of the source audio player. This will automatically switch off the speakers. Tune the AM radio to a free frequency and tune the transmitter's frequency until the 'station' you are broadcasting can be heard. Now adjust the source player's volume control, and the MODULATION control until undistorted audio is obtained from the AM radio. This will take a few adjustments of both controls until you have good quality undistorted audio. There is also the AM radio's volume and tone controls to adjust until you get a good listening level with the frequency balance you like.

You may need to adjust the transmitter's frequency and that of the AM radio to find a free spot on the MW, depending on the time of day, so that no background whistles can be heard. The European medium wave is pretty 'busy', so you may need to tune around for a quiet spot, especially at night when many foreign stations will appear. Reference 5 shows a definitive list of MW frequency allocations in European.

I used a Bush combined analogue radio and CD player, and iPod docking station, bought cheaply from Argos (who own the Bush brand these days). Even if you're not an iPod user yourself, this opens up the prospect of encouraging your children or grandchildren to play their music through that mysterious old radio that stands in the corner. That may be a good or a bad thing, it's up to you!

Modifications

As with any unit of this type, there are many options available in the exact way you build it. Don't feel you have to reproduce my mechanics exactly, but use common sense when thinking about separation and screening.

It might be worthwhile to experiment with a tone control in the transmitter. This could be at the input or output side of V3. The current design relies on the user to adjust the audio tone at the MW receiver.

As I mentioned at the top of the article, many different valves could be used, depending on what you have in your 'junk box'. Also you could use a 'valve' mains transformer to supply the HT and 6.3V, but beware of the high voltages that these transformers produce. Make sure you use a good quality, high voltage (at least twice the voltage on the anode of V2) capacitor for C15.

Conclusions

Hopefully you'll see that this is a low cost, useful piece of equipment to enable you to listen to your favourite music on your old AM radios. Even if you've never built a piece of valve equipment before I think you'll find this easy and safe to build.

References

1: 'Medium Wave Amplitude Modulator' published in Everyday Electronics, November 2004.

2: The Swiss Radio Museum, at: www.radiomuseum.org is a useful way of searching for use of a particular valve (or transistor) in radios or TVs.

3: Voltage multiplier circuits and an explanation of how they work can be found at: www.allaboutcircuits.com/vol_3/chpt_3/8.html

4: 1mm thick perforated aluminium sheet can be found on eBay by searching for '1mm perforated'.

5: A useful source for frequency allocations is the European Medium Guide can be found at: www.chowdanet.com/markc/EMWG-2004A.pdf

Component List

R1,11,21	100Ω 1W carbon film
R2	470k 1W carbon film
R3	220k 1W carbon film
R4,16	100k 1W carbon film
R5	47k 1W carbon film
R6	22k 1W carbon film
R7,19	220k 1W carbon film
R8,9,12,13,18	10k 1W carbon film
R10	33Ω 1W carbon film
R14	1M 1W carbon film
R15	470k 1W carbon film
R17	2k2 1W carbon film
R20	220Ω 1W carbon film
VR1	470k potentiometer MODULATION
C1,2,3	220uF 100V axial electrolytic
C4,5,6,7	10nF 50V ceramic decoupler
C8,9	1000pF ceramic plate
C10	100pF ceramic plate
C11,13,14,15,16,17,25, 27	1000pF 250V polyester film
C12,18,19,21,24	0.01uF 250V polyester film
C22,26	100uF 25V electrolytic (axial or radial)
C20,23	10uF 150V electrolytic (axial or radial)
D1,2,3	1N4005 or similar (see text)
VC1	300pF variable capacitor TUNE
V1,2,3,4	EF91 or equivalent (see text)
SW1	Double pole toggle switch (Maplin FH39N or similar) MAINS ON/OFF
SK1	Banana socket (yellow) ANTENNA
T1	Mains transformer, 0-24V + 0-24V 20VA secondaries. RS 504-662, Maplin N10CF, or similar
T2	Mains transformer, 0-115V + 0-115V primaries 6VA, used as modulation transformer (secondary windings not used). RS 503-962 or similar.
L1	Tuning coil 200-300uH, see text
RFC1,2	Radio frequency choke (RFC) 1mH miniature or similar
RFC3	Anti-parasitic radio frequencychoke (RFC) wound on R10, see text
LED1	High intensity light emitting diode POWER ON

Miscellaneous

Knobs for VC1 and VR1.
7 pin skirted valve holder (B7G) for V1-V4.
Tag strips (Maplin, or similar).
PCB for power supply tripler.
Insulated connecting wire.
Mains cable, grommet and strain relief fixing.
Screened stereo audio cable, grommet and strain relief fixing.
3.5mm jack plug for end of stereo audio cable.
Enameled wire (28SWG 0.4mm, not critical) for RFC3.
Mounting bezel for LED1.
Printed circuit board material and aluminium for chassis and screen.
Perforated aluminium for wrap-around cover.
10mm x 10mm aluminium angle for chassis.
Screws, nuts and washers to hold chassis components together, etc.
Rubber feet.

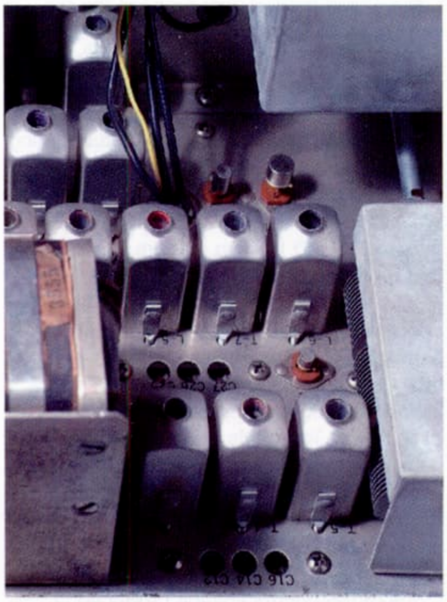
Garden Party at the British Vintage Wireless and Television Museum

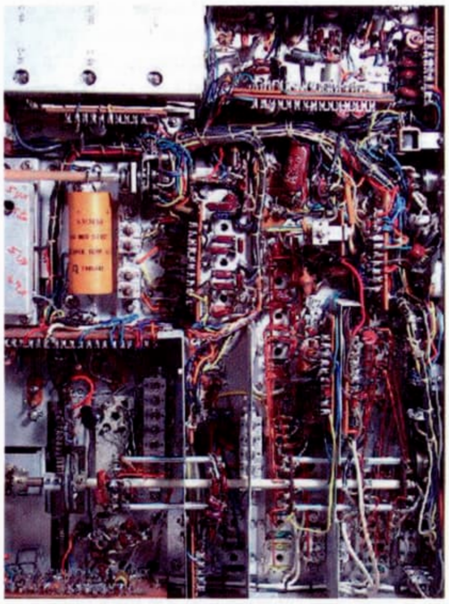
photographed by Carl Glover

Restoring an HRO-500 by Steve Richards

The HRO-500 receiver came in to my possession in the early 1980s. An old amateur radio friend gave it to me in a non working state and hoped that I might restore it to working condition.

Many readers will be familiar with the war time HRO but apart from the name and its use of the same epicyclic tuning dial any similarity with its famous predecessor ends here. In 1964 National entered the semiconductor age with this HRO and with a pretty sophisticated design to boot.





The HRO-500 is a double superhet receiver with a first IF of 2.75 to 3.25MHz and a second IF of 230kHz. It tunes from 5kHz to 30MHz in 60 500kHz wide bands. The first local oscillator is synthesised providing the band selection. The second local oscillator is a variable frequency oscillator for the 2.75 to 3.25MHz interpolation receiver. The dial is direct kHz readout. No longer is a conversion chart required. Variable passband tuning and an IF notch filter are also included.
The set uses 37 transistors all mounted in plug-in sockets with not a printed circuit board in sight. Its built just like a valve receiver. This results in extremely complex under chassis wiring which must have been difficult and costly to assemble. However, the same excellent mechanical design as its predecessor is apparent.

From an ergonomic standpoint I don't think I've seen very many communications receivers to equal it but in terms of performance it's a poor second to receivers of its era such as the 1957 valve based Racal RA17.
The HRO-500 remained in production until 1972 at which time National introduced the HRO-600. I've only ever seen pictures of the 600 but I suspect its printed circuit boards and modular assemblies made it far more reliable than the 500 and far cheaper to manufacture.

The set I'd been given looked clean and tidy. At the time I did sufficient investigation to realise that it had a serious fault in its synthesiser. But other commitments meant I didn't have the time or inclination to get on and fix it. To my shame it remained in a cupboard for the next twenty years or so. However, in September 2004 I finally decided to try and restore it to working condition. Six weeks later after a number of weekends patiently working my way round the synthesiser circuitry stage by stage fixing a succession of faults I finally got it to go.

My HRO-500 is, as far as I can tell, in original condition except that its 120V input mains transformer has been replaced to provide 240V operation. However, I was nervous about applying mains voltage to the set. Firstly, the power inlet is two pin, there is no mains earth connection to the chassis or line fuse on the chassis. Secondly, the mains wiring is contained in a wiring loom together with internal dc and signalling cables and the consequences of a mains short burning out internal wiring was unthinkable.

I decided for the sake of both the receiver's health and my own to run from a bench power supply while investigating the faults. The first thing I did was to apply 12V dc to the 12V inlet on the rear of the receiver and measure the internal dc supplies. The 5V and 7.5V rails, which are stabilised by zeners, were spot on but the 10V and 11V rails were a couple of volts low. A simple ohm meter check around the power supply revealed a couple of carbon composite resistors had gone high resistance and replacing these restored the 10 and 11V supplies to within 0.75 of a volt which I decided was probably good enough.

Next, I pulled the muting transistor from its socket. This transistor applies AGC voltage to inhibit the second IF amplifier while the synthesised first local oscillator is trying to gain lock. I then applied 230kHz from a signal generator to the second IF amplifier which proved the back end of the receiver was working.
I now pulled the first local oscillator buffer transistor from its socket and injected 10.25MHz directly into the first conversion mixer from a signal generator. With an aerial connected this allowed me to tune the 7MHz amateur band. So I knew the receiver was pretty much working except for the synthesised first local oscillator.
My experience of working on phase locked loops is that you have to break the loop and slowly and methodically work round a stage at a time. So first thing I did was to pull out the dc amplifier transistor following the phase detector to remove any control voltage to the voltage controlled oscillator. I was going to pull out the sweep oscillator transistor too but when I scoped it I found it wasn't working anyway.

Having disabled the loop control, I started with the harmonic generator. This comprised a 500kHz crystal oscillator, transformer coupled blocking oscillator with limiting diodes across the transformer windings and a tuned buffer. The 500kHz crystal oscillator was running, I could see it on an oscilloscope, but there was precious little output from the tuned buffer. The handbook showed blocking oscillator base and collector waveforms. Those in my set showed some similarity if you used your imagination a bit. At this point I measured dc voltages and resistor values. Again, carbon composite resistors around the blocking oscillator and buffer were the problem as they had gone high resistance and I replaced three of these. Still no output though. Next I became suspicious of a 0.1uF coupling capacitor between the blocking oscillator and buffer amplifier. Lots of signal one side virtually nothing the other. On replacing this the tuned buffer amplifier collector waveform suddenly started to resemble that in the handbook. I don't have a spectrum analyser so couldn't look at the harmonic generator output in the frequency domain. Instead, I disconnected the harmonic generator feed to the rest of the synthesiser and connected it through a 30dB attenuator to a general coverage receiver (a Redifon R408). As I could hear nice strong signals every 500kHz up the hf bands from 12MHz to 30MHz I thought it was safe to assume the harmonic generator functional.

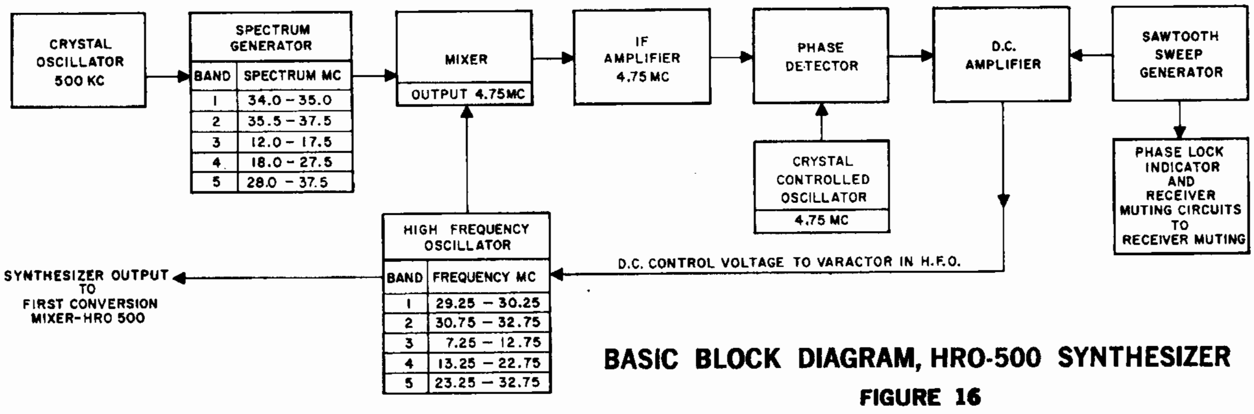
I moved to the high frequency voltage controlled oscillator. I connected my general coverage receiver via the attenuator to the point at which the oscillator enters the synthesiser's 4.75MHz IF amplifier. Well there it was. On the top three band ranges I could tune the receiver in to the high frequency oscillator (the bottom two ranges were out of the tuning range of the receiver). It seemed strange though that when I had pulled the muting transistor previously, the free running high frequency oscillator hadn't provided injection to the first conversion mixer. On investigation I found that the high frequency oscillator has two buffer amplifiers, one which supplies the synthesiser IF and one which supplies the first conversion mixer. The transistor supplying the first conversion mixer was faulty and, when I replaced it, the receiver started to tune signals on its aerial. Of course the set was very unstable because the first synthesiser was not phase locked. At this point I scoped through the three stages of the synthesiser's 4.75MHz IF amplifier. Not surprisingly I didn't get the waveforms shown in the handbook because I'd broken the control voltage feedback loop and, as I discovered, my sweep oscillator wasn't working anyway. But I wasn't seeing much at all even though I had harmonic generator and high frequency oscillator inputs. Before moving on I had to be confident that the 4.75MHz IF amplifier and phase detector were working. So I disconnected the harmonic generator and high frequency oscillator inputs and applied 4.75MHz from the signal generator. My fears were correct. There was virtually nothing at the input to the phase detector.

I decided to work backwards through the IF amplifier a stage at a time moving my signal generator injection point as I went. But first I'd do some dc and resistor value checks. These revealed that the 11V supply to the amplifier was down at about 8.5V and that there were a number of 100ohm and 1kohm resistors in the emitters that had gone high. I replaced the emitter resistors which was fine but it didn't cure the low supply voltage. Tracing the 11V supply wiring back revealed a series 100ohm resistor under the chassis that was reading seriously high. Strange thing was I couldn't find this resistor on the circuit diagram but non the less replaced it with a new 100ohm. By now I'm beginning to think that some unofficial mods were done to the set at some time. This gave me something close to 10 volts supply to the amplifier and I decide I'd live with this. Returning to the plan of injecting 4.75MHz from the signal generator one stage at a time I now worked back through my amplifier tuning the IF transformers as I went. The 4.75MHz crystal oscillator which supplies the reference signal to the phase detector was working. I could tune it on my general coverage receiver. But with 4.75MHz injected into the re-aligned IF amplifier from the signal generator, the dc voltage measured on each of the phase detector diodes was very different and I suspected that the phase detector was out of balance. When I checked the two 10kohm phase detector load resistors one measured 9.5kohms and the other around 17kohms so I replaced both of them.

I returned the DC amplifier transistor to its socket and by adjusting the frequency of the signal generator could see a dc voltage change on its collector. I was pretty confident now that the harmonic generator, high frequency oscillator and its buffers, 4.75MHz IF amplifier and phase detector were all working. So, I reconnected the harmonic generator and high frequency oscillator input to the IF amplifier.

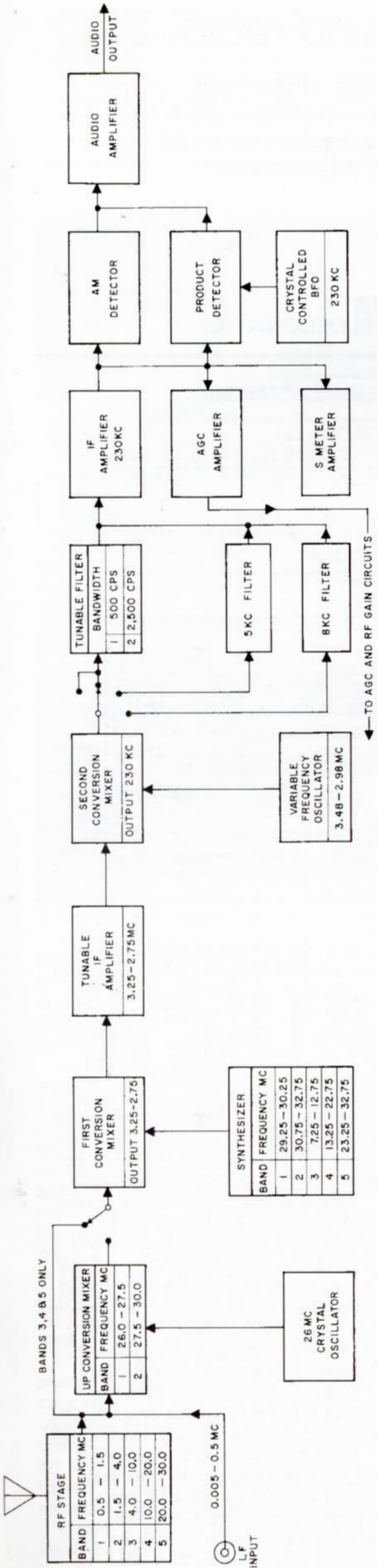
The next thing to do was get that sweep oscillator working. Its purpose is to sweep the high frequency voltage controlled oscillator over a wide enough range so that at some point during the sweep its frequency, when mixed with a selected output of the harmonic generator, results in a signal close enough to 4.75MHz to be captured by the phase detector. There were only four components in this circuit. Two resistors, which when measured were pretty close to the correct value, a unijunction transistor and a 1uF capacitor. I had a spare unijunction so unplugged and replaced this but this had no effect. That only left the capacitor and on replacing it the sweep generator sprang into life. As I carefully adjusted the synthesiser tuning control, the phase lock light went out. Fantastic - it was locking! My pleasure at getting the synthesiser to lock was short lived. As I adjusted the synthesiser tuning to each 500kHz band on each range, I discovered that: on three ranges the set wouldn't lock in on the highest frequency band at all; the calibration was significantly in error on some bands with locking occurring with the corresponding frequency obscured from the display window; and when returning to some bands the synthesiser locked to an adjacent band instead of the band displayed. Well, all the covers were off which I guessed wasn't helping matters. I found that replacing the harmonic generator and 4.75MHz IF amplifier covers had a marked effect on erroneous locking to adjacent bands but didn't completely cure it.
I then started investigating the failure to lock on the highest frequency bands on each range. To do this I removed the sweep generator transistor, disconnected the harmonic generator and high frequency oscillator inputs to the 4.75MHz IF amplifier and injected 4.75MHz from a signal generator. This allowed me to look at the range of the control voltage produced by the dc amplifier as I varied the signal generator frequency about 4.75MHz. As

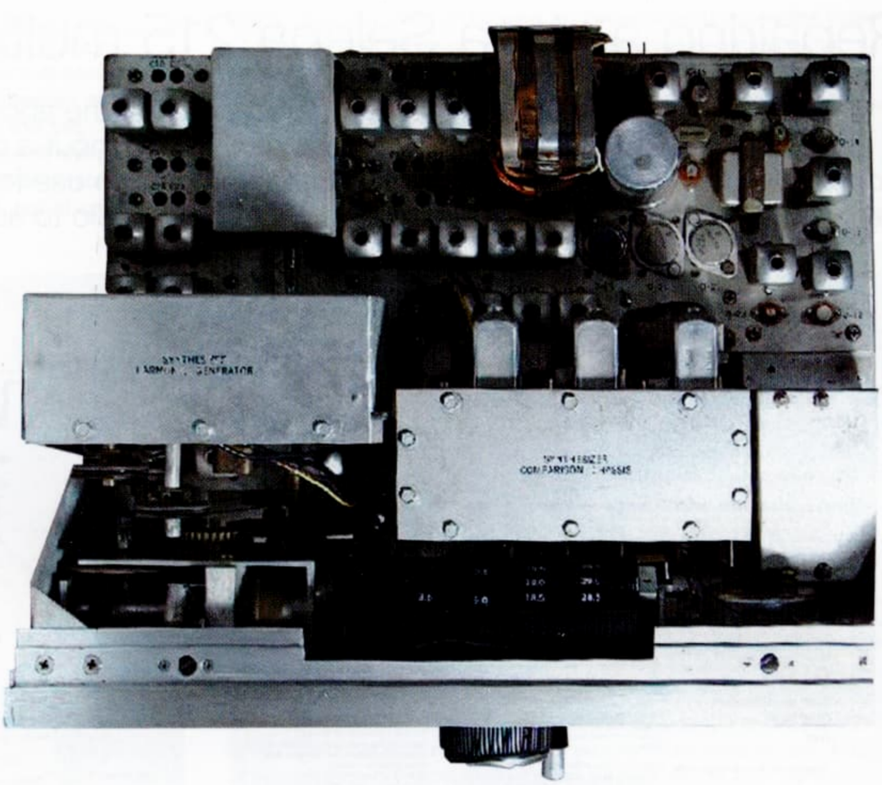
THEORY OF OPERATION



BASIC BLOCK DIAGRAM, HRO-500 SYNTHESIZER

FIGURE 16





this was somewhat less than the 2V to 7V range shown in the handbook I started looking at resistor values around the dc amplifier. Its emitter resistor had gone high resistance. After a significant struggle to get at it I managed to replace it.

The HRO-500 isn't exactly built for maintenance. Some of the components are buried beneath switches and some involve taking the synthesiser sub assembly out completely which involves disengaging cord drives on tracked tuned circuits. As luck had it I just managed to get at the offending resistor by slackening off the screws holding the synthesiser sub chassis and pushing it backwards to allow just enough space to remove the IF amplifier's bottom cover. I didn't fancy re-cording. I then just managed to get my soldering iron in through the side of the receiver.

Replacing the dc amplifier emitter resistor extended the control voltage range but unfortunately when I put everything back together again it still wouldn't lock on the highest three bands and of course the other problems were still there too. To investigate the locking problem further, I now broke the dc control at the connection to the varactor diode and replaced it with a potentiometer across the 10V supply. This is when I discovered that with the high frequency oscillator free running it just didn't have the range to tune the highest frequency bands. This and the other problems suggested that I would have to re-align the oscillator and its associated tuned buffer. I guess frequency determining components had aged and changed value over the years.

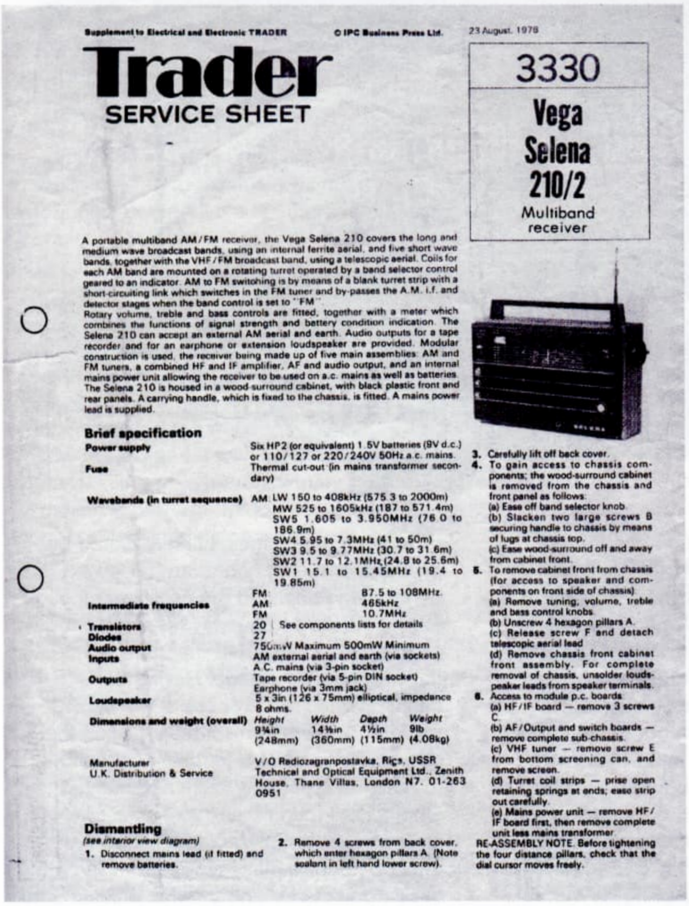
Alignment involved setting the control voltage to 5V (notionally mid range) with my potentiometer and then adjusting the oscillator and tuned buffer tracking. I connected a frequency counter and oscilloscope to the output of the tuned buffer. On each of the high frequency oscillator's five ranges, I first adjusted the synthesiser tuning control to the lowest band, then I adjusted the oscillator inductor for the required frequency reading on the counter, then I adjusted the buffer's inductor for maximum amplitude. Having done this I repeated the process at the highest band on the range this time adjusting the oscillator and buffers trimming capacitors to obtain correct frequency and highest amplitude. I found that these adjustments on the oscillator interacted significantly. In the end I had to make a compromise on the oscillator inductor and trimmer adjustments which gave me the correct frequency for all band points occurring in a position as close as possible to the alignment of the corresponding figures in the display window. This whole process took hours! Having done all this I removed the potentiometer and re-connected the dc control to the varactor. The set now locked on all bands with the correct band shown in the display window and the false locking had disappeared.

I followed the alignment procedure given in the handbook for the 230kHz IF amplifier and pre-selector stages but found that these needed little adjustment. I suspect that the receiver's sensitivity may be down a little when compared against my Redifon and Racal receivers and is probably not up to its original specification. But nevertheless the HRO-500 is now usable. I guess there are more of those wretched carbon composite resistors in the RF and IF stages that have changed values and may be affecting the gain but given the nightmare of getting at them I've no plans to squeeze out the last dB in performance. One final thing. I built a small 12V power supply, to modern safety standards, to power the receiver from its external dc connector. This is in a 6in x 4in x 2.5in box which I've attached to the rear of the receiver using the fixing screws for the receiver's case.

Repairing a Vega Selena 215 multi band radio

by Graham Dawson

In the winter edition of the bulletin I asked for a circuit of the above radio, which I was trying to restore to working order and it was proving difficult without a circuit. I had been given the radio by a lady whose husband had died, and she had no use for it and asked if I would like it. I foolishly said yes, and thanked her for another radio to add to my collection.



Supplement to Electrical and Electronic TRADER © IPC Business Press Ltd. 23 August 1978

Trader
SERVICE SHEET

3330
Vega Selena 210/2
Multiband receiver

A portable multiband AM/FM receiver, the Vega Selena 210 covers the long and medium wave broadcast bands, using an internal ferrite aerial, and five short wave bands, together with the VHF/FM broadcast band, using a telescopic aerial. Coils for each AM band are mounted on a rotating turret operated by a band selector control geared to an indicator. AM to FM switching is by means of a blank turret strip with a short-circuiting link which switches in the FM tuner and by-passes the A.M. i.f. and detector stages when the band control is set to "FM".
Rotary volume, treble and bass controls are fitted, together with a meter which combines the functions of signal strength and battery condition indication. The Selena 210 can accept an external AM aerial and earth. Audio outputs for a tape recorder and for an earphone or extension loudspeaker are provided. Modular construction is used, the receiver being made up of five main assemblies: AM and FM tuners, a combined HF and IF amplifier, AF and audio output, and an internal mains power unit allowing the receiver to be used on a.c. mains as well as batteries. The Selena 210 is housed in a wood-surround cabinet, with black plastic front and rear panels. A carrying handle, which is fixed to the chassis, is fitted. A mains power lead is supplied.

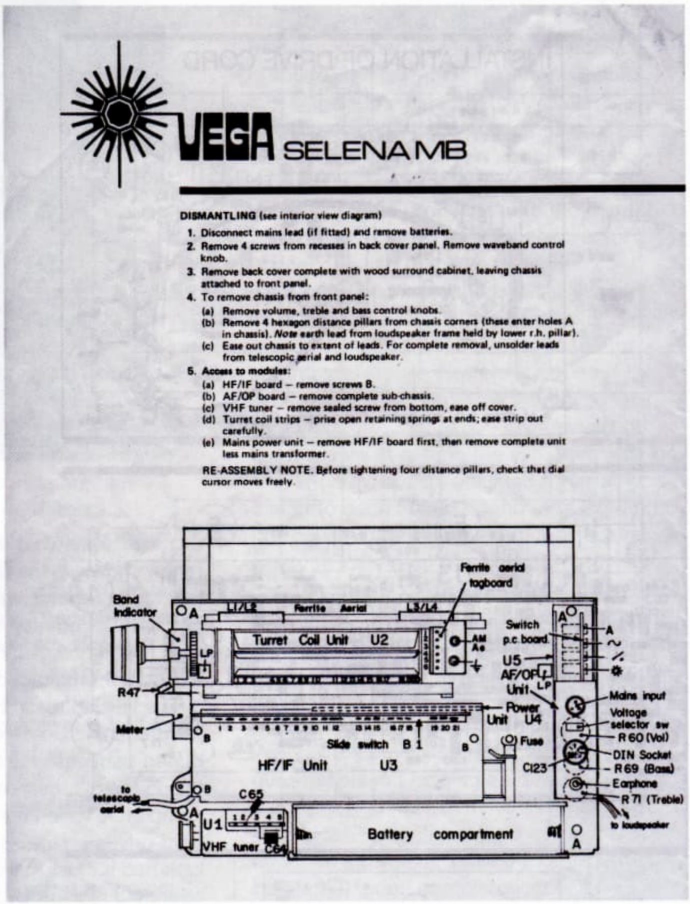
Brief specification

Power supply	Six HP2 (or equivalent) 1.5V batteries (9V d.c.) or 110/127 or 220/240V 50Hz a.c. mains.
Fuse	Thermal cut-out (in mains transformer secondary)
Wavebands (in turret sequence)	AM LW 150 to 408kHz (575.3 to 2000m) MW 525 to 1605kHz (187 to 571.4m) SW5 1.605 to 3.950MHz (76.0 to 186.9m) SW4 5.95 to 7.3MHz (41 to 50m) SW3 9.5 to 9.77MHz (30.7 to 31.6m) SW2 11.7 to 12.1MHz (24.8 to 25.6m) SW1 15.1 to 15.45MHz (19.4 to 19.85m) FM 87.5 to 108MHz.
Intermediate frequencies	AM 465kHz FM 10.7MHz
Transistors	20 See components lists for details
Diodes	27
Audio output	750mW Maximum 500mW Minimum
Inputs	AM external aerial and earth (via sockets) A.C. mains (via 3-pin socket)
Outputs	Tape recorder (via 5-pin DIN socket) Earphone (via 3mm jack)
Loudspeaker	5 x 3in (126 x 75mm) elliptical, impedance 8 ohms.
Dimensions and weight (overall)	*Height* 9¾in (248mm) *Width* 14⅛in (360mm) *Depth* 4½in (115mm) *Weight* 9lb (4.08kg)
Manufacturer	V/O Radiozagranpostavka, Riga, USSR
U.K. Distribution & Service	Technical and Optical Equipment Ltd., Zenith House, Thane Villas, London N7. 01-263 0951

Dismantling
(see interior view diagram)

1. Disconnect mains lead (if fitted) and remove batteries.
2. Remove 4 screws from back cover, which enter hexagon pillars A. (Note sealant in left hand lower screw).
3. Carefully lift off back cover.
4. To gain access to chassis components; the wood-surround cabinet is removed from the chassis and front panel as follows:
(a) Ease off band selector knob.
(b) Slacken two large screws B securing handle to chassis by means of lugs at chassis top.
(c) Ease wood-surround off and away from cabinet front.
5. To remove cabinet front from chassis (for access to speaker and components on front side of chassis).
(a) Remove tuning, volume, treble and bass control knobs.
(b) Unscrew 4 hexagon pillars A.
(c) Release screw F and detach telescopic aerial lead
(d) Remove chassis front cabinet front assembly. For complete removal of chassis, unsolder loudspeaker leads from speaker terminals.
6. Access to module p.c. boards.
(a) HF/IF board — remove 3 screws C.
(b) AF/Output and switch boards — remove complete sub-chassis.
(c) VHF tuner — remove screw E from bottom screening can, and remove screen.
(d) Turret coil strips — prise open retaining springs at ends; ease strip out carefully.
(e) Mains power unit — remove HF/IF board first, then remove complete unit less mains transformer.

RE-ASSEMBLY NOTE. Before tightening the four distance pillars, check that the dial cursor moves freely.



VEGA SELENA MB

DISMANTLING (see interior view diagram)

1. Disconnect mains lead (if fitted) and remove batteries.
2. Remove 4 screws from recesses in back cover panel. Remove waveband control knob.
3. Remove back cover complete with wood surround cabinet, leaving chassis attached to front panel.
4. To remove chassis from front panel:
   (a) Remove volume, treble and bass control knobs.
   (b) Remove 4 hexagon distance pillars from chassis corners (these enter holes A in chassis). *Note* earth lead from loudspeaker frame held by lower r.h. pillar).
   (c) Ease out chassis to extent of leads. For complete removal, unsolder leads from telescopic aerial and loudspeaker.
5. Access to modules:
   (a) HF/IF board – remove screws B.
   (b) AF/OP board – remove complete sub-chassis.
   (c) VHF tuner – remove sealed screw from bottom, ease off cover.
   (d) Turret coil strips – prise open retaining springs at ends; ease strip out carefully.
   (e) Mains power unit – remove HF/IF board first, then remove complete unit less mains transformer.

RE-ASSEMBLY NOTE. Before tightening four distance pillars, check that dial cursor moves freely.

The case was "distressed" with some veneer peeling and needed a little work to make it presentable, but was complete with knobs and handle and a mains lead. It had spent some years in the tropics, but showed no real sign of distress on the circuit boards and there was no rust on the metalwork, of which there is quite a lot on these sets. How appearances can be deceiving ! Had I any idea of the problems in store I would have dumped the set at this stage.

Armed with the confidence of repairing many varied sets over the years, I dismantled the radio in preparation for a quick fix and line up, followed by cabinet work and a re-assembly. It was not to be.

I checked the nine volt supply line for shorts, checked the insulation on the mains transformer and with eager anticipation plugged in and switched on. A fearsome crackling told me the volume control and waveband switch were in need of cleaning, but some muted sounds were heard on medium wave, so it was only going to be a matter of a few hours before this set was in full working order I thought. It was not that easy.

I used switch cleaner on the turret contacts and the volume control track, lightly oiled the drive cord pulleys and triple gang tuning capacitor bearings and switched on again. Nothing but a faint hum. No long, medium or short wave signals nor anything on FM; the set was RF dead.

A few DC checks on the IF strip transistors revealed all was not well with the final stage and an unmarked pnp transistor was open circuit base collector. (the original was a KT3126) A bad start.

This set has a nine volt positive supply line, but pnp germanium transistors which are all configured "upside down" with their collector loads connected to the chassis or earth. I could not work out why it was this way until I realised the audio stages were in a chip which had a positive supply and the mounting lugs were the negative return and designed to bolt to the chassis for heat dissipation. Of course without a circuit finding all this out took a considerable time and involved removing the printed circuit boards from the chassis as the tracks were not accessible. I also soon discovered that when the transistor leads were unsoldered the printed tracks lifted from the board and curled up. Russian radio construction was rather inferior to those of other countries.

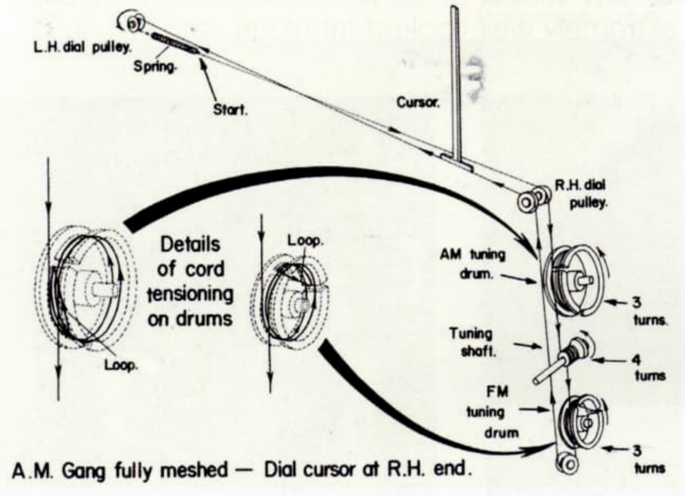
I substituted an AF118 for the final IF transistor and after careful checking of all connections re-fixed the board in the set and switched on again. I could only receive signals on the medium wave, but at least the set was partly working. The sound was distorted and I tried a pair of headphones (not easy as the socket is not for a 3.5 mm jack, so had to be wired in) and the distortion was much less so the speaker cone was obviously rubbing on the magnet. I switched off, wired an old five inch 8 ohm in place of the set speaker and tried once more. The set was absolutely dead again.

Without repeating the diagnosis process again and again I can tell you that the three IF transistors each died in turn and all had to be replaced by AF118s with dire consequences for the health of the printed circuit board and all the wires that connected it to the coil turret contacts. I was starting to have my doubts about this set already, especially as it was not a rare or classic vintage radio that really justified a major rebuild. In fact the problems were only just beginning, but I did not know it at this point.

Old electrolytic capacitors sometimes die hours after they have run seemingly without a problem, and this set was a good (or bad) example. The main smoothing caps had to be replaced at about this point since there was appreciable hum on the output. In fact I decided to change all the electrolytics while the boards were out, since it was quicker than waiting for them to fail in turn. When measured most seemed OK for value and leakage, but I was not taking any chances, as component death at switch on was now a feature of this set.

While putting it all back together the dial cord came off the pulleys and fortunately I had a service sheet for an earlier model which had the same tuning drive, so I was able to re connect it, but of course

INSTALLATION OF DRIVE CORD



with separate VHF and AM tuning capacitors the calibration was now lost; perhaps the least of my worries with this set. I decided to go for an AM alignment, initially of the IF stages only, since changing all the transistors had probably affected circuit capacitances.

At this point I should probably explain that the Selena has somewhat unconventional circuitry layout in dealing with AM and FM signals and coils are dotted all over the board in seemingly random fashion. Without the circuit it was not easy to work out which coils did what and where they were, and I decided not only would the circuit help, but I should get the FM part working first and then do a complete alignment safe in the knowledge that no more replacement parts were to be fitted. As it turned out a wise move.

Between sending my request for information to the Bulletin and it being published, a friend found a website with the circuit of this model and made a copy for me. Now I could see how it was supposed to work and component values. FM was dead, but before looking into the tuner, which did not appear to be giving out any signals, I decided to trace signals through the 10.7 Mhz IF to the detector.

The final stage would not amplify a signal and was not tuning to any frequency at all. Clearly something was amiss in the IF transformer. There being continuity through the coils, which are only a few turns, the likely culprit was the ceramic tuning capacitors which the circuit told me were 30pf. I removed one with difficulty and measured it on my capacitance meter. It was 340pf ! Not open circuit or leaky but had increased in value by a factor of over 10 times. I removed the other one to find it was nearly 400pf. How could these capacitors have done this, as I have never known a ceramic to change so drastically without leaking across the dielectric and giving a reading of a few hundred ohms. Fortunately they were mounted on the board outside the can, so apart from the usual peeling track problem, I was able to put two 27pf caps in their place. On switch on the stage could now be tuned by the cores to peak at 10.7 Mhz.

Now back a stage to try that and discover exactly the same problem. Obviously this batch of capacitors had all failed in the same way. So for the first and second stages I changed the capacitors and tuned them up until I had a fair amount of gain down the strip. On FM this set has one further IF stage after the tuner and before the main IF amplifier, but because different types of capacitors had been used, this worked as normal, so I now had to find out why the tuner was not oscillating.

To work on the tuner you have to remove it from the set and I feared the capacitors may have the changed value problem. Take off the drive cord and unsolder a few wires, then unscrew the tuner chassis and out it comes. Why did I waste time re-stringing the drive cord; I should have known it would have to come off again.

I measured all the transistors in situ and they all seemed to be OK, but at 100Mhz you can never be sure quite what is happening inside, so the best bet was to change the oscillator first and see what that produced. Assuming the transistor in the set was the one on the circuit of course I did not have anything like it (type KT339am). I assumed it to be germanium, but the base emitter voltage was nearly 0.7 so it had to be silicon; or was it ? Nothing about this radio was what you expected, so try one of each type and see if they oscillated. By now desperation had replaced cold reason and I involved some friends in my efforts to finally get it all working, sub contracting the tuner repair to them as they had an oscilloscope that worked to 400Mhz. The tuner could be made to work as a stand alone unit with a 4.5 volt positive supply.

I am comforted to know that making it work was not easy, but eventually by fitting an npn silicon type BF199 as the oscillator with collector, base and emitter in the right places, it worked and 10.7 Mhz was coupled to the output pins. Surely now the set would be working on all bands once this module was replaced.

Well not quite. The VHF tuner refused to function when the screening cover was replaced. This is a catch 22 situation since no measurements can be made with the cover on and the unit mounted on the chassis. I suspect the BF199 was sufficiently different from the original transistor to be very sensitive to stray capacitances and by moving it physically to one side it could be made to oscillate when the cover was replaced. This was far from a stable unit, but at least it did now work and produce signals on the VHF band.

Was it my imagination or did all stations on am and fm sound distorted? I checked the audio output waveform on the scope and there was bad cross over distortion. Measurements showed the mid point voltage had shifted, with no external adjustment possible.

The output integrated circuit (type KT74YH7) was now faulty with little hope of sourcing another one it being of Russian manufacture. It would be possible to fit something similar, but only on a sub board as all connections would be different.

I now had a rather butchered radio which worked on all bands, but with an unstable VHF tuner and in need of a new output amplifier and speaker that would fit in the chassis.

I made one final test before sourcing suitable components to complete the restoration. Switch on and… nothing! The set was dead again.

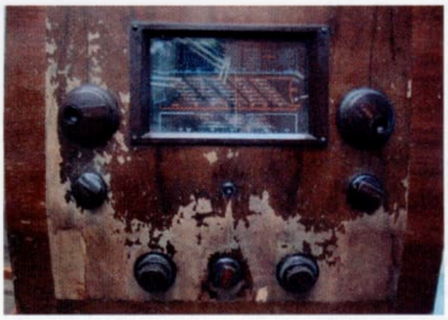
This was the last straw. The radio was not worth all this effort and looked set to fail at every attempt to repair it. I had had enough.

I had achieved the goal of making the set work on all bands and derived some satisfaction from this success, even if only for a short while. Had it been a rare gem or of special interest then I might have proceeded to a satisfactory complete restoration, but it was not worth any more time or money and I removed the transistors and electrolytic capacitors I had fitted and threw the remains of the set in the scrap bin. Chalk it up to experience. Readers who may have lovingly restored one of these sets to full working order will be horrified at my actions, but it will be a long time before I work on a Selena radio again, as I have too many other projects awaiting my attention. I hope however that my experiences may have helped others working with this model and they have either more time or luck than I did at completing a satisfactory restoration. I have often found sets that look in poor condition respond well to a minimum of repair, and sets that look externally sound require a huge amount of effort to put them back in working order. This radio was a classic example of the latter.

The restoration of an unloved HMV 907 by Mike Barker

This poor old set was spotted being unloaded from an antique dealers van outside of his premises by an eagle–eyed BVWS member, who quickly negotiated a purchase and took it from the dealer who was himself relieved not to have to move it any further due to its size and weight. I had previously restored a Bush TV43 for the HMV's new owner. The Bush required a complete electronic restoration. Its cabinet was missing some strips of veneer and most of its top lacquer had parted company long ago. The cabinet was attended to by BVWS member John Sprange who can do wonders with tatty old cabinets. It required several new veneer strips and a complete cellulose spray re-finish. When completed the set performed extremely well, looked fabulous, and still does.

The television as found



Burns on the cabinet

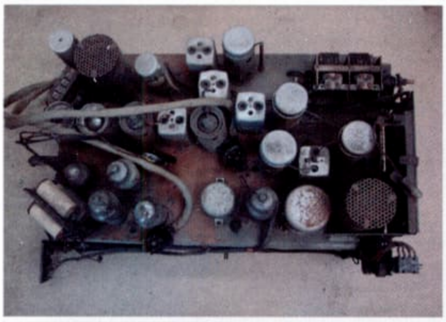
The insides of the television as found

Shortly afterwards a call came from the owner to say that he had another television for me to look at, but his time it was in a bad way. When it arrived, I was delighted to see it was an HMV907 pre-war 9" set, but it was clear it had been given a hard life and even suffered an arson attempt, but the HMV was built of better stuff and had survived. Initial inspection showed the set had been stored in the damp for a considerable time, and the veneers to the front around the control knobs had been lifting up and ripped off where loose. This was true of other areas as well. The side of the cabinet had suffered severe burning which had gone right through the veneer and layers of the ply cabinet. This was going to be a long job! My attentions then turned to the internals which, on opening the back hinged cover, appeared to be untouched for many years. It had at some time been fitted with replacement electrolytics, both on the receiver chassis and the tubular smoothers on the power chassis which were dated August 1948. The EHT smoothing capacitor block had also been replaced by two Visconol units. All the paper and electrolytic capacitors would in time be removed and re-stuffed with new components and a new EHT capacitor block and receiver chassis capacitor block would be made to replace the original units.

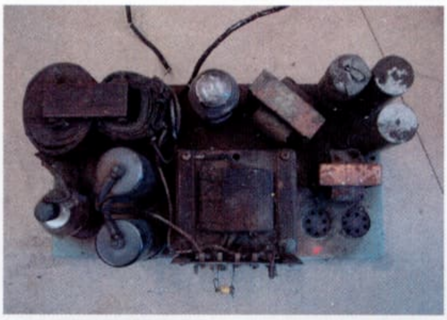
Removing the chassis from the cabinet was more tricky than I had expected as a couple of the bolts needed exceptional coaxing and penetrating fluid to free them up, but once this was done, I was able to remove and inspect the internals further. The tube was carefully removed and hooked up to a tester and to my surprise showed a very good emission. This is no guarantee of a good picture but it was a very encouraging start. It was then stored away with plenty of wrappings around it.

The cabinet was stripped of all its fittings and then transported up to John's workshop for assessment. I was amazed at how supple the rubber mask had remained with very little distortion of its original shape. Due to the state of the original finish and the damaged veneers it was decided that a full refinish was appropriate, and so the cabinet was stripped and work started on replacing the damaged veneers. Several weeks later the cabinet was at a state where the grain filler, sanding sealer and cellulose could be applied. We still had one problem, the HMV decal for the top of the cabinet. Various attempts were made to re-create this on one very thin layer of clear plastic, but although we had an excellent example to scan, we could not print white, so the nipper dog was very carefully painted in by hand before the new plastic film decal could be used. The fine brush marks giving a visible texture and almost 3D effect to the dog. Many lacquer coats were built up to cover the decal and the end result is remarkably convincing. The cabinet side where it had been burnt was built up with filler and thin strips of wood before the new veneers were applied. To help mask the differing grains, the inserted pieces of veneer were cut in "donkey ear" shapes and a certain amount of diluted stain was used to continue on the pattern of the original grain thus making it difficult to see the repair work. This technique was also used on the front around the controls where the darker areas of the grain are very pronounced. Other areas around the speaker opening were given completely new veneers. The edges around the screen opening and cabinet base were repainted and the entire cabinet was then sprayed and flatted many times to get the required finish. This is a slow process which took several months and must be done when the temperature and humidity are right otherwise a lot of expensive materials and time can be wasted. Thanks to John's skills and the tremendous amount of time taken over the fine details, the cabinet looks fantastic.

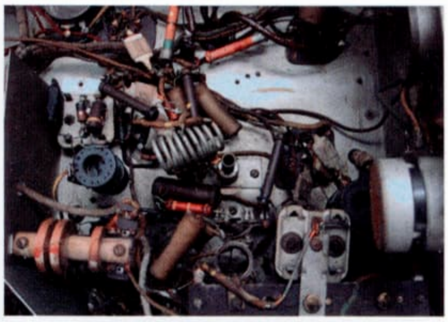
The entire receiver and power chassis were carefully photographed in detail so that I had a set of reference pictures to work with. I do this with all restorations as it can really get you out of trouble when many months have passed and you cannot remember some certain detail. Both chassis had significant surface rust, some of which had become quite pitted. The chassis' were cleared of all transformers and



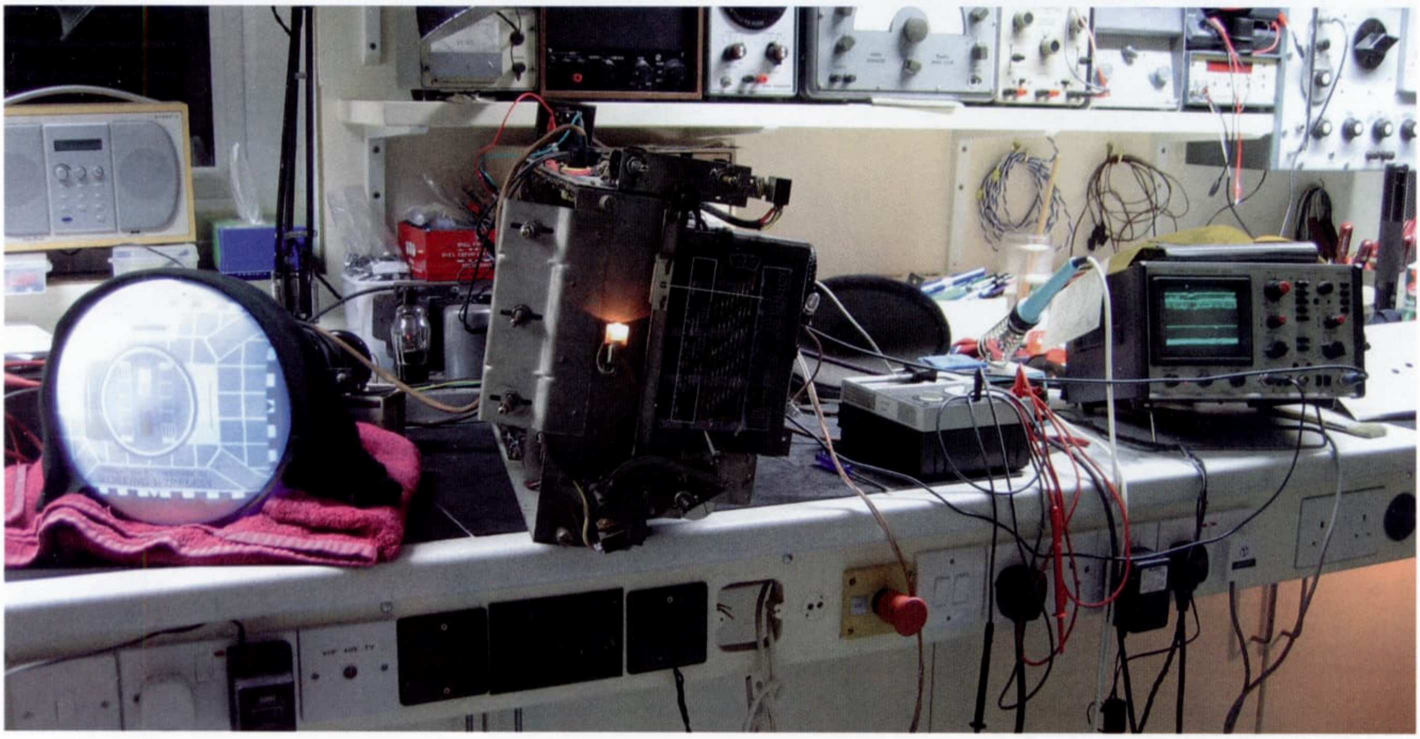
Receiver chassis 'before'



Power chassis 'before'



Underneath the tuner



aluminium coil cans etc. All old rubber leads were pulled back through to the underside and valve holders masked up. Both chassis were then treated with several applications of Jenolite rust killer and a brass wire brush was used to help shift the difficult corrosion. This removed the rust and gave the chassis a clean and tidy but 'old' look. I could have opted for re-plating, but I prefer to keep it looking its age. Being careful to only do small sections at a time, this took most of a week to get things into an acceptable state.

At an early stage, I had decided not to remove the glass radio dial plate. The screen printing on EMI plates of this type and age tends to go powdery and if you remove them you can almost watch the lettering falling off as dust. On a radio you stand a slim chance of finding another, but on a pre-war television the chances are almost zero. So any trapped dust was left alone. The pointer was removed and the glass plate was covered in a thick cardboard jacket to protect it whilst work was being carried out on the chassis.

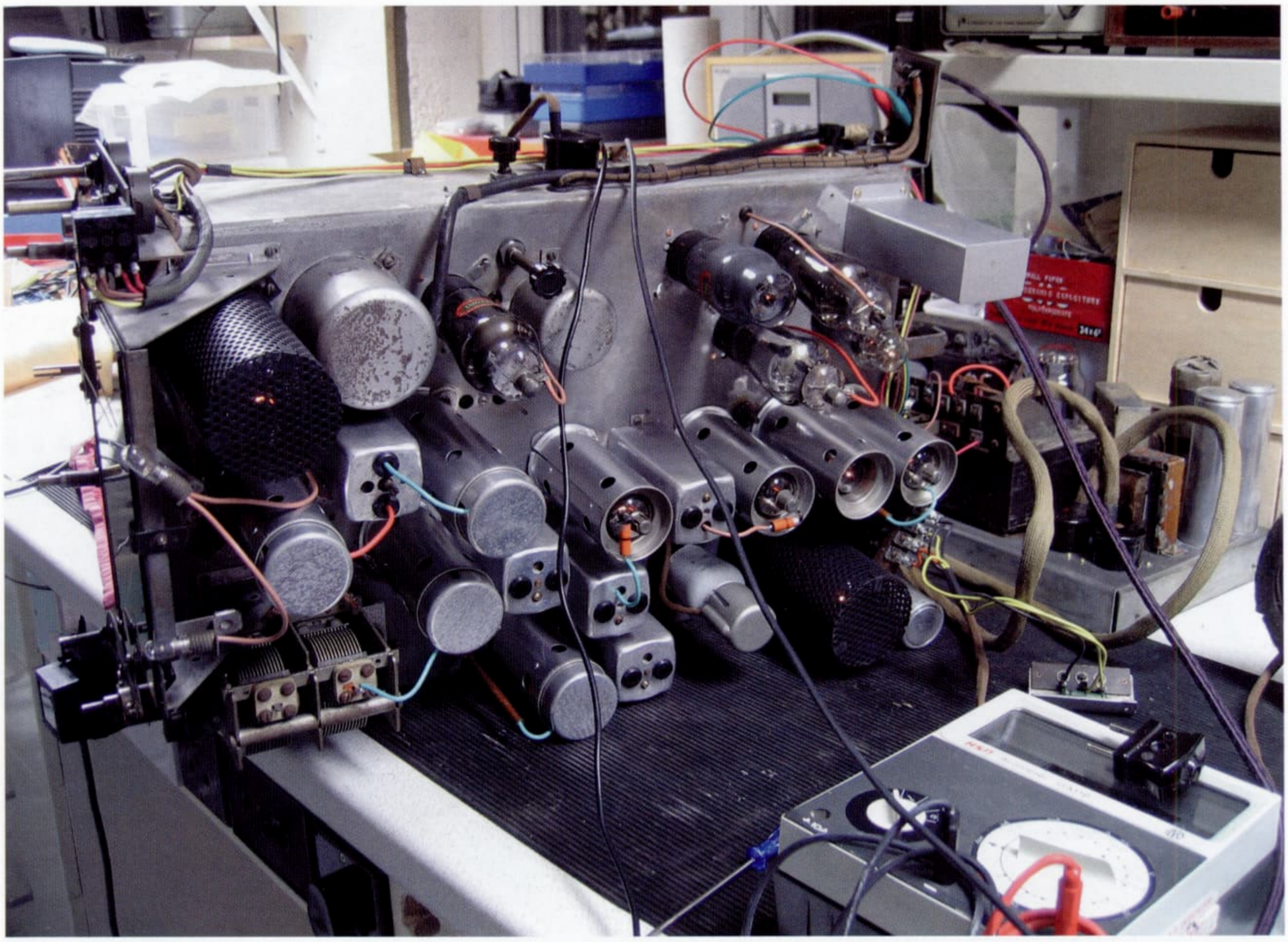
Each and every transformer and coil was inspected and windings checked. Everything was then given a good clean up and new rubber grommets were fitted where the originals had hardened or were missing.

The next job was to re-make all of the chassis connecting leads with silicone rubber wire and where they were inside braiding; this was re-used or replaced from old cable stock. It is quite easy to slip the braid off and then re-thread with new wires. All rubber wires on both chassis were replaced and in other areas where cotton braided wires were used; new production automotive wire replaced it to preserve the original appearance. Silicone EHT car spark plug wire was used in all of the high voltage areas. There is quite a lot of rubber wire on the receiver chassis, but it had to be done as a lot of the original was brittle and falling away when touched. Just like post war Murphy's… All of the paper and electrolytic capacitors were removed and individually re-stuffed and re-fitted. A new metal capacitor block was folded up for the smoothing caps at the back of the chassis and another made for the unit that was missing from the underside as well. This de-cluttered the chassis underside considerably.

Looking carefully at all the rest of the various components under the chassis it was clear that a good number of the larger wattage resistors had suffered, probably due to leaky capacitors over the years. So a full scale resistor value check was made and anything more than 10% out was changed. I hold a massive stock of vintage components and can usually come up with a NOS replacement that is still the correct value, but if not then I either re-paint resistors that measure correctly or use more modern components and again paint them to look vintage. Next my attention turned to the various control pots, some of which are dual gang. These were in a poor state and very scratchy. Several measured extremely high so they were removed and then dismantled (not an easy task for the dual gang units due to the sweat fixing of the end brass sleeve) the carbon tracks were found to have large grooves cut into them where the small disc, similar to a tiny washer, that travels flat on the carbon track had come loose and the sprung radial arm which holds the disc in place was now digging its way through the carbon track and beyond.

A couple could be saved by carefully using different sized discs and making sure they could not come loose again, this giving a larger surface area in contact with the remaining carbon track and hence saving the pot. However this was not always the case, and so I found donor controls of the same make and re-engineered them to fit in the original cases. I was surprised to find that the brightness and contrast pots were by far the worst. You would have expected the volume control to have worn more as it is ganged with the mains switch.

All transformers and IFT's etc. were re-attached to the chassis and wired up. The mechanical drives for the dial pointer and the tuning gang were degreased and new lubrication applied. As with some other EMI chassis this



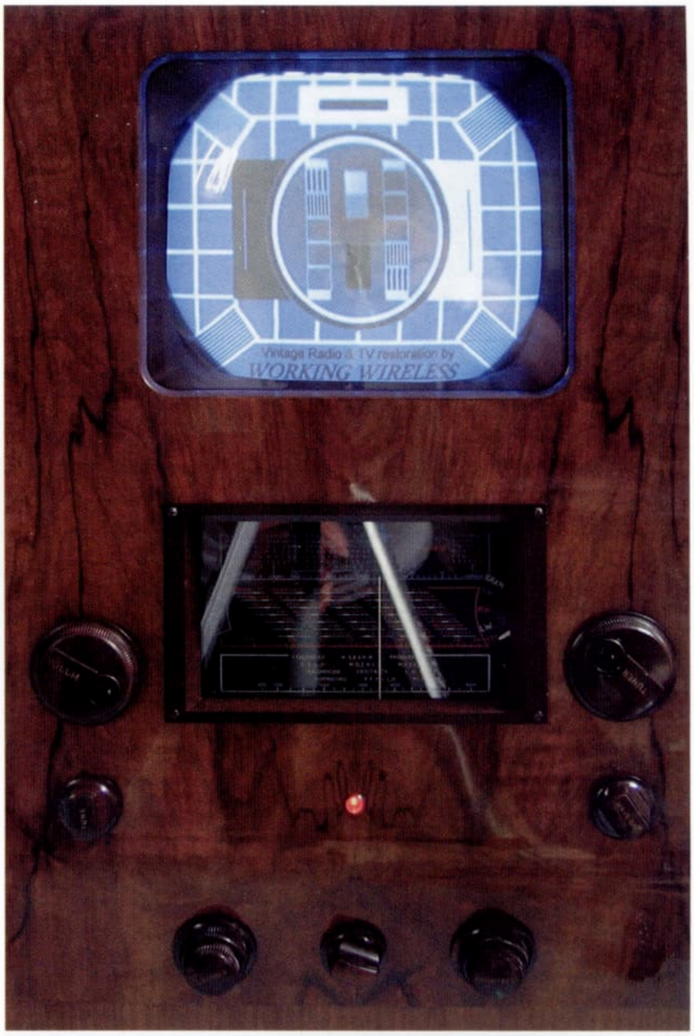
has a system where the toothed drive cogs are paired with small tension springs that ensure a smooth and positive movement without any slip. If these are not cleaned and then lubricated they can cause serious frustration when you come to align the set as the alignment tuning point will move around even though you have everything else correct.

I noted several oddities with this set; the TV tuning control is located way towards the front of the chassis and is a vertically sliding tube with locking nut. When the set is in its cabinet it is virtually impossible to adjust because of its proximity to the glass of the picture tube. Why did they do this and then state in the installation instructions to fine tune the set by this control. Maybe you were only adjusting for max audio and were expected to remove the tube, but it does not say to do so. Being a deep chassis to reach into and the fact that you are never far away from the tube EHT connector, you would be taking a risk, especially in the customer's house at time of installation. The set also has both a front mounted Focus control and a pre-set Focus control on the chassis. It became clear to me why there was a Focus control at the front for the user… With respect to the Focus in this set; the HT line for this section is about 330 volts, this then feeding a resistor of 5KΩ and then the two variable resistors for pre-set and main focus, both of which are 3KΩ. All this then feeds the focus coil of 6KΩ to chassis. Even though the two pots were approximately correct value, as was the focus coil when measured cold, no amount of adjustment would give any amount of fine focus after the set had been operated a short time. After reducing the 5KΩ resistor to 3.5KΩ and adjusting the pre-set focus to give as sharp a picture as obtainable with the front focus control retarded, it was possible to maintain focus for long periods of time with few re-adjustments at the front. As the current in the focus coil was approximately correct with the lower value HT feed resistor, it can be assumed that the focus coil may be changing resistance as it warms up, and also that there is a small amount of unwanted gases in the tube. This is just something that you have to live with if you don't have a brand new tube to hand, and who does?

With everything back in place and connected and a completely new set of valves, tested in the AVO VCM first, installed I was ready to run the set up on the mains. Why did they use the much earlier series of valves in this set? Was it in the development stages for an extended time or did they just needed to get a new model to market. It seems odd that they did not go for all octal series valves. Again we have an oddity with the valves. The X41 frequency changer is stated as X41C, C denoting a ceramic base, which is matched with a ceramic valve holder. I found no particular improvement with an X41C over a standard X41, but the C version was fitted. Now this is an awkward chassis to have running on the bench as you need a lot of space to get the receiver chassis, power chassis and the tube together with its connecting leads in a way you can still work on it safely. This was achieved by putting the receiver chassis on its side on blocks and being very careful. With the chassis switched to radio, power was applied using a Variac, firstly without the main rectifier and EHT rectifier in place. Various voltage checks were made and as everything was looking good the main rectifier was inserted and the HT voltages monitored. Very soon there was plenty of sound from the speaker and activity on all radio wavebands. This was the first hurdle over with, and a full re-alignment would see the radio section working extremely well with excellent sound quality.

The radio section alignment ended up being more complicated and took longer than the TV section. This is due to the positioning of some of the adjustments, issues with screening covers and the crazy idea of moving loops of wire situated inside coil formers with an insulated hook tool to effect alignment changes. It must be said that the internal layout of the radio section has a distinct bench "lash-up" feel to it.

The time came to try the television section, still with the EHT rectifier removed I switched over to TV. The small pilot lamp lit brightly and after a few seconds a strong line whistle could be heard. Voltages were checked in various places and seemed to be reasonably close to those stated in the manual, so after some minutes with no signs of overheating or any other visible problems



I switched off and installed the EHT rectifier.

Once again the set was switched on. This time after the warm up period, I was greeted with a large area of the screen alight and a very out of sync picture. All the necessary initial adjustments were made to frame and line controls. Contrast and brightness were adjusted as required and there in front of me was a very reasonable test card C. Being delighted with this result, I left the set alone for a while to just bed everything in and see what happened. It was not long before I found that the focus was unstable and that the sync was shifting around.

A few quick adjustments to the pre-set sync control to get the feel of what it did and adjustment of the pre-set Focus and main focus and once again a reasonable picture. This now stayed stable for some time. With the set left running for a number of hours it was found that the focus moved further and further until there was no more adjustment left. This is where I altered the feed resistance value to give a stable focus from the front control after the set had been on for some considerable time.

The tube now appeared to be getting a little better in its definition the longer it was run, so a small amount of regeneration of the cathode must have been taking place. It is interesting to note that the 9" EMI tubes suffer from ion burn considerably more than the 12" and bigger tubes of the same period. Luckily the ion burn on this tube was almost exactly the size of the circle on test card C so is barely seen, and even less noticeable on moving images. The TV was left running on the bench for several whole days whilst I worked on other things. Alignment of the TV circuits went well, despite more weird and wonderful ideas of shorting out things through holes in metal screens and adjustments by physically extending and squeezing the oscillator coil. The end result was to get better definition from the frequency bars of the test card and a less milky looking picture. The contrast control could now be backed off considerably more and with better highlights and lowlights.

I noticed that when setting up the picture geometry, I was not able to get a perfect test card C in the picture area. Measurements of the picture area of the tube face against the rubber mask were taken and I found that it was not a 4:3 ratio. I can't think that the mask has changed shape to this extent, so I checked the HMV907 at the Museum in Dulwich, and sure enough it to is taller than a 4:3 ratio would dictate, so the height was adjusted to fill the visible area.

I noticed a distinct variation of the sync and picture geometry on a number of occasions. Meters were attached to various circuit points and a voltage change was apparent on the HT rail when this occurred. The fault was traced to the radio-TV change over switch. This is a toggle switch of special design mechanically ganged to the wave change switch spindle. It operates to short out a 10KΩ resistor in the negative end of the HT rail which is used to give the bias voltage for the sync control. This did not respond to cleaning and so was replaced with another of the same special type.
After being left once more for several days just running on the bench it was time to re-install into the cabinet. This went very well and soon the set was once again complete and working. Now I had the problem of parting with it back to its owner, but I did have the enjoyment of many hours viewing before it was delivered.

After some time I received a call from the owner to say that the set had failed and he only had a very narrow vertical picture about an eighth of an inch wide at most. The set was brought back and a quick continuity test on the line output transformer was all that was needed to diagnose the fault. The transformer was removed and un-potted and re-wound with much better insulation. By this time I had also restored another EMI pre-war TV and the manual for that set had a series of modifications listed. One such modification was to install insulated spacers between the metal can of the line output transformer and the chassis due to excessive failures of this type where internal leakage to the can was apparent. The HMV907 had never been subject to this modification, so in re-fitting, the transformer and its can was insulated as recommended and all has been well ever since.
The end result being a very hansom 1938 HMV907 that can now be enjoyed for many years to come.

Pictures from Wootton Bassett Auction August 14, 2011

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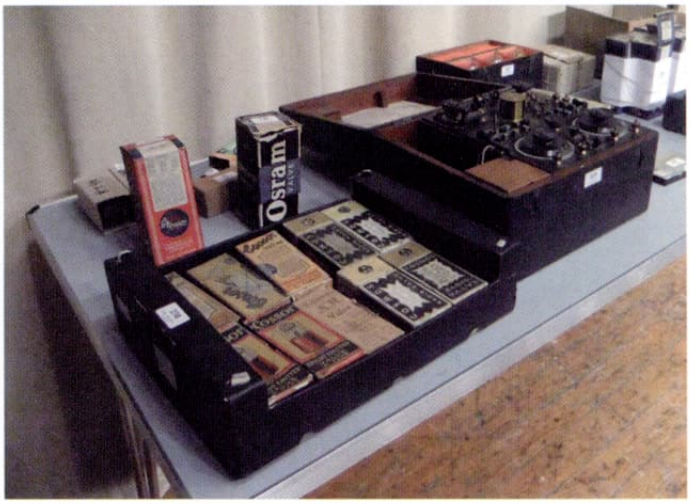
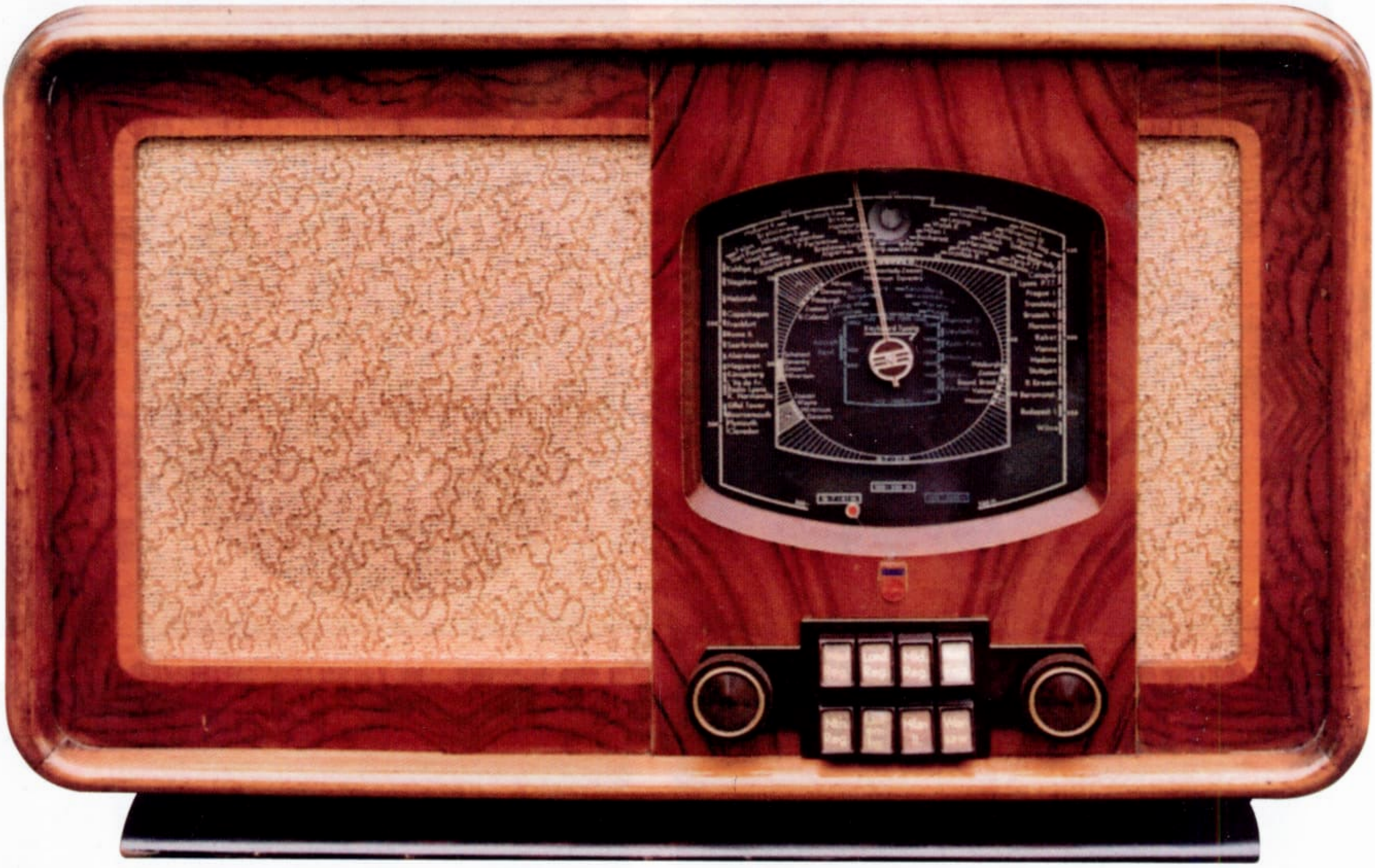
Mullard

Osram



The Philips 660A by Peter Nash

The Philips 660A of 1938 has all the features that one can expect a good Philips from the era to have. It has the quirky but efficient chassis, a notorious drive cord system coupled with a unique tuning device, audio feedback loops and handsome good looks with a sparkling performance. It even manages to incorporate a Bowden cable. 1938 was generally a big year for press button tuning, it became the latest fad. Many different systems were evolved, but the special type of tuning capacitor used by Philips in the 660A meant that it was particularly suited to this type of operation as we shall see. Eight press buttons were provided for preset tuning in addition to there being normal manual tuning across the long, medium and short wavebands. Receiver operation was from AC mains with the familiar carousel type selector catering for a wide range of supply voltages.



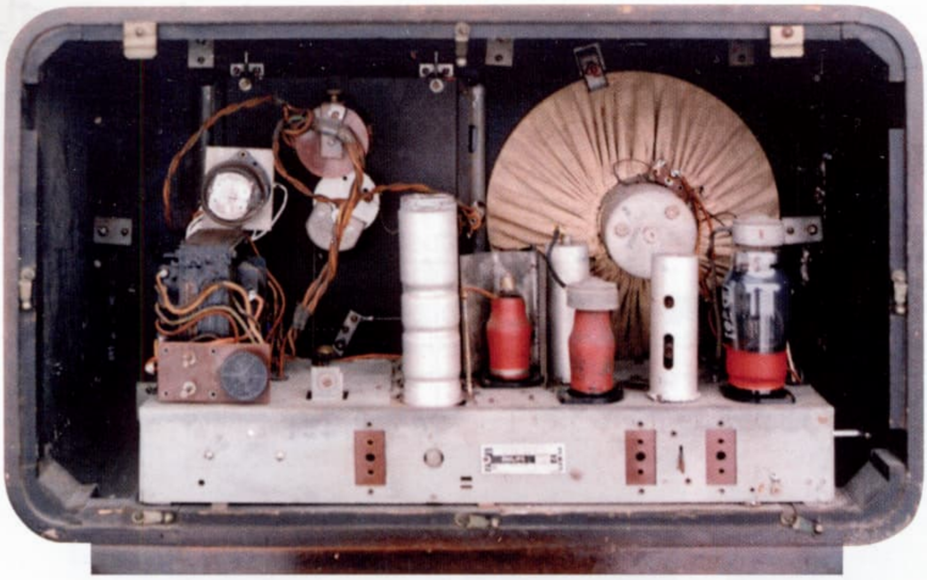
Much thought has gone into the cabinet design. It is neat and uncluttered whilst remaining very pleasing to the eye. All of the tuning controls are situated at the front and all of the sound controls are at the side. The lavish veneers , curves, rounded dial and brass inserts to the knobs give it a fresh, continental aura. It was probably designed in Eindhoven. By contrast to the rest of the set, the dial is very busy indeed; in fact no less than 105 stations are marked if one includes the aircraft band! This gives a clue to its capabilities. All manner of stations are marked here. The Scottish region rubs shoulders with Katowice and London becomes neighbours with Linz. At the top centre of the dial, the crowded stations respectfully part to allow the emerald glow of the magic eye to shine through. At the bottom of the dial is a waveband indicator driven by bowden cable.

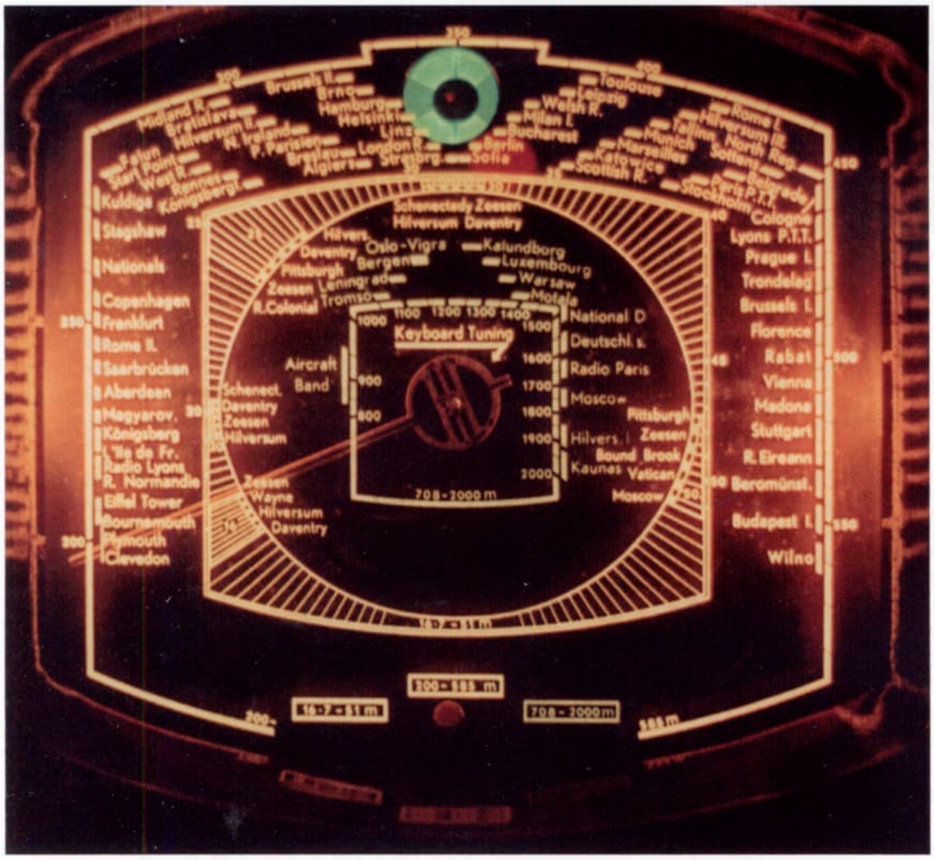
The circuit

The receiver employs six side–contact valves in a 'short' superhet arrangement. The lineup is EF8, EK2, EF9, EBL1, EMI, and AZI. The dial lamps are two MES types rated at 6.3v 0.3A. The special type of tuning capacitor, which we will examine shortly, is a 3 gang unit allowing the use of an RF amplifier to preced the frequency changer. The EF8 is used as the RF amplifier with stage gain controlled by the AVC line. Frequency conversion is performed by RF octode EK2 with AVC only applied to this stage on MW and LW. IF amplification is by RF pentode EF9, which operates with a fixed bias despite it being a vari–mu valve. The EBL1 is a double diode pentode and handles signal detection, AVC derivation, audio amplification and output. EMI is the magic eye tuning indicator which takes its controlling voltage from the signal diode for greater sensitivity, not the AVC line which is delayed. AZI, a full wave rectifier, supplies HT.

Let us now look at one or two finer points of the circuit. The RF amplifier, EF8, is described in the receiver literature as a 'noiseless RF pentode' but according to Mullard (who manufactured the valve) it is a 'low noise hexode'. Either way, it is an excellent choice of valve. Withdraw the aerial plug and certainly the background becomes very quiet. Pop the aerial back in and it springs to life, everything that you hear being from the aerial and not internally generated. The stage introduces a very worthwhile level of gain across all three wavebands. Discrete RF inductors dedicated to each band with separate switching, trimming and padding where necessary contribute towards low loss. The second IF transformer has tapped primary and secondary windings to mitigate the effects of loading.

The audio stage is interesting. In a very clever and effective system, it uses both negative and positive feedback, the volume control setting determining which has the greater effect. The key component used in the system is the output transformer, which





has a centre tapped tertiary winding. The centre tap is decoupled to chassis, one leg then providing a negative feedback voltage which is coupled to a tapping low down on the volume control track. The other leg provides positive feedback and is connected to the top of the volume control. Both feedback lines are subjected to frequency tailoring. So, for lower volume settings, say for local station listening, negative feedback is applied resulting in a high quality of reproduction. For higher volume settings used on weaker signals, positive feedback nullifies the negative feedback and the maximum gain becomes available. A generously proportioned loudspeaker referred to as having an anti directional cone is fitted in the spacious cabinet and protected by enclosure in a dust bag.

In the power supply, HT smoothing is thorough, being by a 28 + 32 μF electrolytic unit in conjunction with a smoothing choke. The RF amplifier has its own privately decoupled anode supply and an anti–modulation hum capacitor is fitted between one of the rectifier anodes and chassis.

The Tuning Capacitor

Nestled among the switch wafers and wiring beneath the chassis is that marvel of Philips' fine engineering, the direct action tuning capacitor. To the casual observer, this would not be immediately recognisable because it does not have the usual sets of intermeshing vanes. The 'plates' of this capacitor are formed from two cylindrical brass foils of slightly differing diameters, one of which is arranged to slide inside the other in telescopic fashion. Almost incredibly, a linear movement of just under half an inch produces a capacity charge of about 480 pF. The manufacturing tolerances and assembly procedures to the component parts of the capacitor would have been most exacting. The air gap which is maintained between the foils is extremely narrow. It will take the thickness of a human hair but possibly not much more. I certainly would never encourage measuring the gap or disturbing the foils in any way, it would be all too easy to ruin the unit. One can begin to appreciate the degree of precision and rigidity that has gone into the unit's production, in triplicate and with eight preset push–buttons added on!

It is the linear movement needed to tune the capacitor which simplifies its adaptability to press–button tuning. The moving foils are essentially coupled to a spring–loaded thrust plate which tends to throw open the capacitor. Each press–button selected is arranged to act against the thrust plate by an amount depending upon a screw setting for each button. It is a delightfully simple system.

Manual tuning, on the other hand, is less straightforward. The rotary action of the tuning control is converted into linear motion by similar means to a nut being driven along a turning screw thread. The rotary dial cursor is driven in an unusual manner. There is only one end of a drive cord which issues from the tuning mechanism, the amount of cord played out corresponding to the tuning position. It follows that any kind of indicator driven by the cord must be under its own tension in order to keep the drive cord taut and allow back and forth operation. This is achieved by using a spring–loaded cursor which is firstly wound up three turns like a clock and then the cord is attached to the cursor drum. Things start to become more complicated because the linear law of the capacitor does not equate to evenly spaced stations around the dial, so some deliberate non linearity is introduced to the cursor motion to make this so. The aforementioned cursor drum is eccentrically mounted to give a quicker pull towards one end of the scale. Add to this a small counterbalance to compenates for variations in loading caused by the eccentric drum and one can see the amount of engineering that has gone into making everything just right.

For further reading on the Philips direct action tuning capacitor, I recommend the article by Geoffrey Dixon–Nuttall, found in the Summer 1997 Bulletin (see page 27).

The Chassis

Once the back and underneath panels are removed, accesibility to the chassis is quite good and it ought to be possible to carry out most checks and repairs without any further dismantling. However, from time to time, it will be necessary to remove the chassis from the cabinet, say to inspect the wiring or to restring the tuning dial. It must be remembered that in this receiver the whole dial and cursor assembly remains fixed to the cabinet. Therefore it is imperative to detach the cursor drive cord and the waveband indicator cable as well as the more usual items before the chassis is withdrawn. Reassembly entails a logical reversal of the removal procedure, but the trickiest part is the reattachment of the cursor drive cord. Pointer accuracy depends upon fairly exact placement of the cord upon the drum, hopefully the part that alters the non-linearity would not have been disturbed. The drum must also be held to stop it unwinding until the cord is properly attached. I have found that it helps to treat the cord attachment lug more like a clamp, gradually pulling the cord through until it is possible to secure good calibration, then tighten the screw up. This procedure can take some time to complete accurately.

For anyone that owns the receiver, it is well worthwhile to try to obtain the service manual. If the Philips manual is not available, try for the Mullard MAS24, for this receiver has an identical chassis. Some Philips receivers were badged up as Mullard. The manual is generally very good and explicit on most points but it can be annoyingly remiss on most basic items. For instance, it gives the part reference for the dial lamps, but not the ratings, or it describes the setting up procedure for the cursor in detail, but it does not tell you how to run the cord from scratch!

Repairs

My own example of the 660A had already received some attention prior to acquisition but more work was needed to complete repairs. Some capacitors including all electrolytics had been replaced with good quality components and the cabinet and chassis were clean. The tuning drive had been restrung in nice new nylon cord but unfortunately the indications ran in reverse. The magic eye was dim to the point of extinction and some of the rubber insulated wiring was in dangerous condition.

Once the cursor was correctly set up, trials brought forth some encouraging results on short and medium wave. Half of the long wave was missing from about 1550 metres upwards, there would be an abrupt silence. Thinking that this was a classic case of a tired local oscillator, a new EK2 was tried, but this did not make a scrap of difference. Checking a little deeper, it became apparent that the local oscillator was being disabled by a standing voltage on the AVC line. This proved to be from one of the diodes in the EBL1, maybe internal leakage or an ionistaion effect being to blame. A new EBL1 put matters right with the original EK2 now able to be refitted. An unusual fault: one does not often cure a local oscillator by replacing the output valve!

A search for a replacement magic eye EM1 was originally unsuccesful because of its scarcity, but an EM4, which is a little more common was found to be a good substitute. The valves are nearly compatible. The data books say that the EM4 requires a different load resistor and also an additional resistor, both of which can be accomodated on the indicator socket. In practice, I found the existing load resistor to be near enough in value, leaving just the additional resistor to be wired across the relevant base connections. The beauty of doing it this way is it gives forward and reverse compatibility. Should the correct EM1 become available, it can just be fitted and the extra resistor ignored (this going to an unused pin on the EM1). The EM4 worked well, the shadow display being of the dual sensitivity type, it could even be considered to be an enhancement over the original.

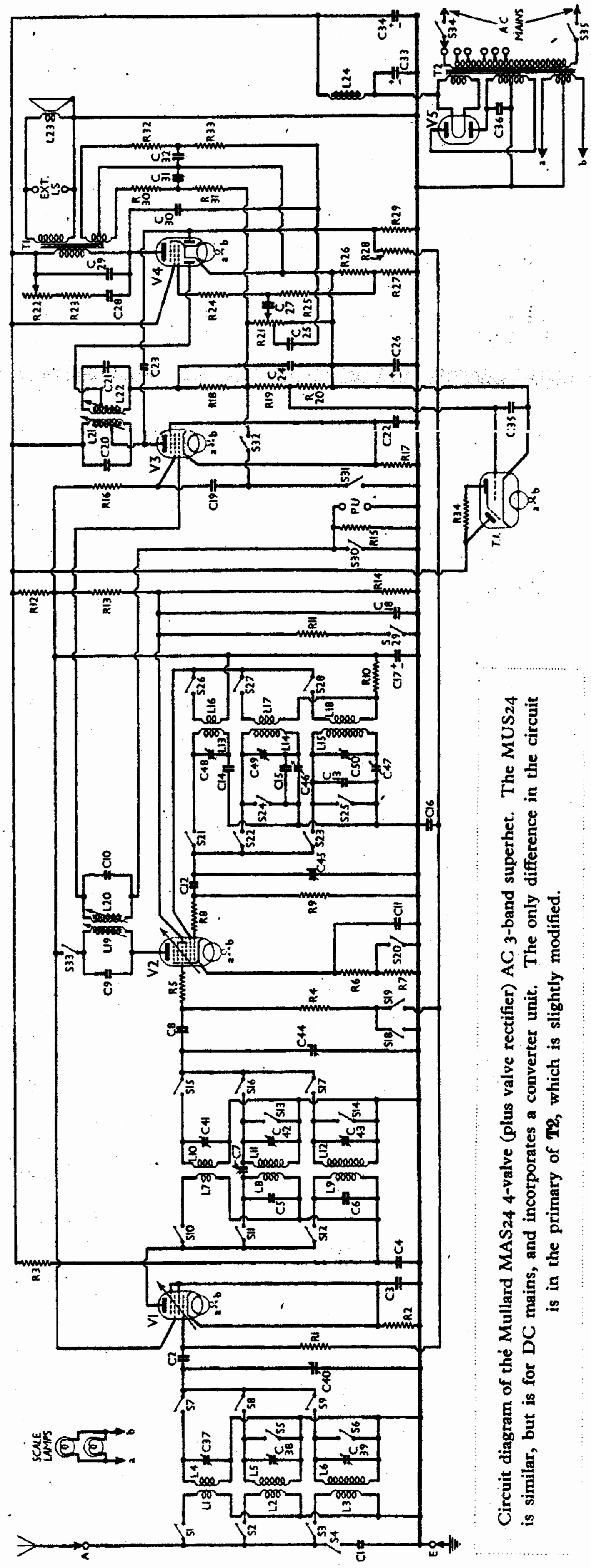
Finally, some rubber insulated wiring was replaced, in particular the rectifier anode cabling had crumbling insulation exposing the inner conductor at a point where it was drawn tightly around a metal edge!

At this point, the radio was working well even without any need to disturb the alignment. It was time to put everything back together properly and cruise the bands.

In use

The first thing that one notices when searching the ether with this set is how effortlessly it draws in weaker signals even if the aerial is not overly efficient. A two speed tuning system is used to promote accurate tuning; turning the control in the opposite direction for a short distance will result in a lower

Article continues on page 44

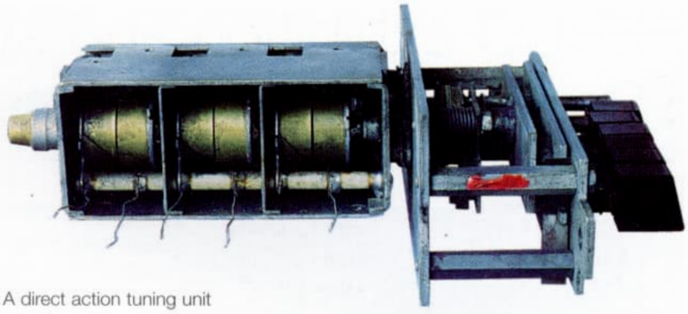


Circuit diagram of the Mullard MAS24 4-valve (plus valve rectifier) AC 3-band superhet. The MUS24 is similar, but is for DC mains, and incorporates a converter unit. The only difference in the circuit is in the primary of T2, which is slightly modified.

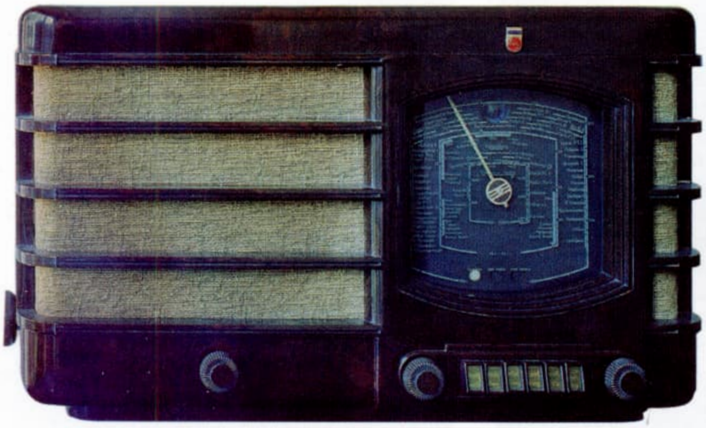
Direct Action Tuning

by Geoffrey Dixon-Nuttall (originally from the Summer 1997 issue of The Bulletin)

In 1938 there was a sudden outbreak of enthusiasm for press-button tuning. Some manufacturers were taken by surprise, and had to hurriedly add buttons to their usual chassis. Most either added a ready-made mechanical unit (usually from the States) or went in for switched coils and/or trimmers. These tended to drift.



A direct action tuning unit



Philips 680A

Philips 555A

Philips had obviously been thinking about this for some time, and when the 1938 models were launched it was seen that they had not one, but two separate systems. One was a clever, and completely original, motor tuning system, which worked very well, but the other was even more unusual. This was christened 'Direct Tuning', and is what we are concerned with.

One of the problems with press-buttons is that they move in a straight line, whereas the tuning capacitor rotates. The obvious answer, they thought, was to make a tuning capacitor that slid.

What they designed is a most amazing device. It consists of a cylindrical coil of brass shim which moves inside another one. The clever thing is the tiny clearances that they achieved; I have never dared to measure them, but it looks like a very few thou. To maintain this in production was quite a feat, and I would like to know how they managed it.

The whole affair is about 30mm in diameter, and the movement is 10mm. In this they managed to get a change of 480 pf, which is very reasonable. An incidental advantage of this construction is that the microphony is very low, as the capacitor is very small and very rigid. In practice the capacitors are three-gang.

This makes the actual mechanism very simple, and the manual tuning arrangements are also quite easy; you just arrange for a screw to push the thing along. There are, however, one or two snags.

The first one is that the capacitor has a straight line capacity law, so that the stations tend to crowd into the high frequency end of the dial. This entails using a non linear dial drive, which is arranged by having a cord pull against a spring-loaded drum, which is offcentre. This means that the press buttons cannot move the pointer round, as it would get left behind and the cord would derail; so the pointer is used on the manual tuning position only. Another snag occurs when changing from manual to buttons, as the cord is still wound, and there is no way of returning the capacitor to zero.

This means that when it is desired to use preset tuning the pointer has to be wound back to the high frequency end of the dial before pressing buttons. Not very user-friendly! To get from press-buttons to manual, the tuning knob is pulled out; this lifts the latch bar and allows all the buttons to return.

Two chassis used this system, the 660 and the 555. The latter was the cheaper one, and the 660 had two rows of buttons and an epicyclic drive on the manual tuning. The buttons on the 555 are too close together for people with thick fingers.

From the customer's point of view, it was all very confusing. Setting the buttons was tricky, as you didn't know where you were on the dial. You had to make sure that the pointer was returned to zero before pressing a button, and you had to select the right waveband. In fact it all worked very well, but you had to know the rules! Setting the buttons, by the way, was accomplished by means of a special key which set the screw inside the buttons. This key is always missing from these sets, in fact I have yet to see one!

Philips obviously took all these objections to heart, and the next range of sets, which came out for the 1939 Show, was much more civilised. What they did was to change the press buttons to piano type keys. These turned a shaft which moved the pointer by means of a crafty arrangement of bell cranks, so that it would work at sufficient speed. This shaft also carried a crank, which pushed the tuning capacitor into position. It was also arranged that this shaft could move the bandswitch if desired. Further, the tuning capacitor foils were tapered, so that the dial drive could be linear.

It will be noticed that they had now gone back to a rotating shaft, so that the whole point of the clever tuning capacitor had been lost! A normal capacitor would, however, have required a much larger movement of the shaft. Surprisingly, the mechanism had no trouble with locating the capacitor with suffficient accuracy, and these systems still work reliably. Even the capacitors never seem to give trouble which considering that they are not dust-proofed, is amazing. This type of mechanism is set by a different type of tool, for which they provided a little hole in the back of the cabinet. They still get lost, though! There is also a provision for setting the first three keys to either medium or long waves by the same tool. Changing from keys to manual is accomplished by pressing in the tuning knob, which releases all buttons except the waveband selectors. Pressing any key will release this.

Apart from the expense of assembling the mechanism, this system seems to be ideal, and one wonders if it would have been used again in the next year's models. Unfortunately, more serious matters intervened, and by the time things were back to normal costs had increased to the point when radios had to lose all their frills to show a profit. So all that clever engineering was never used again.

Apart from the tuning mechanism, these sets were well ahead of their time; if you imagine the buttons in cream instead of brown the styling is very like any of those German sets of the fifties. Except that they got all vulgar and overdid the brass trim!

EKCO exhibition and symposium at Southend Central Museum and Library

8 October 2011 to 28 January 2012, symposium on 29 October 2011

A timely email from Ken Crowe of the Southend Central Museum alerted me to this upcoming exhibition and after a brief phone call I (plus camera) visited the Museum's impresssive collection of EKCO related material.

Kind thanks are extended to the museum for allowing me to take photographs of original promotional and photographic material as well as the sets themselves. The following text was kindly supplied by Ken Crowe.

Carl Glover, August 2011.

Designed for Living: Ekco 1922 – 1970
This exhibition explores the importance of design to the success of EKCO, from the 1930's to the 1960's. A combination of cutting–edge design, the use of new materials, quality control and the innovative relationship that EKCO built up with its dealers, ensured that EKCO was one of the great success stories of the midddle decades of the 20th Century.

Case 1
Case 1 in the exhibition will explore the early history of EKCO, from the beginnings in 1922 to the building of the new factory in Priory Crescent in 1930. In 1922, the year that the British Broadcasting Corporation was founded, Eric Cole started up a small business to manufacture 2–valve wireless sets (making 6 a week) and tackled the problem of the short battery life. He developed the Battery Eliminator, which meant that sets could be operated from mains electricity. He was joined in this venture by a customer of his, William Verrells, who supplied the much–needed cash. EK Cole Ltd was formed in 1926.

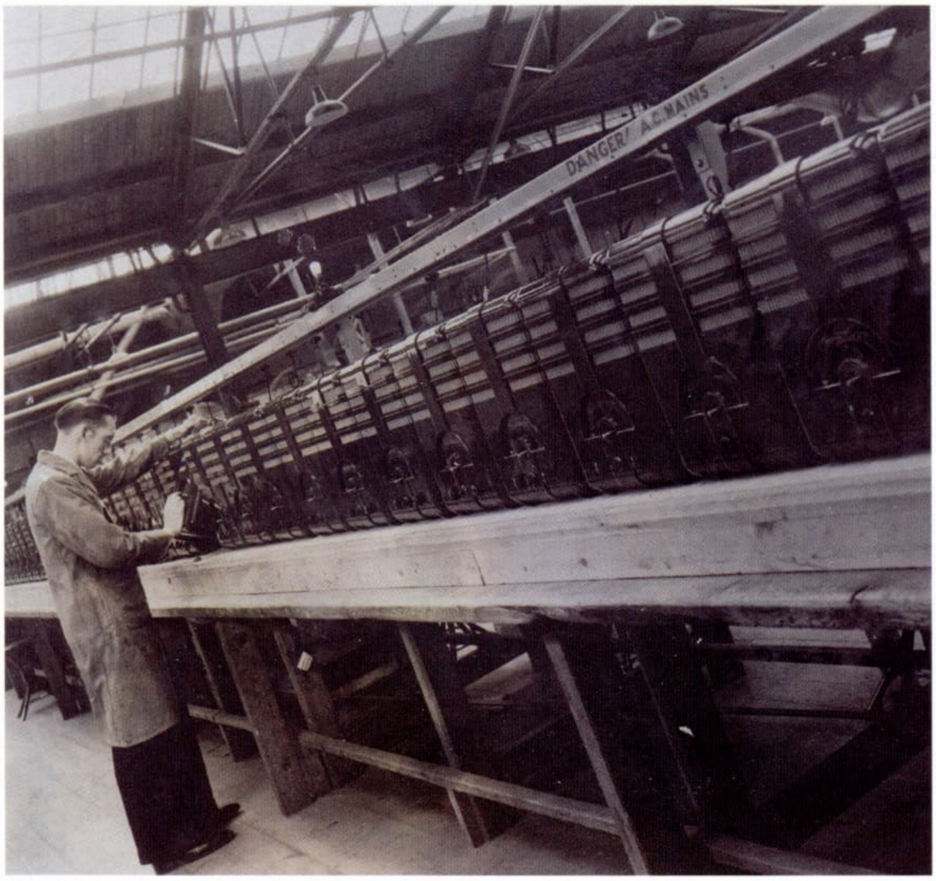
From a spare room in the family home, Cole then rented rooms over a sweet shop in London Road, Leigh. By the end of the decade, with about 100 employees, the works were spread over several different sites all over the borough. In 1930, with orders increasing following the Radio Exhibition at Olympia, a new factory, the EKCO Works, was built in Priory Crescent, Prittlewell, in the northern part of the town.

Case 2
EKCO recruited John Wyborn (from Marconiphone) as Chief Engineer, and Michael Lipman as Production Engineer. They also introduced Bakelite for radio cabinets. Lipman, who had worked for AEG in Germany, was responsible for introducing Bakelite to Ekco. Initially the radio cabinets were made for Ekco by AEG in Germany, to EKCO's own designs.

In 1931 swingeing import duties were imposed on industrial products which could have proved disastrous for EKCO. However, they decided to build their own plastics plant in which they installed huge bakelite moulding presses. In early 1932, however, a fire at the

Below: part of Southend Central Museum's Ekco collection which is currently in storage.

Another shelf of Southend Central Museum's collection

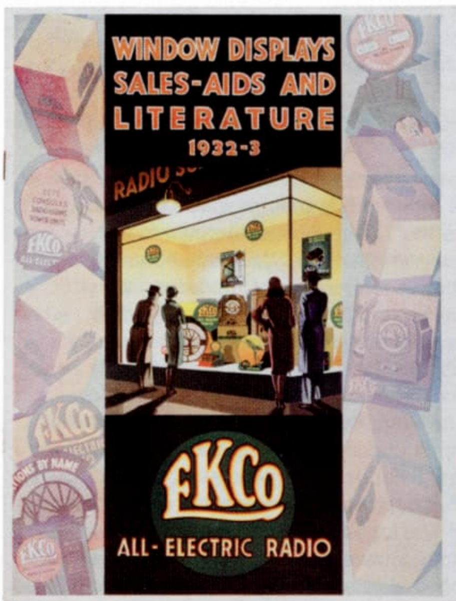


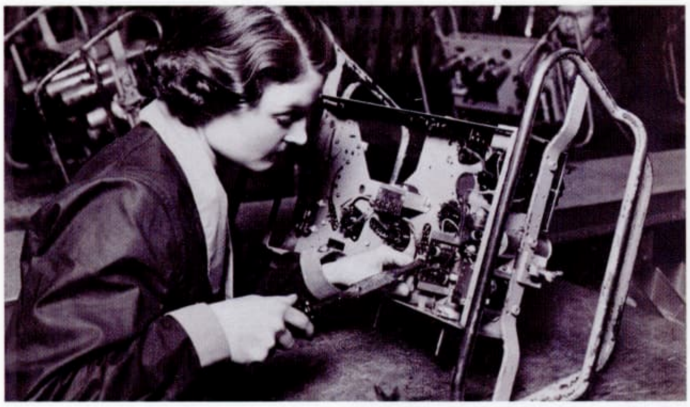
factory destroyed the designs for the 1932/3 season, which could have brought an end to EKCO. The models produced in 1932 were built in the same cabinets as those of the previous season (Jake White's design), which proved disastrous for the firm.

However, the company survived (both Verrells and Cole mortgaged their houses), John Wyborn brought in the famous architects and designers, Serge Chermeyeff and Wells Coates to design new radio cabinets, exploiting the potential of Bakelite; the modernist movement came to EKCO. Other Modernist designers who worked with Ekco included Misha Black and Jesse Collins.

Case 3

Following the Second World War, (during which EKCO's production was turned over to war work, including the development of radar and production of plastic practice bombs) EKCO's production of plastic products increased enormously. In 1947 injection moulding presses were introduced





Prototype cabinet for testing fit of Ekco AC85 chassis.

into the enlarged Plastics Department, and industrial contract mouldings for other companies (eg car interiors, fridge liners, camera bodies, and telephone bodies) became a major part of the work of EKCO. In 1956 EKCO Plastics Ltd. was formed as a wholly owned subsidiary company.

Martyn Rowlands began his working career for Bakelite Ltd., but then joined EKCO Plastics, to develop a new range of proprietary plastic products, including the 'Supabath' which won Design of the Year award in 1958. The gold seal range he designed also included food warmers, a pedal bin, a dust pan, a watering can, and other kitchen, bathroom and nursery items.

In April 1960 David Harman Powell was appointed as chief designer for EKCO Plastics. Having responsibility for product innovation, he designed most of EKCO's consumer products of this period, including kitchen storage containers, bathroom accessories, nursery equipment and the Nova range of tableware. In 1968 Nova Ware was awarded the Duke of Edinburgh's prize for Elegant Design because 'they felt it represented a really successful solution to the many design and manufacturing problems associated with the development of plastic materials for this purpose.'

Case 4

Quality control, innovative design and advertising all combined to ensure the success of EKCO products. They led the way in their innovative and direct relationships with their dealers, in which EKCO suggested shop window display, provided signage and promotional literature.

As with all the major radio companies, advertising had to be as well designed as the products. In 1932 a wireless journal stated 'EK Cole occupy a leading position in what has rapidly become a most important industry. They have gained that position by producing sound, efficient goods at reasonable prices, by maintaining a clear-cut trading policy and by keeping faith with their dealers.

By 1955 there were seven subsidiary companies and seven associate companies, from New Zealand to Ireland. EKCO distributors for Ekco Plastics and radio were based all over the globe: Europe, Africa, Australasia, and America.

An EKCO Symposium
29 October 2011
To be held at Southend Central Library (adjacent to Southend Central Museum), a day devoted to exploring the themes of EKCO and design

Speakers are:
Dr. Tom Going (early history of EKCO)
Chris Poole (EKCO at War)
Steve Akhurst (Martyn Rowlands and EKCO)
David Harman Powell (EKCO and Plastics design in the 1960s)
Dr. Elizabeth Harding (Wells Coates)
Susan Lambert (Plastics at MoDIP)

Guided tours of the exhibition

Admission by ticket only (£10 adults, £5 students/Concessions). For more information please contact Ken Crowe on 01702 434449, kencrowe@southend.gov.uk.
www.southendmuseums.co.uk

Letter

Dear Editor

As an occasional cinemagoer I am one of those who remain to the end of each film to view the credits. Following a list of strange sounding job titles, unique, it seems to the mysterious world of film production one often spots interesting little snippets like the locations used. All this takes place while the audience are putting on coats and perhaps anxiously checking mobile devices from which they can hardly bear to be parted for just two hours.

At a viewing of the Oscar nominated film 'The King's Speech' cleaners were hovering in the aisles as I remained to the bitter end. My endeavours were rewarded by spotting credits to our British Vintage Wireless and Television Museum. I later spoke with Gerry Wells and he did indeed confirm that props had been loaned for the production where they formed a significant part of the content. It's good to see the museum being recognised in such a prestigious production and members might take delight in some of the sets so prominently featured.

Kind regards,
Ken Brooks

The Philips 660A continued from page 34

geared tuning, a most useful feature. One is aware of the pointer speed increasing as the tuning is brought down to the low wavelength end of the scale – remember that eccentrically mounted drum which compensates for the tuning capacitor law. To activate the keyboard tuning, to use Philips' parlance, one must firstly tune manually down to the extreme low wavelength end of the dial. This is to fully open the capacitor, if this is not done then it will not be possible to select any stations that happen to be downwind of the pointer.

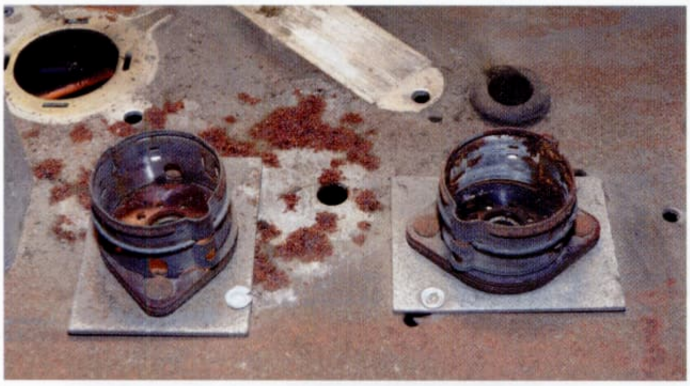
The long term stability of the preset adjustments remains excellent; I have not needed to retune any so far after about fourteen years. This says something for the quality of the receiver which is already a septuagenerian. Return to normal manual tuning is accomplished by pulling out the tuning knob to release any latched in buttons.

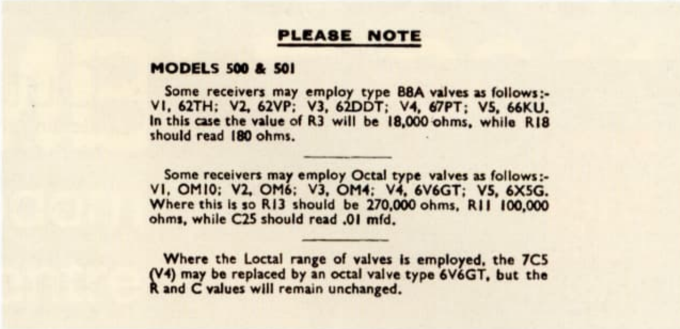
Tonally, the Philips is in its own league. The full range of frequencies broadcast are reproduced very well from a thumping bass to high and clear treble. There is no severe sideband cutting yet the selectivity is good so the passband response must clearly approach the ideal. Given that there is only a single stage of audio amplification, it does not perceptibly change when adjusting the volume control although when listening to a powerful local at moderate volume one is aware of the fullness and purity of tone. The tone control, which is of the normal top-cut type provides for a wide range. The dial illumination, which is very adequate makes an attractive visual feature.

Conclusion

It is a pleasure to use this receiver, a good all rounder with its superb tone and lively performance. Then there is all of the clever engineering for added interest. In fact, one could truly apply one of Philips' old advertising phrases to this radio: Simply years ahead!

Some Observations on a Cossor Melody Maker 501AC Chassis by Stef Niewiadomski





PLEASE NOTE

MODELS 500 & 501

Some receivers may employ type B8A valves as follows:- V1, 62TH; V2, 62VP; V3, 62DDT; V4, 67PT; V5, 66KU. In this case the value of R3 will be 18,000 ohms, while R18 should read 180 ohms.

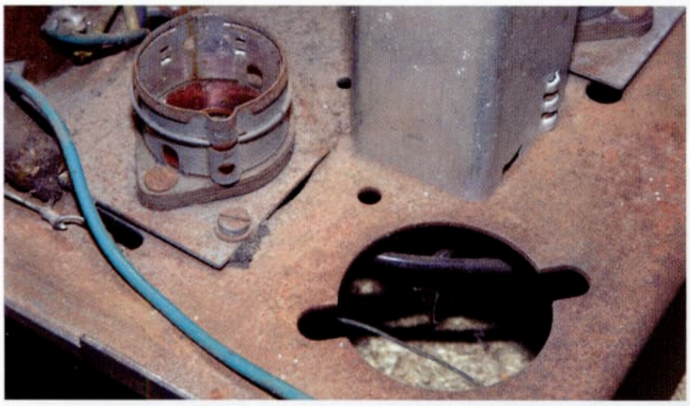
Some receivers may employ Octal type valves as follows:- V1, OM10; V2, OM6; V3, OM4; V4, 6V6GT; V5, 6X5G. Where this is so R13 should be 270,000 ohms, R11 100,000 ohms, while C25 should read .01 mfd.

Where the Loctal range of valves is employed, the 7C5 (V4) may be replaced by an octal valve type 6V6GT, but the R and C values will remain unchanged.

Figure 1 (above): B8A sockets for V3 (62DDT double-diode-triode detector valve) and V4 (67PT audio output valve), showing the mounting plates riveted over bigger mounting holes.

Figure 2 (top right) : 'Please Note' section of the manufacturer's service sheet pointing out to the service engineer the valve possibilities that could be found in the set, and the corresponding changes needed to some component values.

Figure 3 (below): The B8A socket for the 62TH triode-hexode frequency changer valve mounted on a plate over a bigger hole. You can also see another (unused) octal socket-sized hole alongside.



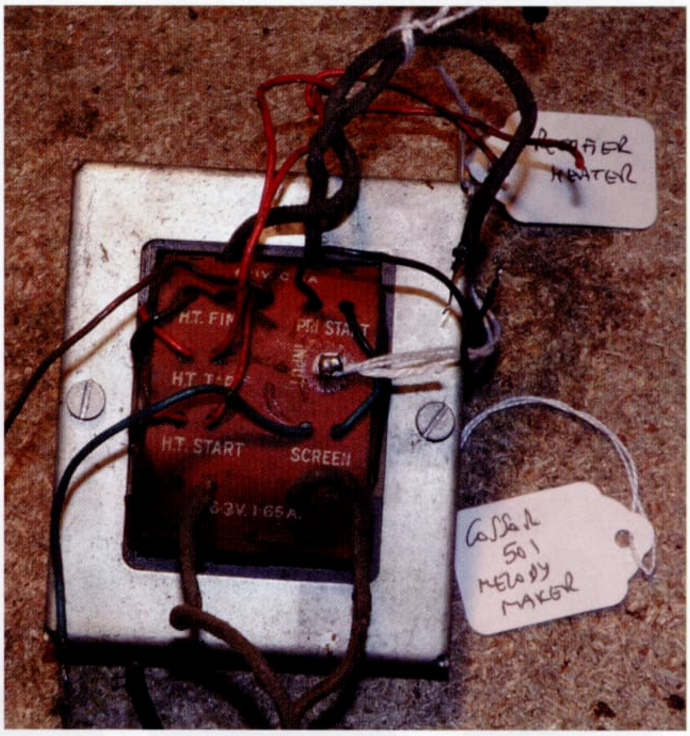


Figure 4 (right): The recovered mains transformer with 250V-0-250V HT winding and 6.3V at 0.6A (for the rectifier valve) and 6.3V at 1.65A for the remaining valves.

I picked up a knocked-about Cossor 'Melody Maker' 501AC radio recently with the intention of rescuing the mains and audio output transformers from the rather rusty chassis and probably binning the rest. When I removed the chassis from the case and started looking for salvageable components I noticed that all the valve holders were mounted on small rectangular plates which were riveted over larger circular holes. You see this occasionally in radios that have been repaired sometime in the past when a particular replacement valve couldn't be found, but I thought it was quite interesting that all the valves were mounted on these plates, and decided to investigate why this should be so.

An Unremarkable Superhet

Looking up the 501AC in the UK Vintage Radio Service Data DVD-ROM the set is an unremarkable five valve, three waveband table superhet, released in June 1950. The 501AC comes in a 'moulded' case whereas the electrically identical 500 is housed in a wooden cabinet, for which you paid about £2 extra. There was also a 501U AC/DC set (using an OM10, OM6, OM4, 332PEN and OM1 line-up in a 200mA series-fed heater chain) incorporating a mains dropper instead of the mains transformer of course, and only available in the moulded case.

According to BRTR Service Sheet R95, the 501AC (and the 500 model) could be fitted with any one of three sets of valves, specifically:

B8B loctal: 7S7, 7B7, 7C6, 7C5 and 7Y4 (the 7C5 could be replaced by an octal 6V6GT in some models)
B8A: 62TH, 62VP, 62DDT, 67PT and 66KU
Octal: OM10, OM6, OM4, 6V6GT and 6X5G

My set was fitted with a B8A set of valves (62TH, etc), hence the need for the socket mounting plates over the bigger octal holes. Imagine the anticipation of a service engineer opening up a faulty 501AC (or one of the other sets in the range) and wondering what set of valves he was going to find. I wonder if the Cossor collectors among you try to acquire models with all four combinations of valve line-ups. Does anyone know how common each variant of the radio is?

The Chassis Design

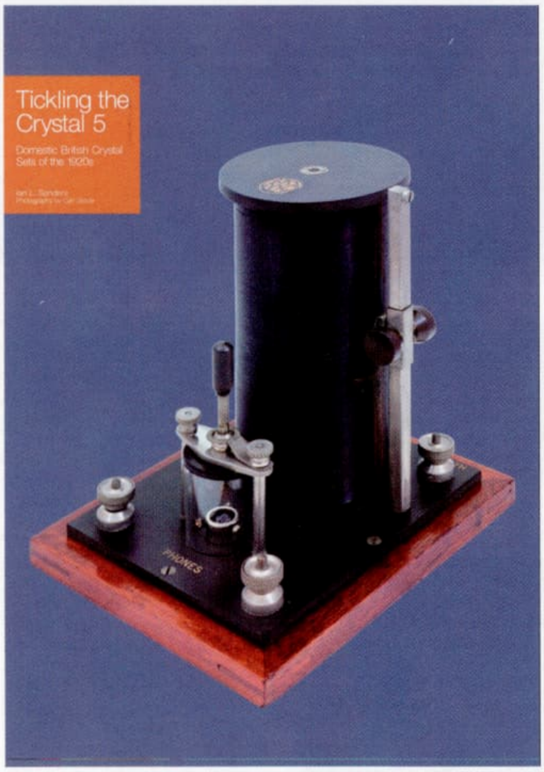
I presume that the chassis had been designed originally for octal valves, but at some stage it was realised that there was merit in having the option of fitting B8A or B8B valves, without re-tooling for a new chassis. Maybe in 1949/1950 supplies of valves were still uncertain and so it was safer to be able to accommodate the three types. Or maybe Cossor's radio buying department found they could get lower prices for B8A or B8B valves from Cossor's valve selling department (or other sources), if indeed this was the way the company operated.

The 501AC chassis looks very similar to the earlier 494 (released in July 1949), except that the 494 looks like it was designed solely for B8B loctal valves in that it didn't have the bigger holes needed to fit octal valves. I presume then that this chassis was modified between the 494 and the 501 models to accommodate octal valves. This seems strange in 1950, by which time you would have thought octal valves were 'yesterday's technology'.

The Rescued Mains Transformer

And by the way I removed the mains transformer and it tested good on an insulation tester, so whatever caused all the rust on the chassis has dried out by now. See the photo for a view of this very useful transformer.

BVWS Books



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BVWS Books

Sunday 9th October 2011 10.30AM - 4.30PM

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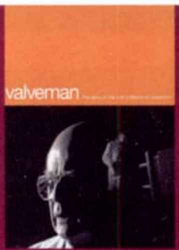

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The Bulletin Back issues

Earlier Bulletins and supplements are priced at £2:00 each + postage. Bulletins from volume 21 onwards are priced at £2.50 each. + postage. Postage: for individual Bulletins add 50p, for 2-5 bulletins add £1, for 6 or more add an extra 20p each. Cheques to be made payable to 'British Vintage Wireless Society'.

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EKCO EXHIBITION

at SOUTHEND CENTRAL MUSEUM 8 October 2011 to 28 January 2012

An exhibition exploring the central role that design played in the success of the Southend-based firm of EKCO, one of the country's leading radio, television and plastic manufacturers from the 1920s to the 1970s.

The EKCO Story An introduction to the firm founded by E.K. Cole against the background of early wireless and the BBC.

Radio design in the 1930s The first Bakelite radios and the Modernist Movement. Radio designs by J.K. White, Serge Chermayeff, Wells Coates, Jessie Collins, Misha Black.

Plastics for the Home: the 1950s and 1960s The formation of EKCO Plastics. The work of the designers Martyn Rowlands, David Harman Powell and others.

The Promotion of EKCO Advertising was as carefully designed as the products being manufactured. This area will examine the design of EKCO advertising and the relationship that EKCO built up with its dealers.

An EKCO Symposium 29 October 2011

To be held at Southend Central Library (adjacent to Southend Central Museum), a day devoted to exploring the themes of EKCO and design

Speakers are: Dr. Tom Going (early history of EKCO), Chris Poole (EKCO at War), Steve Akhurst (Martyn Rowlands and EKCO), David Harman Powell (EKCO and Plastics design in the 1960s) , Dr. Elizabeth Harding (Wells Coates), Susan Lambert (Plastics at MoDIP)

Guided tours of the exhibition

Admission by ticket only (£10 adults, £5 students/Concessions). For more information please contact Ken Crowe on 01702 434449, kencrowe@southend.gov.uk. www.southendmuseums.co.uk

The British Vintage Wireless and Television Museum

23 Rosendale Road, West Dulwich, London SE21 8DS
020 8670 3667 Registered Charity No. 1111516
www.bvwm.org.uk Please make appointments beforehand

Minutes of the Annual General Meeting of the British Vintage Wireless Society held at the Harpenden Halls on Sunday 6th March 2011 at 12.30 pm.

Present: Committee members Mike Barker (Chair), Terry Martini, Martyn Bennett, Graham Terry, Jeremy Day, John Evans, Guy Peskett, and 37 ordinary members

1. Apologies for absence: Ian Higginbottom, Paul Stenning.

2. The Chairman (Mike Barker) began his report with a tribute to honorary member Gordon Bussey who died suddenly at the beginning of this year. Gordon made major contributions to wireless heritage both inside the Society and in the wider world. In the Society he arranged for high class reprints of historic documents and provided material for special Bulletin supplements and for films for the Christmas DVDs including last year's. He also played a key role in saving the Society at the time of the emergency Committee that followed a crisis in the early 1990's. His greatest achievement outside the Society was the rescue of the Marconi collection, both hardware and documents, from dispersal at auction and its subsequent gifting intact to Oxford University by the Marconi Company. Without Gordon this would not have happened.

The Bulletin continues to be a highly respected and professionally produced publication. It has also grown in size over the years and for 2011 onwards we have negotiated with our printers a further increase in pages without an increase in price. The Chairman urged the many members actively engaged in restoration to write articles for the Bulletin.

The 2011 NVCF will take place after this AGM (following the move of the AGM from June back to March). The 2010 NVCF was reported on at the AGM last June where it was mentioned that it would be necessary to increase fees to enable the Society to continue to support projects at the Vintage Wireless and Television Museum. Last year we provided for the installation of a replacement boiler at the Museum and funding for Chris Gilbee and Ian Blackborne to carry out extensive repairs to the wall of the shed corridor.

Regional meetings remain well attended despite the difficult economic times. There will probably be extra auctions at Wooton Bassett as our store is full to bursting and there are more collections waiting to be picked up. Many thanks are due to Mark Ryding and his family for organizing a successful meeting at Golborne (moved from Lowton) where again there have been displays of working 405 line TVs by Russell Atkinson.

The Chairman thanked the committee and the membership for their continued support and singled out for particular recognition the unsung helpers at the Society's' events.
The Chairman concluded by announcing that none of the Committee members were at the end of their three year terms and were all willing to continue so that no elections were needed this year.

3. The Treasurer (Jeremy Day) reported:
The BVWS and NVCF accounts are once again healthy, with the 2010 NVCF event producing a reasonable profit. From the accumulated profits generated by the NVCF, just over £3,500 has been spent during the year on the improvements at the Museum mentioned by the Chairman.

On the printing side we have enjoyed four more pages per Bulletin for no additional cost. The Bulletin supplements and the BVWS calendar have proved very popular with the members.

The revenue derived from meetings and estate sales has held up well compared with last year. I would like to give my special thanks to Graham Terry, our membership secretary, for helping me out at subscription renewal time and whose help once again has ensured really prompt renewals again this year.

There is only one piece of bad news I have to relay to you and that is the cost of membership will need to increase to cover the cost of postage that comes into effect in May this year.
We hope that this will be the last increase for some long time into the future.
Postage is the one thing that is obviously out of our control, but that said I think even at £26.00 per year your subscription still represents truly excellent value for money.

4. The Membership Secretary (Graham Terry) reported:
As of today the paid up membership of the Society stands at 1281 of which 6 are honorary and 57 are complimentary members, 123 are still to renew. There have been 51 new members enrolled so far in 2011.

5. The Secretary (Guy Peskett) reported on the National Vintage Communications Fair.
The feedback from last years NVCF was all positive and augers well for the future. It is too early to be sure but it seems that the increases in stall and entry fees imposed to reduce the squeeze on our income from the event and enable us to continue to support the Wireless and Television Museum are not affecting bookings for this year's fair. We have also been able to make small but useful savings on the hire of tables.

6. Presentations by the Chairman
The Pat Leggatt award to Roger Grant for "Give us the tools and we will finish the job" The R1155 Receiver.
The Duncan Neale award: no award was made this year.
The Geoffrey Dixon-Nuttall award to Peter Lankshear for "The SE1420, IP501, and IP501A Marine Receivers". The meeting closed at 13.20

News and Meetings

GPO registration 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 GU13 8LB
telephone: 01252-613660 e-mail: martyb@globalnet.co.uk

2011 Meetings

September 11th Table Top Sale at The British Vintage Wireless and Television Museum
September 18th Murphy Day at Mill Green Museum
September 25th Harpenden
October 9th Audiojumble
NVCF at Alexandra Palace - CANCELLED
November 20th Golborne
November 25th Festive Music Night at The British Vintage Wireless and Television Museum
December 4th Wootton Bassett

2012 Meetings

4th March Harpenden
May 13th NVCF at Warwickshire Exhibition Centre
9th June BVWS Garden Party
10th June Harpenden
July 1st Wootton Bassett
23rd September Harpenden
2nd December Wootton Bassett

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 10:00, tickets for sale from 09:30, Auction at 13:30.
Contact Vic Williamson, 01582 593102
Audiojumble: The Angel Leisure Centre, Tonbridge, Kent.
Enquiries, 01892 540022
NVCF: National Vintage Communications Fair
See advert in Bulletin. www.nvcf.co.uk
Wootton Bassett: The Memorial Hall, Station Rd. Wootton Bassett.
Nr. Swindon (J16/M4). Doors open 10:30.
Contact Mike Barker, 01380 860787
Golborne: Golborne: Golborne Parkside Sports & Community Club.
Rivington Avenue, Golborne, Warrington. WA3 3HG
contact Mark Ryding 01942-727428
Mill Green Museum: Bush Hall Lane, Mill Green, Hatfield, AL95PD
For more details with maps to locations see the BVWS Website:
www.bvws.org.uk/events/locations.htm

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0.01µF	£20.50	0.22µF	£28.00

Only available in packs of 50 by post.
Available in smaller quantities at all BVWS events

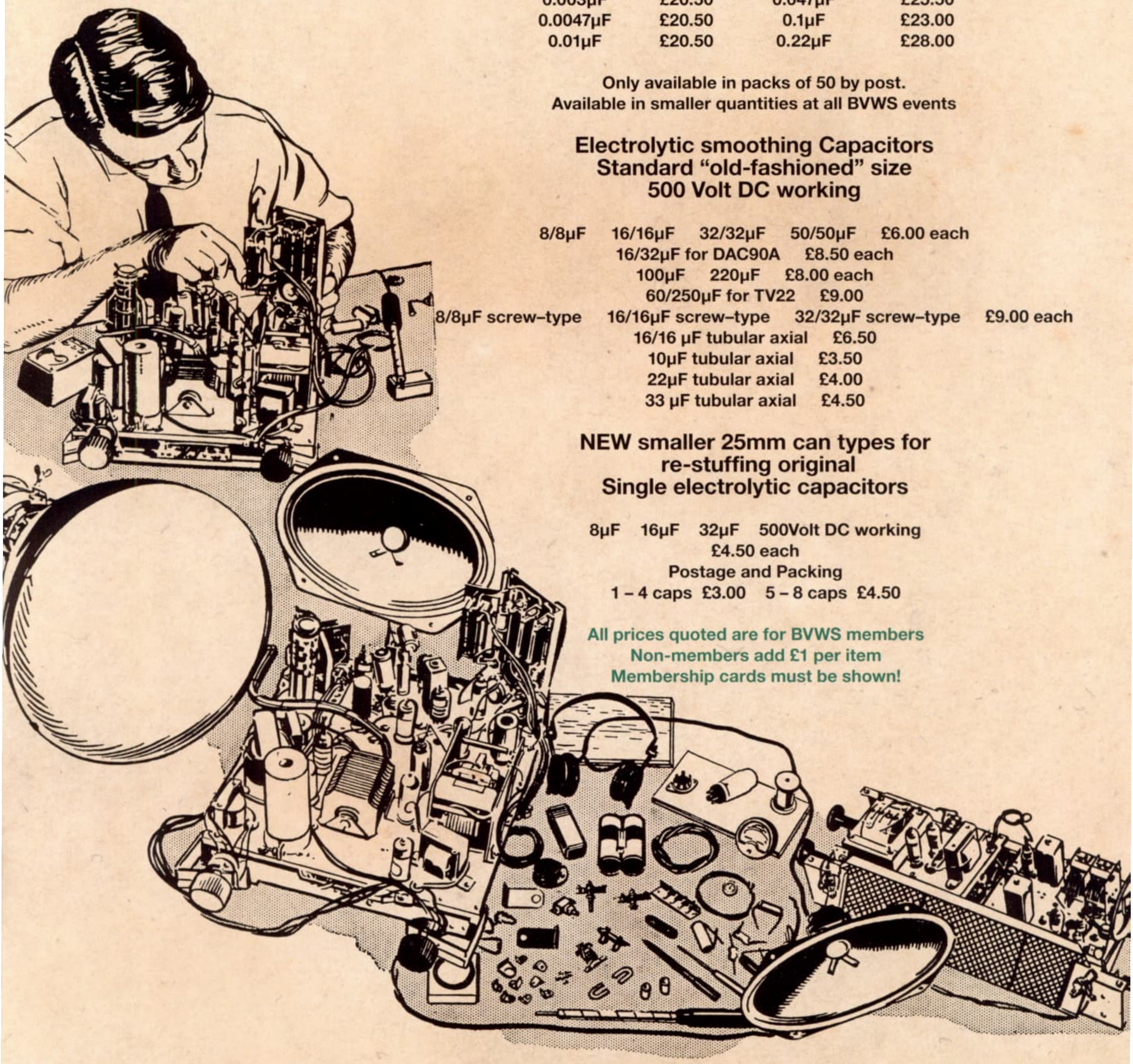
Electrolytic smoothing Capacitors
Standard "old-fashioned" size
500 Volt DC working

8/8µF 16/16µF 32/32µF 50/50µF £6.00 each
16/32µF for DAC90A £8.50 each
100µF 220µF £8.00 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 £3.50
22µF tubular axial £4.00
33 µF tubular axial £4.50

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

8µF 16µF 32µF 500Volt DC working
£4.50 each
Postage and Packing
1 – 4 caps £3.00 5 – 8 caps £4.50

All prices quoted are for BVWS members
Non-members add £1 per item
Membership cards must be shown!



For non UK addresses, please contact Graham Terry 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
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 wireless supplies


FOCUS
TELEVISION & V.H.F. AERIAL
50~ MAINS VOLTAGE
200
210
220
230
240
250
WARNING
THIS APPARATUS IS SOLD UNDER THE CONDITION THAT THE MAKERS SHALL NOT BE HELD LIABLE FOR ANY DIRECT OR CONSEQUENTIAL INJURY OR DAMAGE CAUSED TO OR BY ANY PERSON TAMPERING WITH THE INTERIOR OF THIS APPARATUS OR ANY EXPOSED METAL PART WHEN CONNECTED TO THE ELECTRICITY SUPPLY.
INPUT A.C. MAINS OR 12V.D.C. 7A.
IMPORTANT USE ONLY SPECIAL LEADS SUPPLIED
VISION INTERFERENCE LIMITER
MIN.
MAX.
SERIAL Nº
EKCOVISION
TYPE TMB.272
PORTABLE TELEVISION RECEIVER
50C/S. A.C. MAINS (90W.) OR BATTERY OPERATION
E. K. COLE LTD.
SOUTHEND-ON-SEA, ESSEX.