The Bulletin

Vol. 39 no. 3 Autumn 2014

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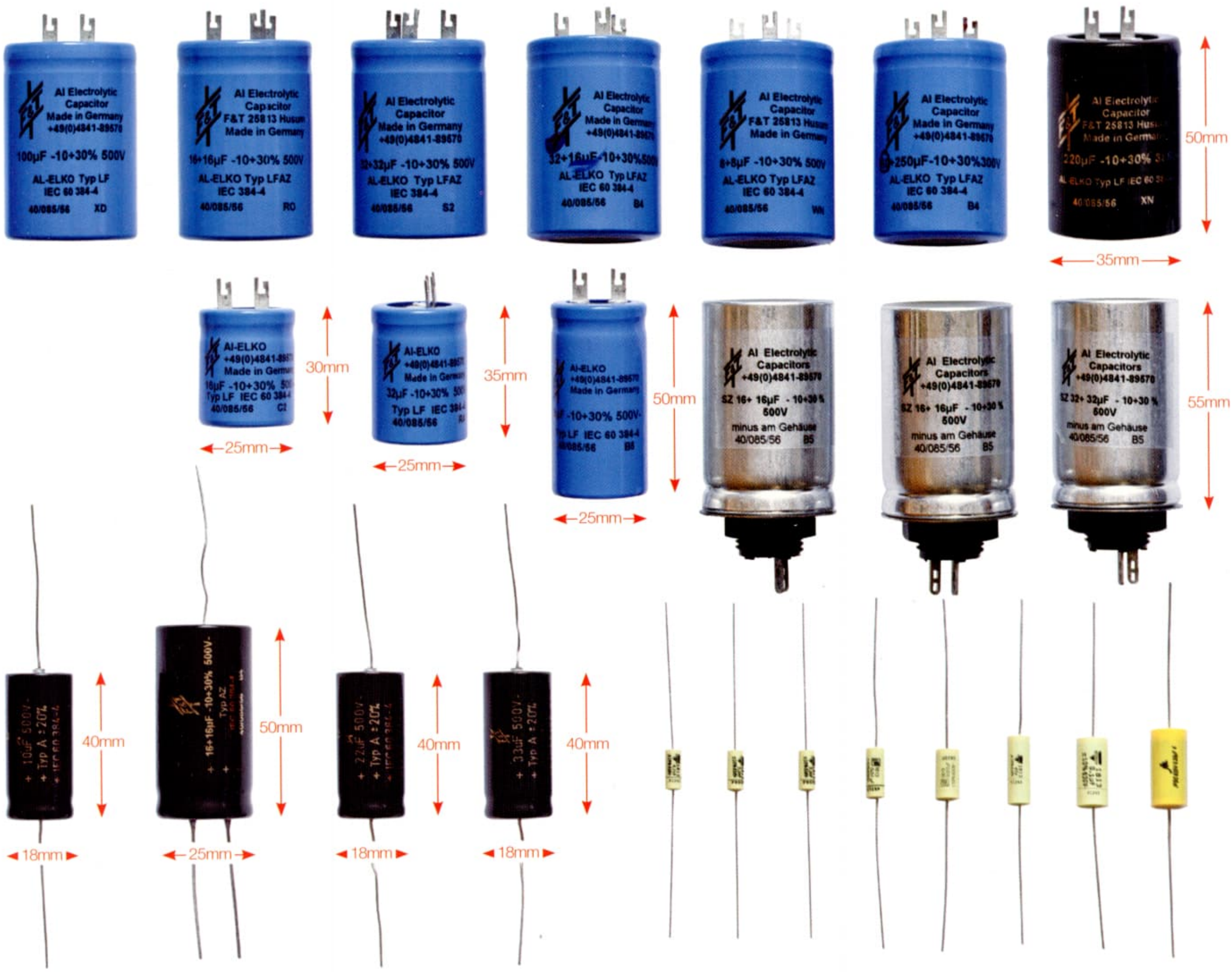

For non UK addresses, please contact Mike Barker for prices, (see below). All orders should be sent (with payment made out to BVWS) to: Mike Barker, Pound Cottage, Coate, Devizes, Wiltshire, SN10 3LG. Cheques payable to British Vintage Wireless Society. Please allow 14 days for processing, but usually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

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Contents

From the Chair

Autumn is knocking on the door. The nights are drawing in and now is the time to sort out the workshop bench ready for winter projects. There will be plenty of new treasures to acquire at Harpenden, the Audiojumble, Golborne and Royal Wootton Bassett as the BVWS store is bursting at the seams with stock and still more to arrange to collect before RWB, so stock up on all the essential components, turn on the workshop heaters and blow the cobwebs from the soldering iron. There will be lots to do.

This will be the second Bulletin sent out using the new method of direct mailing from the printers and I am happy to say that only one out of more than 1300 items was reported to have been damaged in the post. This however was not the plastic damaged, but the Bulletin being badly creased. Many members have commented on how well it has worked and they will not receive a soggy Bulletin in wet weather as before. It has also worked out well financially and providing the door takings at Harpenden and the auction commission on the day is up to a good standard, we should be able to afford the Christmas DVD. We certainly have the material to make it. The final decision will be made at the next Committee meeting on the advice of the Treasurer.

2015 Dates

With events in mind, I would ask that you take a look at the diary page at the back of the Bulletin as it lists all of the BVWS 2015 dates so everyone is given the best possible chances at planning for next year. These dates and maybe some others will also appear on your 2015 BVWS Calendar which will arrive with your Winter Bulletin.

Harpenden

After careful consideration of the attendance numbers and the total costs of the Summer Harpenden event, the Committee has decided that this particular meeting is no longer viable. Even though we have given our best efforts to making this event worthwhile, it is an unreasonable amount of work for the poor attendance both by stallholders and members. It really is a case of 'use it or lose it', this being the result. Therefore there will no longer be a Summer Harpenden event.

Both the Spring and Autumn Harpenden meetings are well supported and remain busy with more than 130 visitors each time and a hall filled with stalls. The unfortunate effect of this is the loss of funds raised by the Bring & Buy stall for the Museum and we lose an auction. However with the ever increasing amount of items that we are accepting for auction, we will have no choice but to put on other events that are specifically just an auction to cope with demand. These events may be arranged at relatively short notice and will have to fall in line with availability of venues but we will make every effort to ensure you are informed and they do not clash with other related events.

New Punnetts Town meeting

The first Punnetts Town meeting back in August was an excellent meeting arranged by John and Brenda Howes and family. The day started with poorer weather than was hoped for, but this certainly did not put off both stallholders and visitors. The event was so busy at times it was difficult to move around our tables. We took a good number of things to sell on the BVWS table and thankfully managed to bring back much less than we had taken.
A date for next year's event will be found on the diary page.
I would like to extend my thanks to John and Brenda for their hospitality and making the event most enjoyable. Thank you.

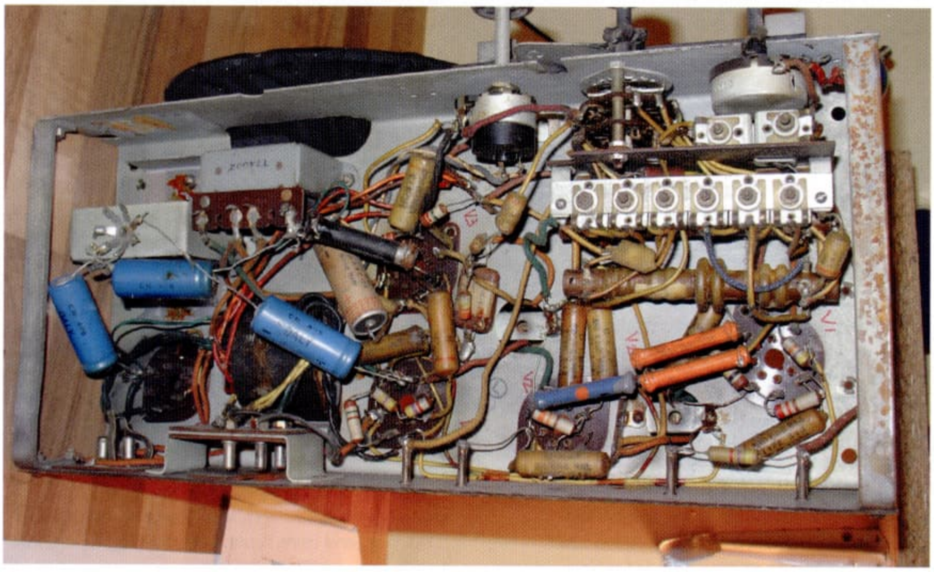
Mike...

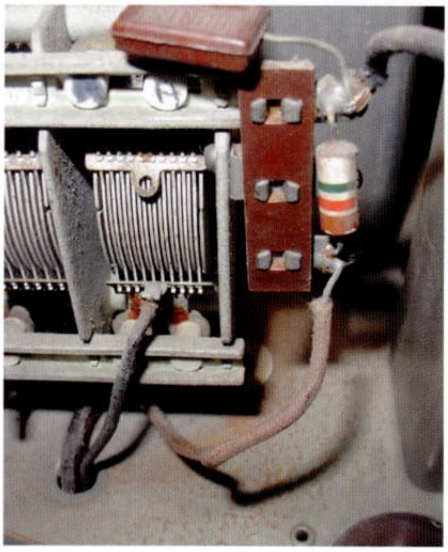
Below: David Taylor receiving his Geoffrey Dixon-Nuttall Award from Mike Barker for his article 'Designing and using a universal router jig for making replica radio backs' at the NVCF

A Radio Rentals impulse buy at Wootton Bassett

by Ian Liston-Smith

Having thoroughly rummaged around on the stage through the auction lots, I was relieved to find nothing I wanted to bid on in the December 2013 Wootton Bassett auction, so I was preparing to just sit back and ride out Mike Barker's impressive performance as auctioneer.





Mike is very good at finding something positive to say about most items, and lot 121 was no exception. He described it as something like "a classic little set made for Radio Rentals, comes apart by removing just two screws for easy maintenance, trouble was they never went wrong! A lovely cabinet made from thick bakelite. Do I have £10?"

I was sharing a stall with my old friend Paul who leant over and whispered: "Go on then! That's a great set!" And as if hypnotised, I found myself waving our bidding number and the damn thing was mine for £20!

When I collected it from the stage, I must admit my heart sank. I thought to myself: "Whatever did I buy this for?"

A closer look

A few days later I took a closer look. Yes, it had a decent bakelite case. The dial was a little grubby, but more importantly the lettering wasn't flaking or faded and looked cleanable with care. All the knobs were in good condition. And indeed, removing just two screws from the back released the entire chassis from the cabinet as the wave-change switch, tone and volume knobs passed though oversized holes in the front of the cabinet.

But what Radio Rentals model was it? I posted a picture of it on the vintage-radio.net and "mickjjo" replied saying it was a Radio Rentals model 58. This was confirmed by a bit of Googling which also suggested that it was probably built by EK Cole for Radio Rentals around 1948/49. I later noticed clear "58" printed in red on the dial which I'd earlier overlooked.

It had had some previous work done. The original cardboard electrolytic smoothing capacitors had all been replaced, but very clumsily with some of the worse soldering I've ever seen; the joints just pulled apart.

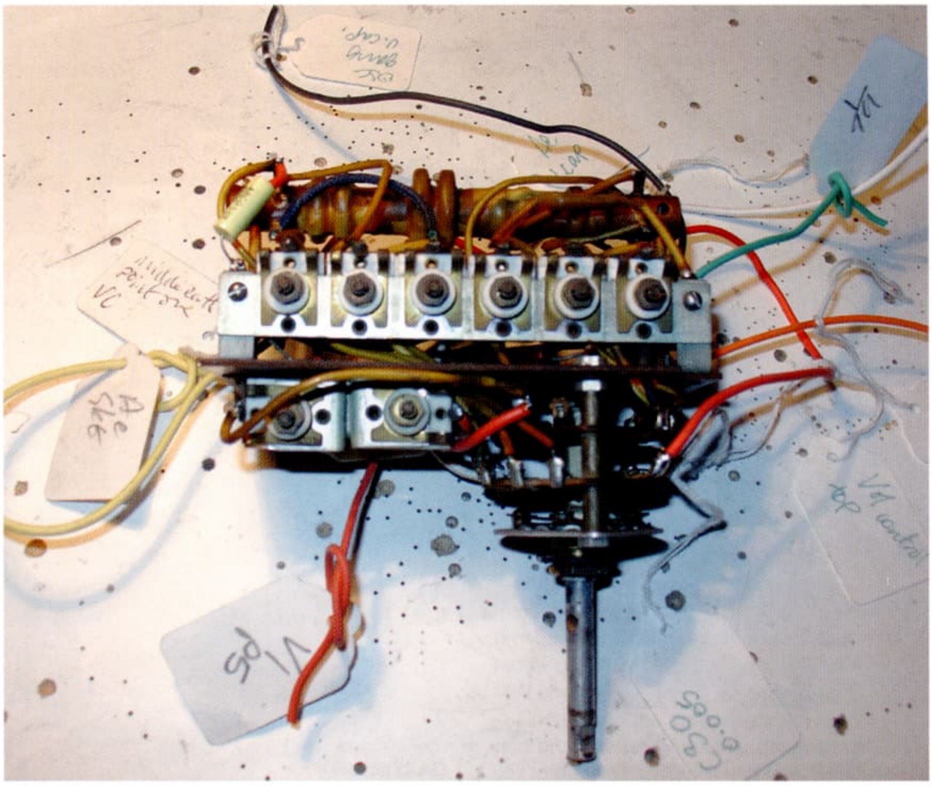
The back was made of what appeared to be thick paxolin, and riveted to the chassis. No chance whatever of any untidy maintenance workshops losing it! In fact the riveting theme extended to almost all chassis parts that you'd normally expect to be screwed together with a nut and bolt. This meant that the relatively few nut-and-bolt earthing points attracted long meandering wires from heaters, dial bulbs, smoothing capacitors and cathode components. A possible recipe for hum and instability...?

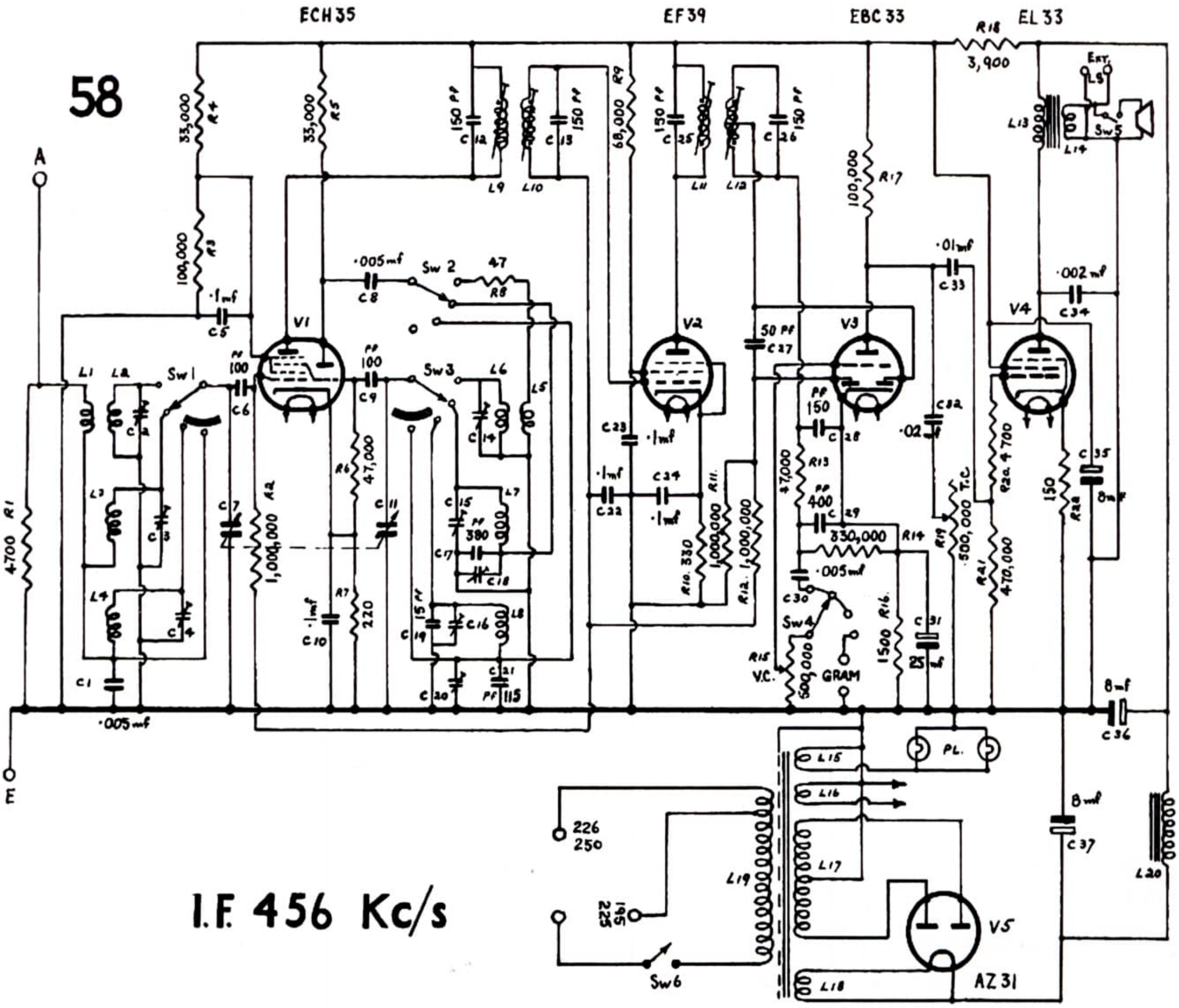
Basic checks

After completing a few basic resistance checks everything seemed more or less ok, so I decided to apply full mains and stand back...

Bulbs on, slight hum from speaker, loud hum and crackling when turning the volume control. A finger tentatively applied to the gram input produced a healthy hum, and a bit of audio tone from an AF signal generator also applied to the gram input produced a reasonable note from the loudspeaker. The audio circuits appeared to have nothing major wrong with them. However, the set received no signals on any band. Voltage checks revealed zero volts on V1 screen grid. I expected R4 to be open circuit, but C5 had gone short circuit, but the rating of R4 meant it had survived apparently unscathed.

Overall, I could have decided to just patch up this rather unexceptional set. But after some pondering I decided to do a complete strip down and rebuild, particularly as cosmetically it could be made





to look like new. I had no major projects on and thought it would be er… "fun".

I paid for and downloaded a copy of the original Radio Rentals service sheets from Paul Stenning's site (www.service-data.com). They weren't as in depth as those published by say Bush or Murphy, but were quite adequate.

Grub screw

Removal of the glass dial required the removal of the tuning knob, but this task revealed the first hurdle; the tuning-knob grub screw was split at the slot. Careful drilling with a 1mm drill bit loosened it, but unfortunately the grub screw lay in a groove in the tuning shaft, making knob removal much harder and more frustrating than expected.

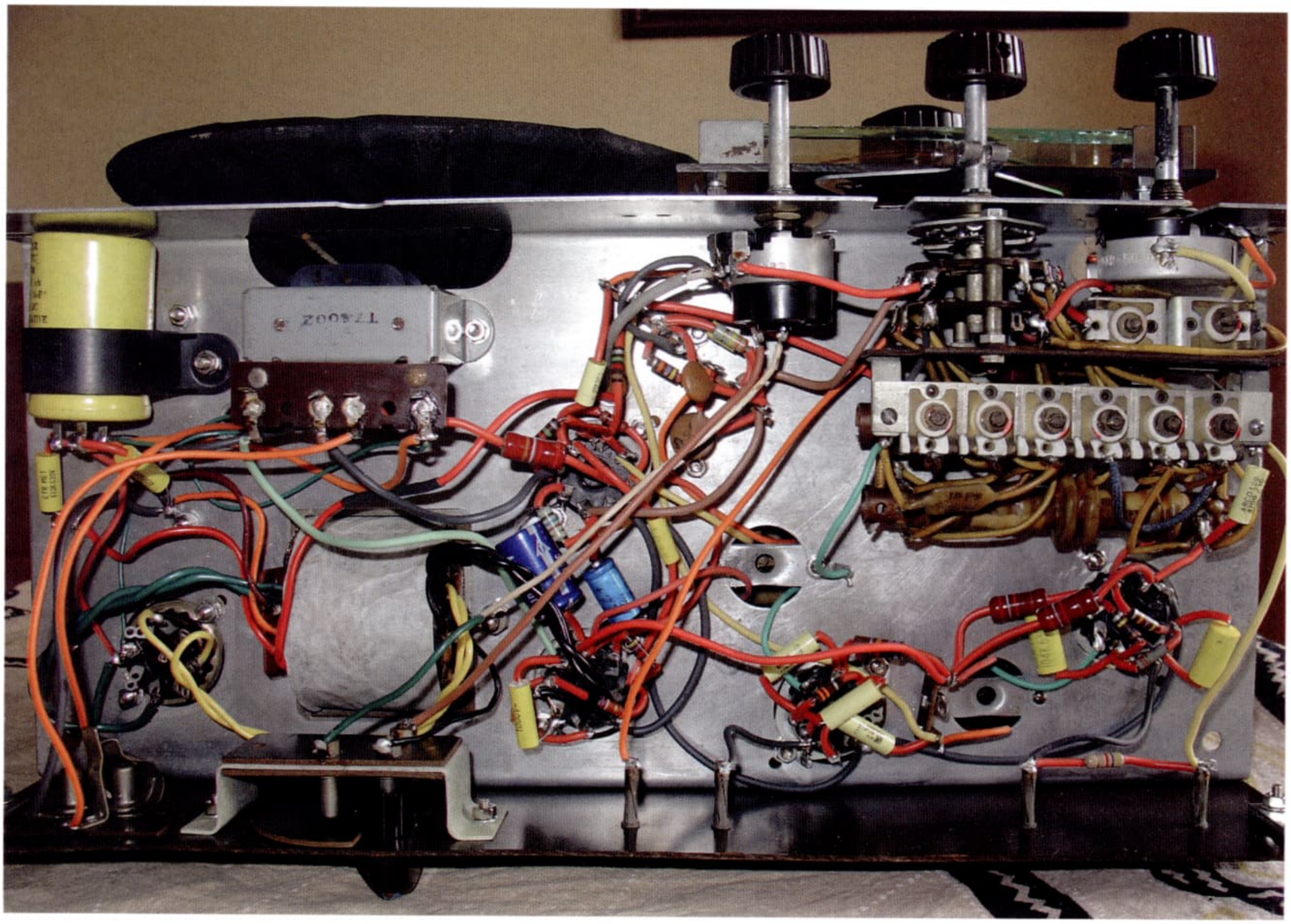
When I eventually removed the glass dial I very delicately cleaned it with cotton buds barely dampened in slightly soapy water, constantly checking that the dirt never changed colour to that of the lettering! It didn't, as the lettering seemed to adhere fairly well to the glass; the cleaning revealing a very clear and tidy dial.

Next, I took plenty of photographs showing the chassis components and drew the layout and wiring on a large sheet of paper and traced it out on the circuit diagram as I went. Then I checked my hand-drawn diagram by retracing it on a new copy of the circuit diagram. A bit excessive perhaps, but it was important to check my drawing for errors.

Dismantling began, and this required the careful drilling out of the many rivets to remove and clean all the cheap paxolin valve holders, brackets and bulbs holders.

Some of the valve holders turned out to be cracked with badly corroded pins, so I decided to replace them all with better quality ones. Unfortunately the replacements didn't fit the chassis mounting holes, requiring plenty of new drilling into the steel chassis.

The contents of the IF cans were in good condition, so I just replaced their brittle rubber-coated connecting wires. Unsurprisingly the hardest parts to clean and check were the aerial and local oscillator coils, with their related capacitors and switches. These were all mounted on the wave-change switch assembly. Although the service sheet contains only three pages, it does have a



useful - if somewhat cryptic - diagram of the wave change coil assembly showing where all the connecting wires go.

The mica capacitors were all within specification so all that was needed was a clean and lubrication of the switch. But this required the removal of the whole assembly, with a careful record of all the connecting wires. This is where I later came unstuck!

I cleaned all the mechanical parts, opened and cleaned the volume and tone controls and polished the bakelite knobs, case, paxolin panels and repainted the colours on the wave-change indicator plate.

Reassembly

Time for reassembly, starting with the power supply and audio stage. Mounting everything with nuts and bolts now meant I could use much shorter leads for components to be earthed to the chassis with solder tags close to where they were needed. Moving earthing points can introduce unpredictable problems, but most of the wires going to these points were really quite long.

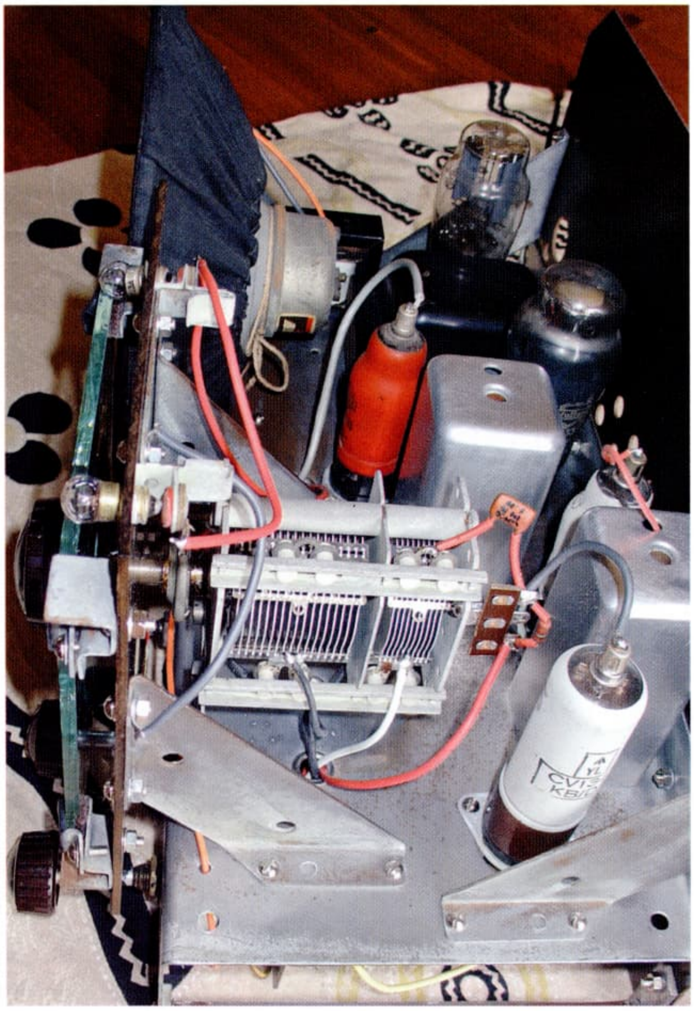
A careful check of my work so far around V5 and V4 against the circuit diagram didn't reveal any errors, so it was ready for a switch on.

All voltages were about 15 percent higher than listed, even when using an Avo 8 rather than a high impedance digital multi-meter. But I assumed that was mostly due to the voltage table showing a mains input of 225V when mine was 245V, even though I was on the 226-240 volt mains transformer tapping. In addition, the components around V1, V2 and V3 were not yet in circuit, so without the full HT load, the HT voltage was bound to be a little high.

Nevertheless nothing overheated and an audio sine wave across the volume control showed a healthy, undistorted signal on the 'scope at the loudspeaker. So far so good.

I continued assembling the rest of the components, checked for obvious errors and the time came for a proper test.

The local oscillator was working on each band, although the coverage was a long way out. With a decent antenna connected there was hardly anything audible on LW or MW, but SW was quite lively. That all seemed fair enough as I hadn't yet checked IF or RF alignment.



Very deaf

An injection of 456 kHz into the IF and a bit of tweaking brought sensitivity up a bit, but the set remained very deaf. RF alignment proved impossible; the local oscillator remained about 100 kHz off on LW and MW and the sensitivity was still dreadful.

Connecting the antenna directly to V1 grid brought the signals up greatly, but still in the wrong places and with much whistling. This indicated something was wrong in the aerial tuning circuits. I partly dismantled the wave-change switch assembly to see if anything was amiss there, but everything seemed in order.

After a lot of head scratching I discovered what I'd done, and it had been staring me in the face. I'd swapped the aerial and local oscillator connections on C7/C11.

On many sets this wouldn't have such a dramatic effect as both sections of the tuning capacitor usually have the same value. But on the RR58 they do not. There is also a small tag strip supporting R2 and C6 mounted on C7, the aerial side of the tuning capacitor, so there's no wonder it behaved as it did!

Good sensitivity

Swapping these wires round brought the receiver up to very good sensitivity on all bands. But I gave the IF circuits a proper alignment with my wobbulator and adjusted the local oscillator calibration and aerial input circuits on all bands with an accurate signal generator. (I always use a digital SW radio tuned to the local oscillator while aligning the short-wave band as this ensures I'm tuned to the real calibration signal and not the image.)

Short-wave performance is quite good, but the dial is about 2 MHz out at the HF end. There is minimal adjustment possible here with just C14 supposedly setting the local oscillator tracking for the entire band. But many domestic sets with a single short wave band included it as more of a novelty selling point than for serious short-wave listening, so I expect the calibration is as good as it ever was.

This radio has polished up very nicely. The printing on the dial is bright and in a perfect "as-new" condition. The set is very lively, even with only a few feet of wire and has quite a nice sound.

As impulse buys go this Radio Rentals 58 turned out to be a rather good little set...

Harpenden, June 2014 photographed by Carl Glover

Vernon Henton with his Avo meters

Bob Smallbone's interesting stall

The bring and buy tables

Rare Pam 710 - the first UK transistor radio

Ekco AD65

Auction Items

Auction Items

Alex Hewitt making the Youtube video

Ultra 'Twin'

Roger Grant, a Philips 274A and Rodney Dews

The Pye PE94MBQ/LW Portable/Mains Radio

by Stef Niewiadomski

I found this radio lurking under a table at a recent BVWS meeting. If a radio is under, rather than on, a table it's usually a sign that the seller doesn't have great hopes of selling it, but luckily in this case it caught my eye, and it was mine. If there were to be a beauty contest for radios I doubt whether this model would win a prize. If the overall size and weights of portables were compared I'm pretty sure that this radio would come out at the biggest and the heaviest.

Figure 1: The Pye P94MBQ/LW portable/mains radio, fitted with its smart new carrying handle. The telescopic aerial can be seen extending slightly from the top of the radio, and an external aerial socket is mounted on the right hand side of the cabinet. My radio has a black cabinet: I have also seen an example with a brown finish.

The radio can be seen in Figure 1. Since there's nothing in the photo to show scale, it may be that you're wondering what the fuss is about, but note that the cabinet is 16-inches wide by 12-inches high by 8½-inches deep, and the radio weighs in at 8.5kgs (almost 19 pounds) without its battery. At least the width gives enough space for a relatively long dial. It took me a while to realise what was missing from the dial: apart from wavelengths and the positions of the short wave bands, there are no other markings - for example station names on the long and medium waves. I think this shows the export aspirations for the radio.

What then made me buy this radio? I have an interest in portable radios (mainly of the valve type) and for me it's the fact that with its multi-band coverage, RF amplifier stage and 'magic eye' signal strength display, it's probably the ultimate in British portable / domestic radio design for a radio using D-series 1.4V battery valves.

Brief history

The radio was originally released in 1953 as the PE94MBQ, covering the medium wave and four short wave bands. The 'E' in this context normally indicates a radio intended for export. There's a good chance that any such sets are abroad now, if they still exist at all. Figure 2 shows Pye's advert for the 94MBQ/LW, and its other portable sets for the year. Note some of the aspirational activities that an owner might enjoy, including air travel, though I'm pretty sure they would not be lugging this model onto an aeroplane!

There seem to have been some inconsistencies in the exact model number: on the chassis plate of my radio it definitely says PE94MBQ/LW (and it has the serial number 624096) but I've also seen the set described as a P94MBQ/LW and sometimes the 'P' is missed off the front of the model number. My radio covers the long (usually an indicator that the set was aimed at the UK domestic market) and medium waves, and three short wave bands. Pye certainly considered the PE94MBQ and P94MBQ/LW to be distinct models, as they issued separate service sheets for the two radios. They also referred to the radio as the 'Intercontinental', presumably because of the long range potential of its RF stage and short wave coverage.

Competition

There were several competing radios to the Pye PE94MBQ, these being battery/mains operated and covering a range of short wave bands, and incorporating an RF stage. I may be mistaken but the magic eye feature of the Pye could be unique amongst its contemporaries.

Zenith used the 'TransOceanic' name for various models from about 1940 into the 1980s. The 1951 TransOceanic model H500 is probably the closest in design (and size and weight) to the Pye PE94MBQ, using US-equivalents of the 1.4V filament D-series of valves, and covering several short wave bands as well as the medium wave (often called the 'standard' broadcast band in the US).

The Hallicrafters TW-2000 is another similar battery/mains radio with medium and short wave bands. This radio was designed to operate from 105-120V DC or AC mains, and could be used on 220V mains with the use of a 'ballast adaptor' module. An operating example of this radio can be seen on YouTube if you search for 'Hallicrafters TW-2000'.

RCA produced the cowhide-covered 'Strato-World' model 3-BX-671, and no doubt there were other US-produced sets.

In Germany Grundig made several multi-band portable/mains sets with a DF91 RF stage, such as the 'Reise-Super' and the 'Grosser Boy'. There were also several similar models produced by STC in Australia. Some were purely battery operated, but still with a tuned RF stage, and others (for example the B5132) were capable of battery or mains operation.

The design

The schematic of the radio is shown in Figure 3. V1 is a DF91 AGC-controlled tuned RF amplifier. As well as providing useful gain, such a tuned stage also helps reject image signals in a superhet with a 'normal' intermediate frequency of 470kHz, which is expected to work up to the 16m broadcast band, the top-end frequency of which is about 18.3MHz. The input to the RF amplifier stage comes from an external aerial (the socket of which is mounted on the right hand side of the cabinet), a telescopic aerial, or a frame aerial intended for medium and long wave use.

V2 is a DK92 self-oscillating frequency changer which converts the amplified signals from V1 to the IF of 470kHz. This valve is mounted in a high-quality ceramic socket, presumably to help its high frequency performance. C4, C14 and C25 form the triple-gang tuning capacitor. As you can imagine the numerous coils and switches needed lead to a complex wiring and switching arrangement: Figure 4 shows the coil/switch compartment under the chassis.

V3 is a second DF91 acting as the IF amplifier. The second IF transformer feeds V4, a DAF96 signal / AGC detector diode and AF pre-amplifier. This valve is mounted in a screened anti-vibration socket,

Figure 2: Pye's advert for the 94MBQ/LW, and its other portable sets for the year. Note some of the aspirational activities that an owner might enjoy, including air travel! Reproduced by kind permission of Mark Johnson, author of Attaché Radios.

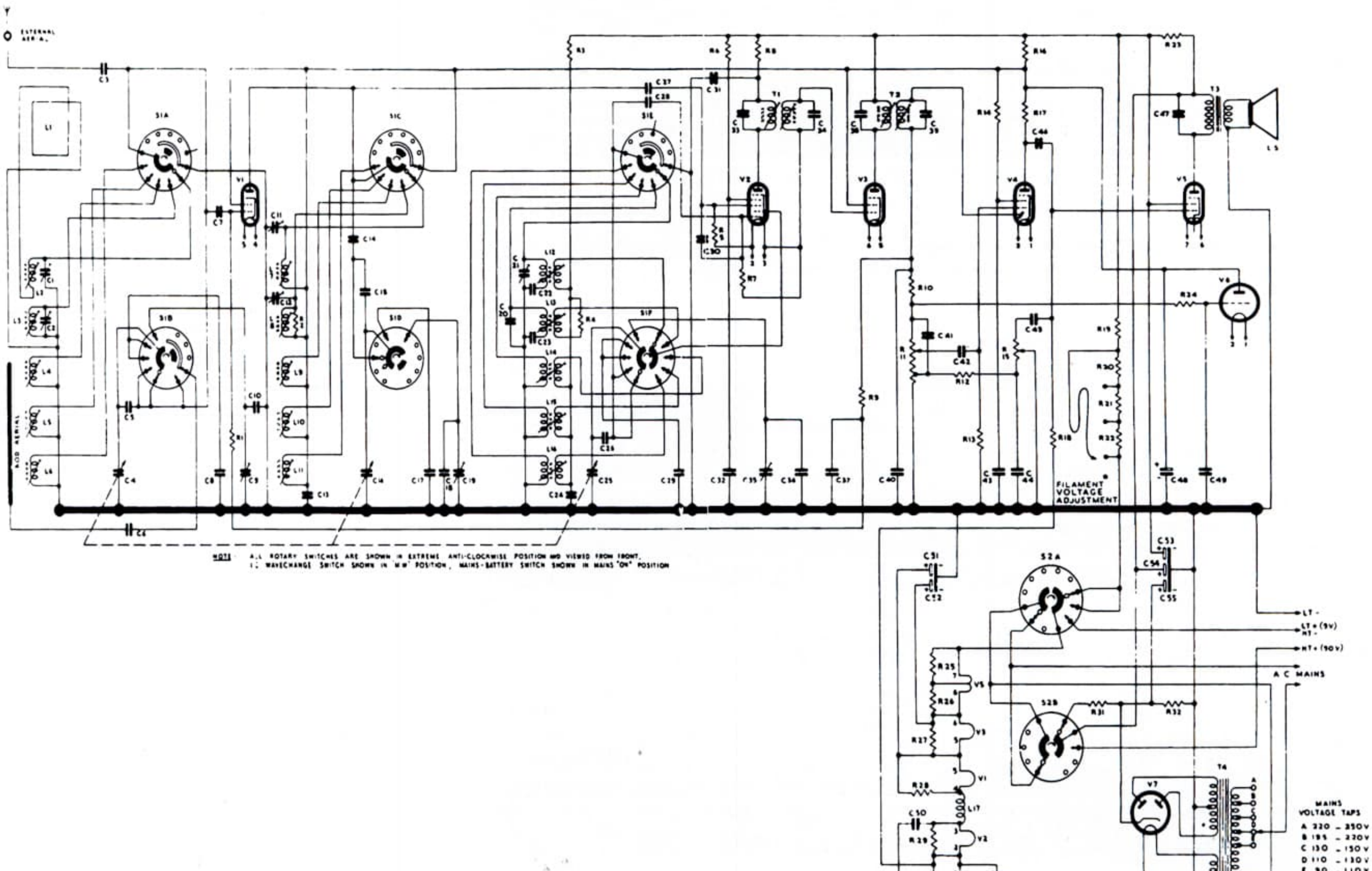


Figure 3: Schematic of the P94MBQ/LW.

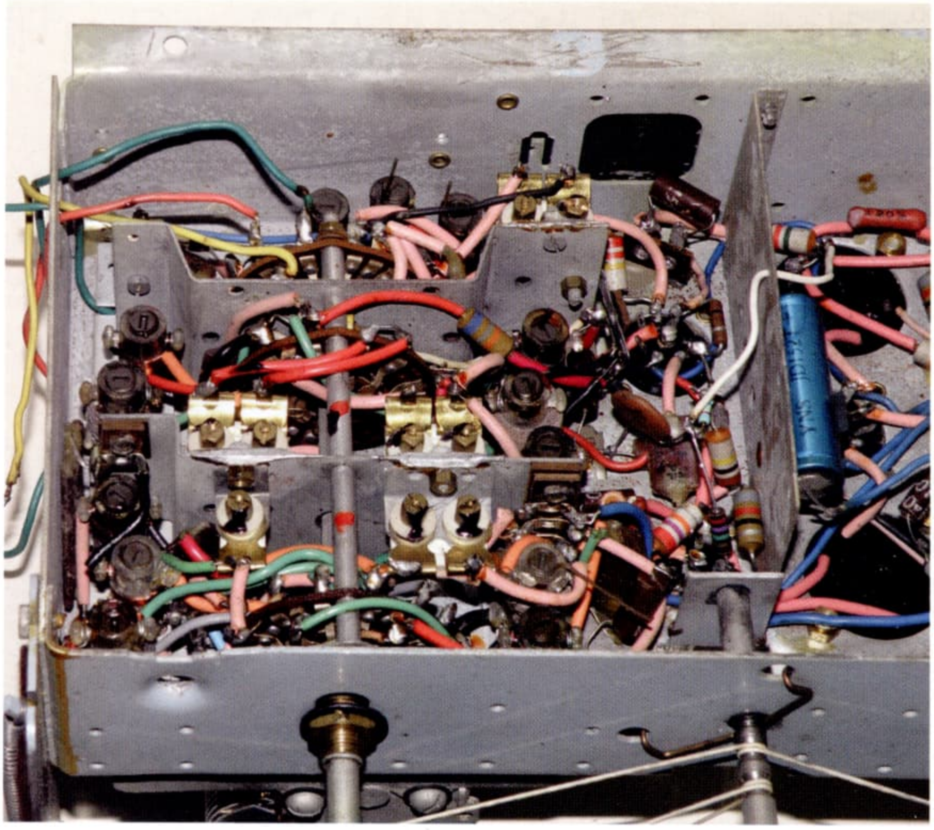


Figure 4: The coil compartment of the radio.

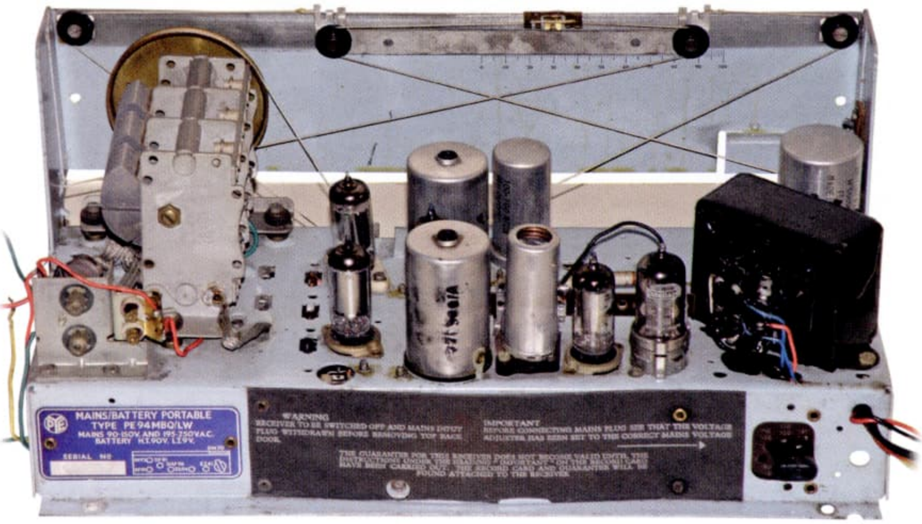


Figure 5: Top view of the chassis removed from the cabinet.

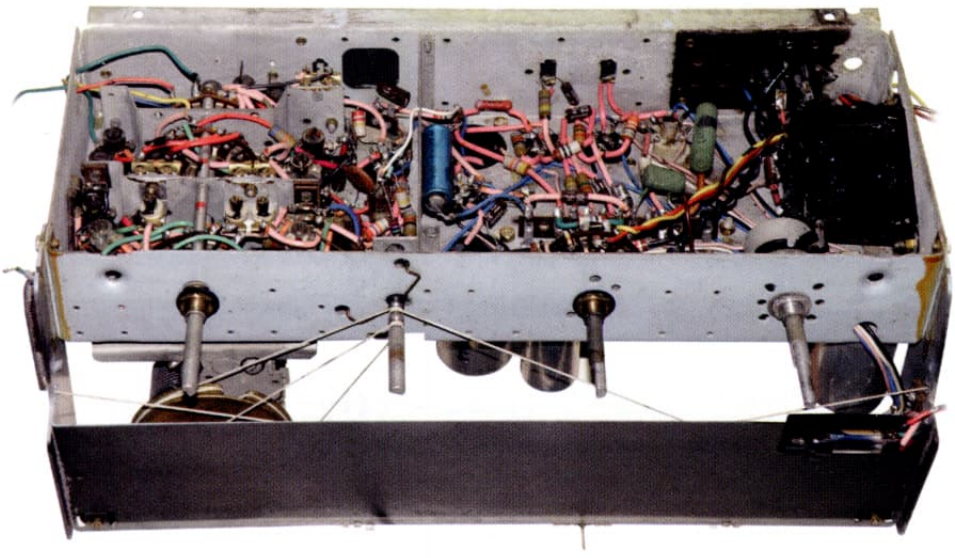


Figure 6: Under view of the chassis. The complexity of the dial cords can be seen.

which reduces any tendency to microphony, which can be a problem with the DAF96.

The audio output of V4 drives V5, a DL94 audio output stage. V6 is a DM70 'magic eye' sensing the AGC voltage and displaying this visually to represent the received signal strength. This works by showing a wide bar when there is no signal and a narrow bar when a strong broadcast is being received – which seems like the wrong way round, but that's the way it is.

Selecting the exact position of each valve in the filament chain was quite a skill when the set was designed. All the 'battery' valves except V4 were chosen for their 50mA filament currents, but a DAF96 was chosen for V4 because of its 25mA current. This allowed it to be connected in parallel with the filament of V6 - the DM70 'magic eye' - which is a 25mA valve, adding up to the 50mA flowing down the filament chain. The DM70's control grid needs to be referenced to its cathode (that is the filament in this directly-heated valve) and hence one side of the filament needs to be connected to chassis, which means that V4 and V6 need to be at the 'bottom' of the chain.

The total LT voltage needed comes out at 8.4V and I presume that when operating from a battery, the nominally 9V LT battery was expected to fall to about this voltage under load. For operation from the mains, the LT voltage is adjustable via taps across the R20/R21/R22 chain. In the service notes it was advised to check the LT voltage, and to adjust the tapping point if necessary, whenever a valve was changed.

V7, the EZ41 full-wave rectifier valve, is on a B8A base. This valve is only active when the radio is operating from the mains and therefore its heater - this valve has an indirectly heated cathode - is connected to a 6.3V winding on the mains transformer, and is not associated with the filament chain of the battery valves. The AC mains input to the radio is isolated from the chassis: at the time that this set was designed many radios were intended for AC and DC mains, and hence did not use a mains transformer. Any heater/filament voltages were generated via a dropper resistor, which wasted much power which had to be dissipated inside the cabinet. Sometimes a transformer was used solely to generate the heater/filament supply, and this meant that the radio was then only usable on AC mains.

All the valves in my radio were of Mullard manufacture, and looked as if they were the originals.

Because of the unusual LT voltage required, the recommended 90V HT + 9V LT battery was an Ever Ready B135, and there seem to have been no other UK-based manufacturers of a compatible battery. The other battery manufacturers recommended on the back panel of the Pye are the US-based National Carbon, Burgess, RCA and Rayovac; and Pertrix which I believe was a German manufacturer. These US-produced batteries were sold into the Zenith, Hallicrafters, RCA (and others?) markets, and I assume that Pertrix were selling mainly to Grundig owners.

The chassis

The top surface of the steel chassis is painted in grey and this had lasted very well on my radio, with no chips or rust. Figure 5 shows the neat layout of the major components on the chassis, with the three-gang tuning capacitor towards the left (looking from the rear). To the left of the mains transformer is the EZ41 rectifier, which I think is positioned a little too close to the DL94, and radiates some of its considerable heat towards the DL94, which gets hotter than I've typically seen in an all-battery radio.

The underneath of the chassis (see Figure 6) is plated and it shows some small signs of surface rust, maybe as a result of its exposure to leaking batteries over the years. The DM70 tuning indicator and some of the complexity of the dial cord arrangement can be seen in the photo.

The only slight criticism I have of the chassis is that no grommets are used in the holes carrying wires between the top and bottom, though I couldn't see any evidence of any detrimental effect of this arrangement on the wires' insulation.

Drive cord

The drive cord arrangement, making use of three cords, must be the most complex in any domestic radio: I just hope none of mine breaks. See Figure 7 for the manufacturer's diagram of how they are stringed. The pointer runs on a floating 'sub-dial' which itself moves. I was trying to work out why this is so complex (and the complexity of the pulleys, etc, restricts the width of the calibrated dial to 8-inches out of a total cabinet width of 16-inches) and looked at the tuning scales for a clue. What's interesting about the scales (see Figure 8) is that they are not cramped towards the high frequency (lower wavelength) end – which is typically what you get on most radios - and in fact they seem to be more spread out at the high frequency end than at the low frequency end of the dial. This effect could possibly be caused by the design of the tuning capacitor, but the one fitted (made by Polar of Liverpool) here is a standard straight-line capacitance component. I suspect that the dial cords cause this strange, and very beneficial, effect.

The radio is fitted with a 4½-inch diameter Celestion speaker. You might think a bigger elliptical speaker might have been fitted but this diameter is the biggest that could have been accommodated without fouling the battery. I suppose the size and rigidity of the cabinet helps the quality of the sound, which is very good, and surprisingly loud from the 240mW or so that the DL94 output valve is capable of producing.

Switch on

I switched the radio on, in mains mode, and after what seemed like a long wait it came to life. Typically D-series valve radios come to life in a second or so, and so I assume that the warm up time was due to the EZ41's heater warming up.

I checked the LT voltage being supplied to the filament chain and it measured 8.3V, pretty close to the desired 8.4V and so no adjustment of the

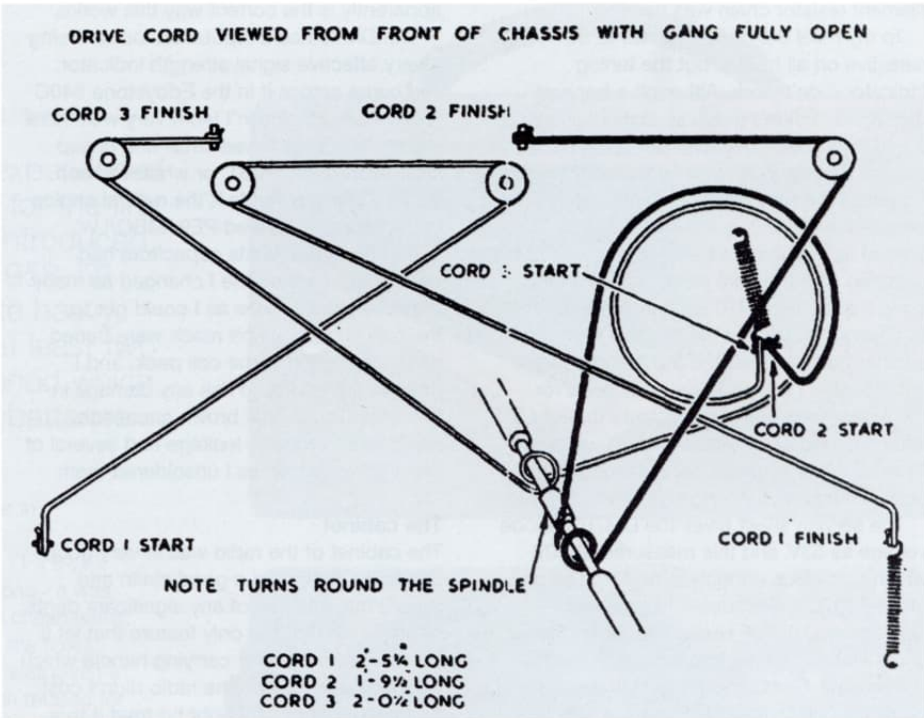


Figure 7: Pye's diagram of how the three dial cords are arranged.

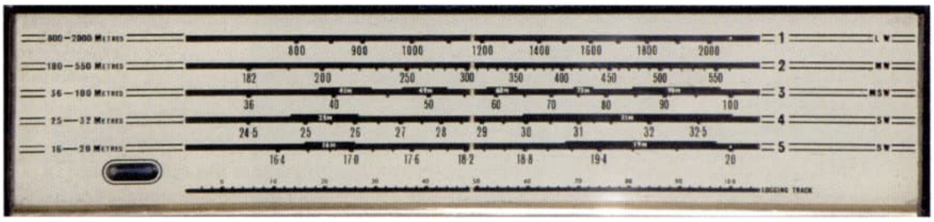


Figure 8: The dial of the radio. The 'magic eye' is visible through the horizontal slot on the left hand side.

Figure 9: The new leather handle with the metal end covers of the handle finished with a gold effect: this definitely gives a luxurious look to the top of the cabinet.

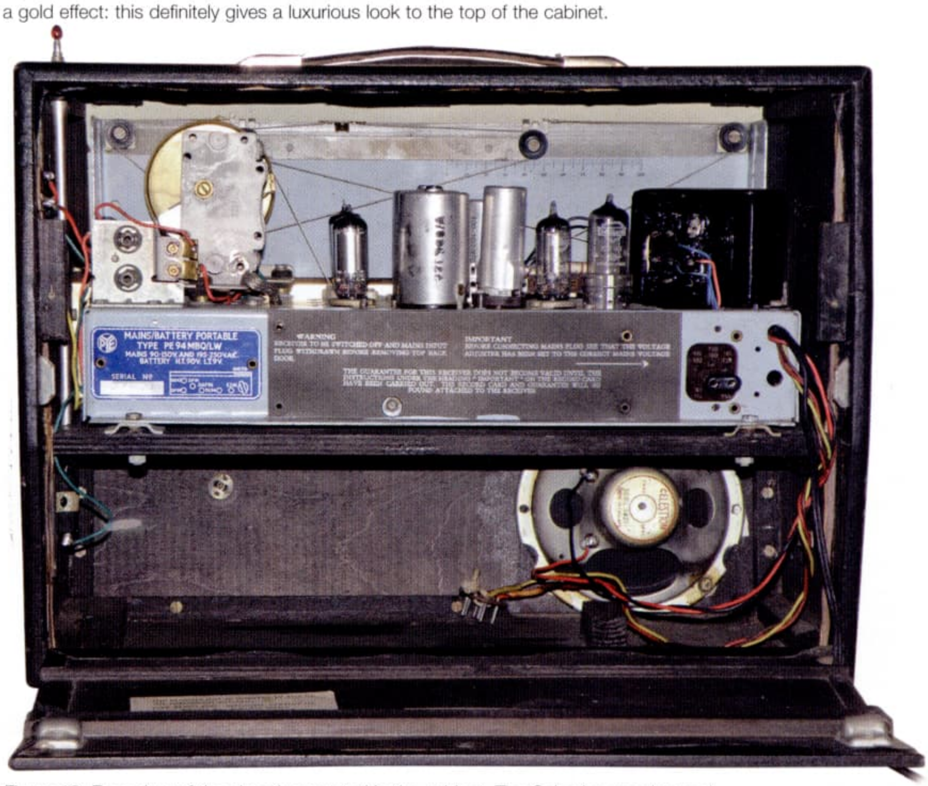


Figure 10: Rear view of the chassis mounted in the cabinet. The Celestion speaker and the space for the Ever Ready B135 (or equivalent), battery can be seen.

filament resistor chain was needed.

To my relief the radio seemed to be sensitive on all bands, but the tuning indicator didn't work. Although a bar was displayed, it didn't move as stations were tuned in and out. Because the sections of the display that did light were reasonably bright, I resisted the temptation to immediately order a new DM70, preferring to check around its voltages to make sure it was being supplied with the right potentials. With its flying leads, the DM70 isn't an easy valve to change. I removed the chassis from the cabinet and reconnected the frame aerial and speaker on long leads - not good for the higher frequency bands, but I thought at least the long and medium waves will work. Switching the set back on, indeed I could hear stations on the long and medium waves.

The service sheet gives the DM70's anode voltage as 63V, and this measured at 70V, which was close enough to be OK. The grid of the DM70 is decoupled to ground by a little brown 0.005μF Hunts tubular capacitor and it seemed to me that since this pin is driven via a 10MΩ resistor (which measured close enough to its nominal value), then any leakage in the capacitor was very likely to 'kill' this voltage. So this was the first capacitor I changed, for a BVWS 0.0047μF component, and this fixed the issue. The magic eye now worked, though I must admit that it's not very impressive. You see a bigger bar when the radio is not tuned to a station than when it is tuned to a station, which apparently is the correct way this works.

The DM70 has a reputation for not being a very effective signal strength indicator: I've come across it in the Eddystone 840C receiver, and it doesn't work very well there either. I suppose it was small and cheap compared to an EM81, or whatever, and its 1.4V filament made it the natural choice in the battery-powered PE94MBQ/LW.

As one of the Hunts capacitors had proved to be unreliable I changed as many of the remaining ones as I could get to: the only two I couldn't reach were buried under the wiring in the coil pack, and I thought it best not to risk any damage in this area. These little brown capacitors seem to be prone to leakage and several of them fell to pieces as I unsoldered them.

The cabinet

The cabinet of the radio was in very good condition. It needed a good clean and polish, but was free of any significant dents or rips. I felt that the only feature that let it down was the leather carrying handle which was well worn. Since the radio didn't cost me much money I thought I'd treat it to a new handle, ordered from a local saddler, though this cost me considerably more than the radio. The metal end covers of the handle are finished with a gold effect: this definitely gives a luxurious look to the top of the cabinet, see Figure 9.

The tone control is concentric with the volume control, and is the outer control of the two. It's labelled 'Fidelity' on the front panel and arrows indicate the directions to rotate for 'brilliant' or 'mellow' sound.

Figure 10 shows the chassis mounted back into the cabinet. The space for the battery below the chassis can be seen. A wooden panel hinges upwards to cover the battery compartment, and a screw-on panel covers the rear of the chassis.

conclusions

Aesthetically this radio is no beauty, and it's a heavyweight example of the ultimate in portable and mains radio design for worldwide reception in the 1950s. It may be an example of 1950s design style, which to some extent has come back into fashion these days, but I think it's still too big to fit into modern homes today.

Despite its age my radio worked very well, and replacing the normal capacitors has helped prolong its life for many more years. From a technical point of view the radio has a tuned RF stage to help with sensitivity and selectivity at its higher frequencies, and a 'magic eye' signal strength indicator – though I doubt whether this ever worked very well.

The P94MBQ/LW doesn't seem to be a common radio these days and it took me a while to find the one I purchased. It may be that once smaller and lighter radios with the same sort of coverage became available, then many examples of this Pye heavyweight with its lump of a battery weren't so attractive and were disposed of.

Chan Sundaram

It was with great sadness that I recently heard of the passing of Chan Sundaram.

Chan will be well known to many people for his visits to BVWS meetings, NVCF and of course the many times he could be seen at the Museum in Dulwich.

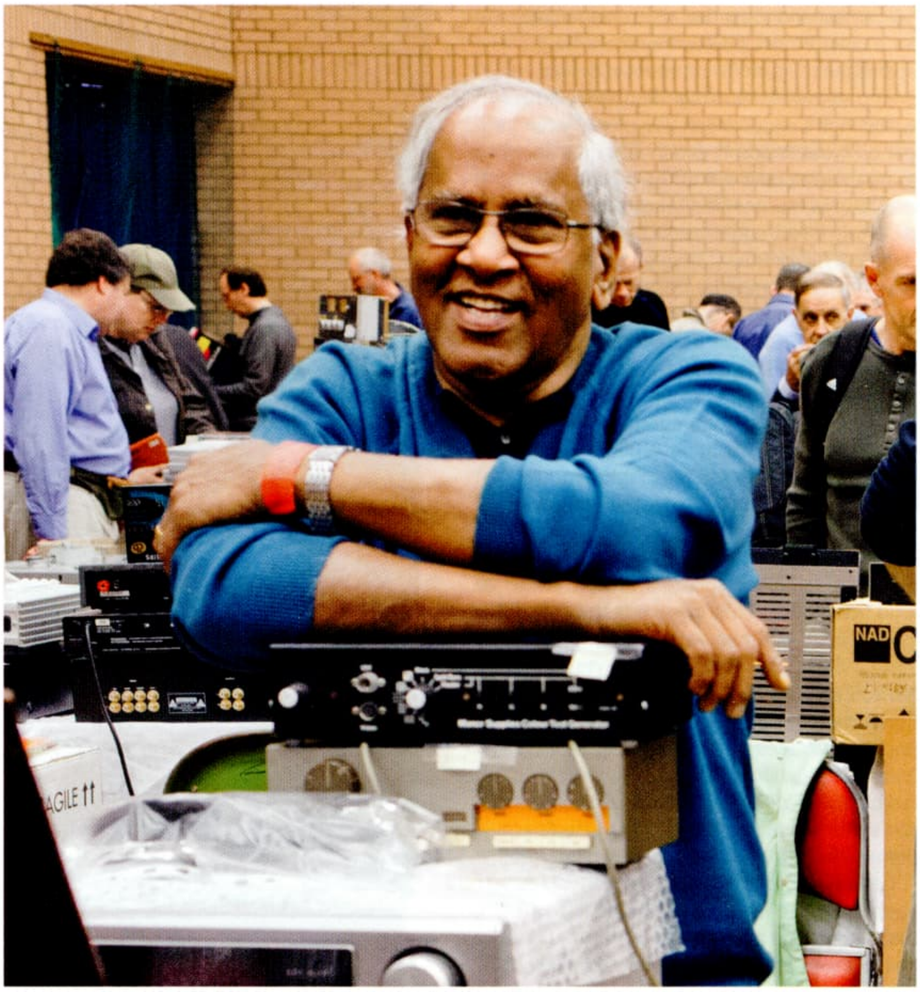
Chan was a great supporter of the Museum and would always get 'stuck in' to any job that needed doing. He was famous for his Garden Party Curries and it will not be the same again without him.

It was at Royal Wootton Bassett in July that I was fortunate to spend some time chatting and joking with Chan. Later that day he decided to leave early to avoid the London M25 traffic as he was feeling a little under the weather.

It was only a few days later that he suffered a major heart attack and died.

Chan always wore a broad smile which had a magical way of brightening the mood of everywhere he went. Chan was a very good and caring friend to many people and he will be missed by many of us.

Mike Barker

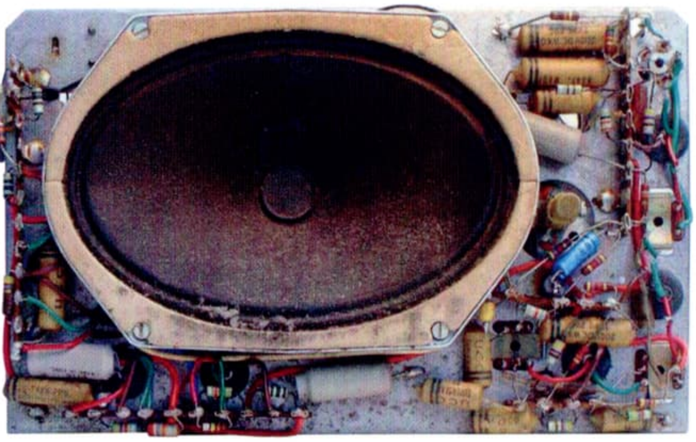


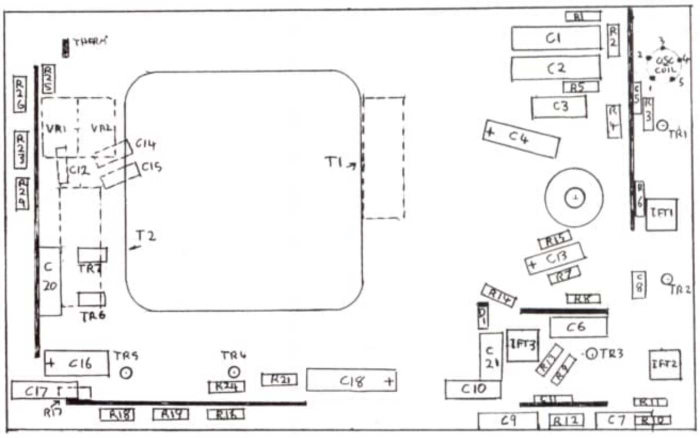
Chan pictured during happier times at the Audiojumble, Tonbridge

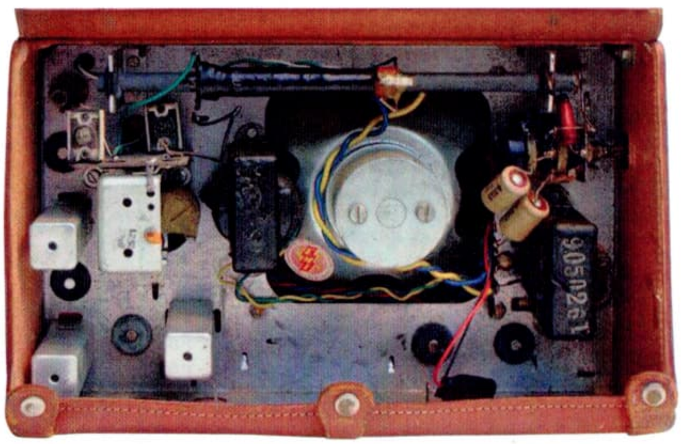
A 'Tranny' from 'Down-Under'

by Richard Shanahan

The modern generation have not experienced the joy of owning a personal radio for the first time. Transistor radios, when first introduced, were a revelation. Up until about 1958–59 portable radios were generally quite heavy, needing, except for a few cases, at least two batteries. I have a Vidor, of that period which is rather hefty, needing HT and LT batteries.







The 'tranny' in this article, was my wife Mary's first transistor radio. She is Australian and bought the set in 1961–62 from an importer called Mason Dicusey.

The set is neither small or light, measuring about 11 x 6¾ x 4 inches and weighs 6 lbs. It had two major attractions - it was modern and only needed one PP9 battery. It wasn't cheap either, she thinks about £30 (three to four weeks wages at the time), Australia was still using sterling at the time, my dad was given a Marconi 'attaché case' transistor radio in 1961 which retailed for 21 Guineas. Mary remembers the joy of listening to the local radio station in Gympie, Queensland, playing the current pop music.

The radio is cased in 'Genuine Steerhide', this is stamped on the top. The leather is quite thick at an eighth of an inch! As one of the photographs shows, the radio was manufactured by HMV and given the legend 'All Transistor'.

I have seen several Australian radios of the period which were generally 'one band' MW, with their dials marked with station call signs such as EG, GH, AT. QLD is of course Queensland. Mary's local station was 4GY. Mary left Australia in 1968, travelling overland by bus, they did it once a year, when one arrived another returned carrying the outgoing passengers - you couldn't do it now! We were married in 1971, she didn't return until 1978 with our 16 month old daughter, the radio came back then.

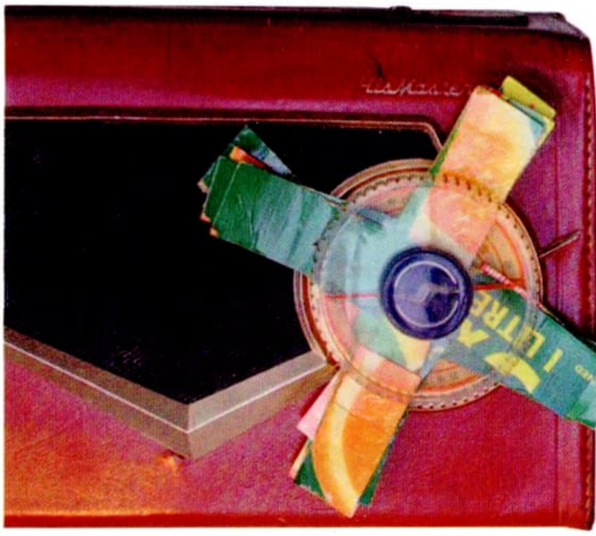
I put a new battery in the set, it took a lot of switching on and off to get it going. The volume wasn't good and only a couple of stations were clear. The handle was damaged and a strap was missing. Also absent was the volume/on–off knob. I had a leather craftsman make a handle which cost £10. The set stayed in a cupboard until recently.

Mary asked me to see if I could get the set going. The inside–rear of the set contains a major component outline, together with alignment details. There are two small clips, one on the ferrite rod, the other on a small platform above the tuning gang, these are shown as ext. aerial and earth terminals. Interestingly, apart from the line of holes in the back there are no lead–out features. I applied 9 volts and switched on. Silence! A finger on either of the volume control pots (ganged switch) brought a good hum. Tuning brought in an almost inaudible station, my twenty foot high by forty foot long aerial only marginally improved things.

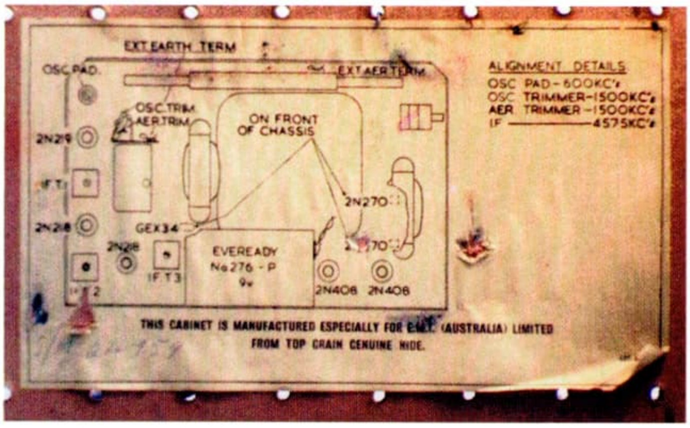
Time to excavate the chassis

The chassis is a galvanised iron sheet, with turned up edges, held in the case by three screws. However, nothing is simple in a 54 year old radio, the large clear tuning control knob must be removed, clear plastic of this vintage is very brittle and breaks easily, sometimes leaving the central section behind if great care is not taken. Anyone who has serviced the notorious Bush portables (Bush TR82C and similar) will know how stubborn these knobs can be. I've seen other ideas in various magazines and most involve wrapping twine behind the knob and pulling hard. The danger with this approach is that with a large diameter knob, the leverage on the rim is excessive.

My approach to knob removal uses lengths of printed stiff cardboard as found on breakfast cereal packaging slid underneath the knob equally on all sides. The shiny surface will lower the friction between pieces, adding more cardboard will add considerable force without leverage. I have used this system many times with much success, on rare occasions I've left it overnight. This knob took about fifteen to twenty minutes to remove. Don't rush the process and avoid putting



How to carefully remove the tuning knob without damaging anything



anything like a screwdriver between the pieces of cardboard.

The chassis came out very easily. Undoing the volume control bush nut allowed the control to be slid back giving clearance for chassis removal. The component layout is small, the 7 inch eliptical speaker has a label on it which says: 'Made by EMI Australia Ltd Sydney NSW' I'm not sure whether this refers to the speaker or the rest of the set. I decided to trace out the circuit, it would be useful for the present problem and a good reference for the future.

A couple of things were obvious, TR1 and TR2 had been replaced or removed for testing at some stage. All the transistors had conveniently coloured sleeving: Red = Collector, Brown = Emitter, and Green = Base. TR1 and TR2 had been cut mid–lead and resoldered. All except the two output transistors were pushed into rubber grommets. I gently pushed out TR1 and TR2, TR2 was an AF127. These, as most people know have a connection to 'case'. Many develop breakdowns between the P and N junctions and case. The trick, if you are lucky, is to 'snip' the lead. This one already had it done. TR1 was a 2N219, perhaps TR2 became a problem. Mary cannot remember any repairs.

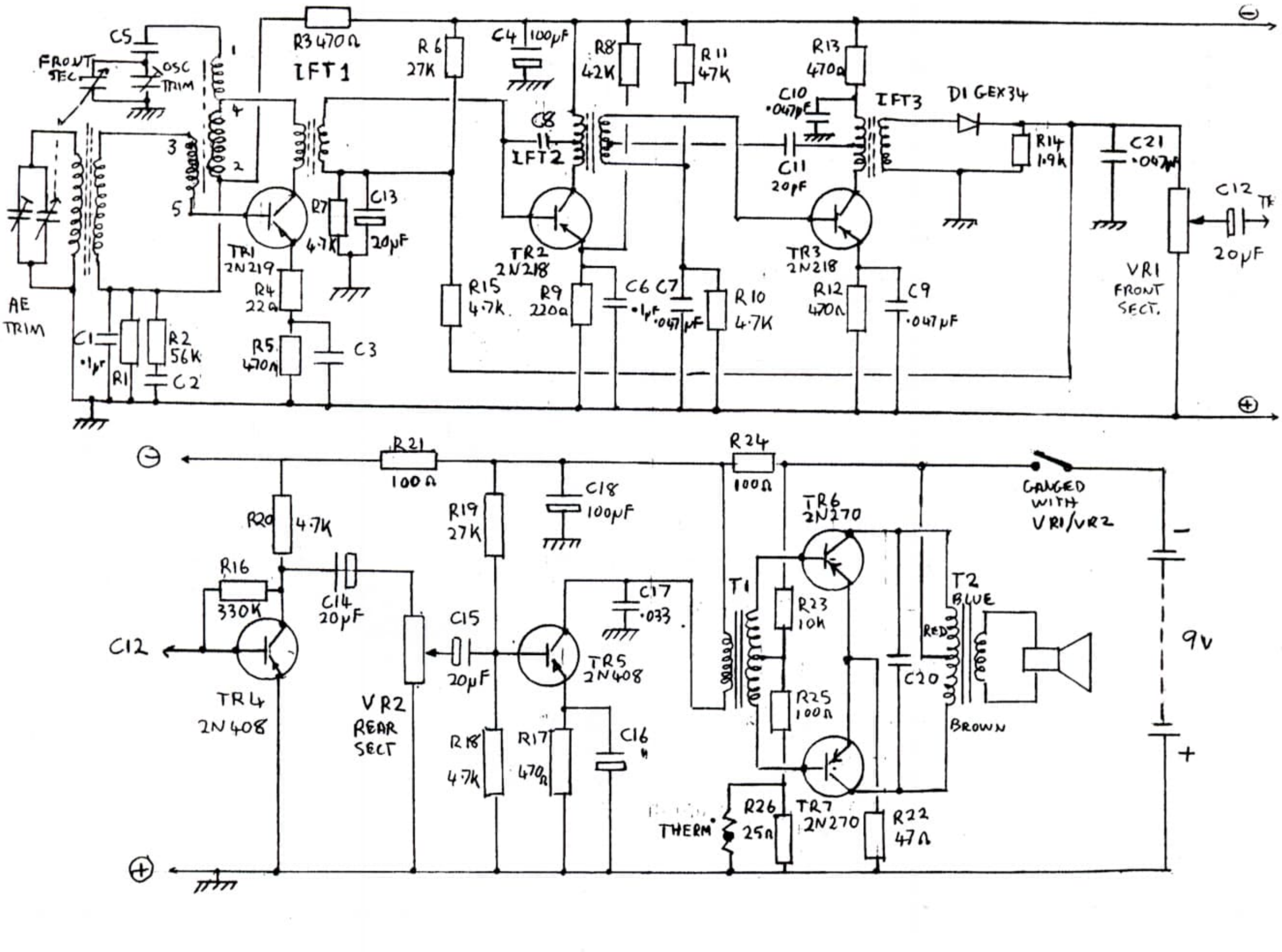
I did the usual fault finding sequence. I knew AF was probably good, but I tested it anyway. I applied my trusty Advance B4A7 signal generator at 44Hz modulation, resulting in powerful signals right through to VR1.

A few words on the traced circuit might be interesting. Initially I thought the ganged pots were volume plus some sort of tone balancing system. A friend says that he has come across this in Hacker and Roberts radios but the controls seem to be in a normal circuit mode. There is an expected AVC feedback circuit. TR6 and TR7 are in push–pull mode, and there is a thermistor in the bases of TR6 and TR7. Two small capacitors, I could Identify C11 as 20pF are coupling IFT1 to IFT2 and IFT2 to IFT3, I'm not sure of their function.

The two transformers and the ferrite rod are heavily coated in a hard black compound, perhaps for tropicalisation?

Back to fault finding

Changing to RF, with a modulated 457.5 kHz signal I wormed my way up to TR2. The AF127 had nothing at its base, up until then there were good signals. Bingo! I thought. I took it out and tested it on my trusty home–made transistor tester taken from an RSGB design. It showed a gain of



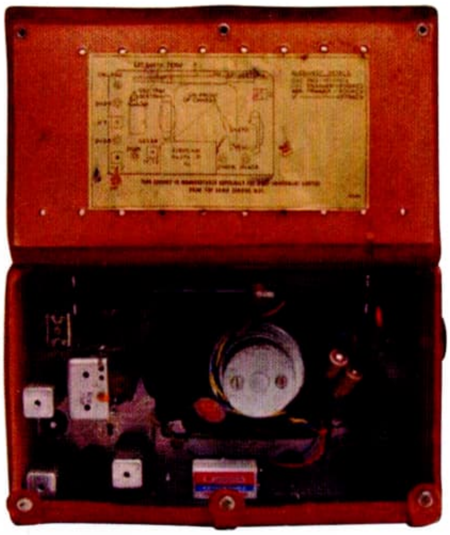
about 50 with an ICEO of 20µA, I've known worse transistors working well! Bearing in mind the AF127's history, I put in an OC42 and switched on again. Reapplying LF signals, touching the base, the set burst into life! It stayed on for few seconds then fell silent. I tried a second OC42 giving the same results! In fact touching any of the leads in and around TR2 produced identical results. One thinks of dry joints, loose connections, triggering junction breakdowns etc. I tried replacing TR1 with the first OC42 with the same results!

I spoke to Gerry Wells, he was also suspicious of early transistors and also any waxed paper capacitors. As I had solid, stable signals up to the collector of TR2, I concentrated on the immediate components around it. I just happened to touch C13 with a screwdriver and the set burst into life, then stopped. I snipped the lead – bingo! Signals loud, clear and continuous! C13 is a 20µF 24 VWG electrolytic, with the letters UCC ECE67BE, most capacitors are marked 'Made in Australia' but this one was not. It measured 5kΩ in both directions. I had to use two 10µF, 63VWG, in parallel. I left in the OC42 for TR2, replacing the 2N219 back into its place as TR1.

The trimming up was straightforward, the IFs were almost on–tune, the oscillator padder was billed as 600kHz, the oscillator and aerial trimmers also marked at 1500 kHz. As there are no frequency markings I had expected to some sort of calibration 'spot' but none were evident. Perhaps service technicians used the known frequencies of say GM near the HF end and QL at the LF end? I used this approach – it gets Capital Gold 1548 kHz, near the top of the HF and Asian Radio 557.9 kHz at the LF end. The background is very quiet and the stations in between are received at good quality and volume. Like many radios with a ferrite aerial it is very directional.

Summing up

It has been a pleasure to work on this delightful radio, it's excellent performance coupled with a quality case must surely qualify for the term 'A blast from the past'.



Minutes of the BVWS Committee meeting held at 58 Church Road, Fleet at 6.30 pm on Friday 20 December 2013.

Present: Mike Barker (Chair), Martyn Bennett MB(2), Jeremy Day, Guy Peskett, Paul Stenning, Lorne Clark, Greg Hewitt.

1. Apologies for absence: Jon Evans, Terry Martini, Ian Higginbottom.

2. Minutes of previous meeting:
MB(2) suggested the following clarifications which were approved:
Para 4 "The reasons for this should be investigated." replaced by
"The reasons for this will be investigated, once the database is updated."
Para 4 penultimate sentence
"It was proposed that ...." replaced by
"One proposal was that........"
Para 4 Last sentence
"This was approved" delete completely.
Para 6 Line 8
"....main items of expenditure (Bulletin production and postage)...:" replaced by
"....main items of expenditure (such as Bulletin production and postage)...:"
Para 6 Sentence before (i)
"Against this background the Treasurer proposed:" replaced by
"Against this background the following items were discussed at length and approved:"
Para 6 Last sentence
"These proposals were discussed at length and approved:" delete completely.

3. The Chairman thanked the Committee for their hard work and support in 2013.

4. The Treasurer (JD) tabled draft accounts for the Society for the year ending 31/12/2013. He remarked that the measures taken at the last meeting to reduce the operating deficit would start to bite in 2014 and would make it a challenging year. He also tabled draft accounts for the 2013 NVCF that showed a healthy position allowing a donation of £2,900 to be made to the British Vintage Wireless and Television Museum for essential maintenance and a replacement boiler for the heating system in the garden display buildings and workshop.
It was noted that Jeremy (JD) is retiring as Treasurer at the next AGM. He and the new incoming Treasurer, Greg Hewitt, who we expect to be voted in at the 2014 AGM are arranging a gradual transfer of responsibilities. Greg expected to be fully up to speed by the AGM. The Chairman thanked Jeremy for his mammoth 10 years of sterling service to the Society.

5. The Membership Secretary (MB(2)) reported that earlier than usual renewals of membership had resulted from an earlier mailing of the Christmas (Winter) Bulletin. This was welcome both for helping the cash flow and spreading the secretarial load and he hoped it would be maintained in future years. He presented figures showing that the time profile of renewals was similar to last years after allowing for the earlier start. It was too early to detect any trend, up or down, in the overall membership numbers. His experience with the renewal software over the year had led him to suggest a number of keyboard shortcuts that would speed up data entry and Rob Chappell had incorporated these. He planned to investigate some aspects of the renewals for three-year members later in the year. The Chairman thanked Martyn and Anne for their efforts.

6. There was no Bulletin Editors report.

7. The 2014 NVCF is due to be held on Sunday May 11th. Applications for stalls have started to come in.

8. MB(2) proposed that financial reports to the Committee be more detailed, the aim being to highlight trends in major items of income and expenditure. This was agreed.

9. GH initiated a discussion on trends in membership. He began by pointing out that many societies such as ours were experiencing loss of older members and the inability to interest young people. Ways of increasing publicity such as a presence in social media were discussed. Other measures such as appealing more to wider interests like Audio and expecting recognition of the Society's efforts in, for instance, helping to set up the new Science Museum gallery. (LC was tasked with discussing this with the Science Museum.) It was also suggested that it might be illuminating to find out how members first became interested in vintage wireless and television. The Chairman will make this the subject of his next "From the chair".

10. The Archivist (LC) and PS reported on progress in making the Societies archive available online. LC had supplied scans of images amounting to about 1.3GByte to PS who had set up a basic website which for the time being was being hosted on his own site. Members of the Committee who had visited the site expressed their appreciation. The next task is to add a search facility (keywords etc.) It was agreed that all our images be watermarked and copyright acknowledged if known. If not known images would be annotated with "This image is made available in good faith, please inform us of any copyright violations."
The resolution at which images should be stored was discussed and it was agreed that it should be at 800 pixels on the long side. LC mentioned the need to scan documents larger than A4 and agreed to investigate the purchase of an A3 scanner.

11. JE requested that all the issues of 405 Alive magazine (amounting to 187 Mb) be put on the BVWS website. This was agreed. It was also agreed that the first 20 years Bulletins be put on the site in due course. Some recent auction results (prices achieved) need to be added to the site. The Chairman will send the files to PS.

12. Online shop: To produce a demonstration site PS needs images of items for sale including books with some sample pages. The Chairman will provide images of the capacitors.

13. Awards 2013: Following discussions it was agreed that the Duncan Kneale award for "for Excellence in Preservation" be made to Steve Harris for his preservation of the ex BBC scanner truck 'North 3'.
The recipient of the Geoffrey Dixon-Nuttall award for restoration must be decided by mid-January. The Pat Leggatt award for the best Bulletin article of 2013 will be decided by the members vote on renewal.

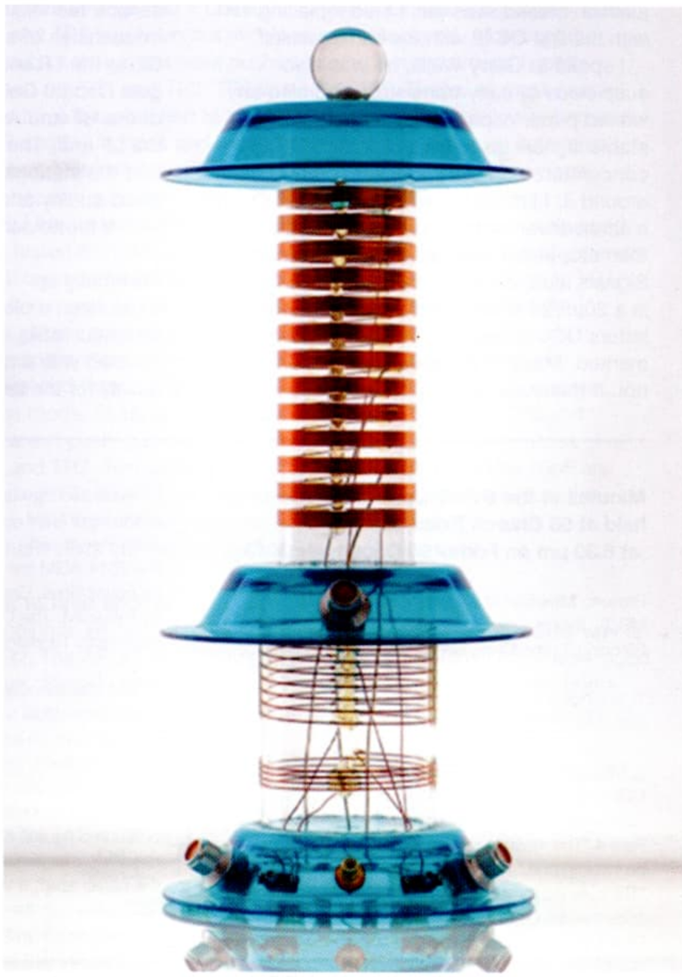
14. AOB
(i) PS. A member was restored to the complimentary category after being misplaced
(ii) PS raised the issue of damaged Bulletin envelopes.

15. Next meeting: Friday 25th April at venue TBD.

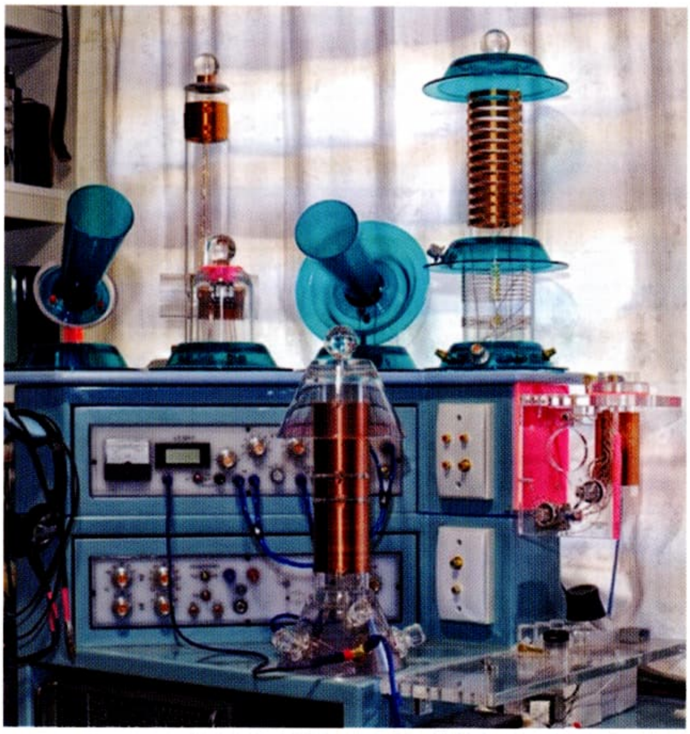
The meeting closed at 11.15 pm

My crystal set journey by Leonard Janesse

As a teenager I was introduced to crystal sets in secondary school science project, as years past my journey was in other directions until about 10 years ago,when I started collecting old transistor radios, which stimulated the desire to once again build crystal sets and of course learn more about the hows and whys of these magical little receivers.



2 Tier crystal set



Crystal Set workstation

Firstly I wanted to build sets with a difference and bring them into the future using modern materials and components, I was always looking for acrylic plates and dishes in shops which I could use for the structure and purchased acrylic tube for the inductor form, one idea lead to another and still keeps evolving, I am by no means a technician, I enjoy the journey of exploring, trial and error and find crystal set building opens my eyes to the wonders of the universe, upon this journey I have learnt some understanding and some theory which is needed to reconfigure coils, wire size, etc.

2 Tier crystal set

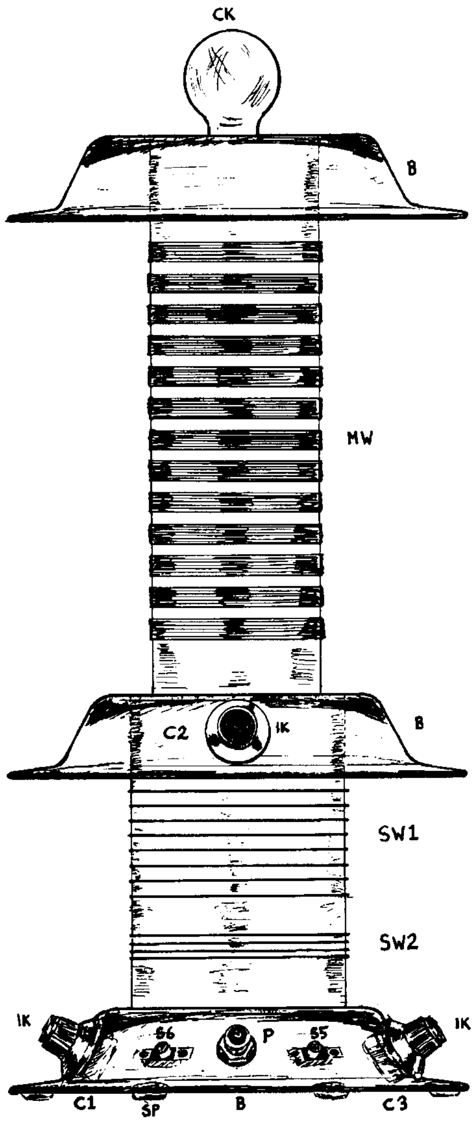
I felt I had gained some knowledge from a number of sets that I had built to explore in greater depth my own ideas and which I have used for the '2 Tier' set, the MW coil I have space wound a principle which comes from reading about LW coils and pile winding to help reduce capacitance and increase the 'Q'? I thought if I apply this to my MW coil it may help increase the 'Q' there are 3 PVC dielectric gang variables used , 15 - 160 pf for ground,13 - 551 pf for MW tuning and 22 - 225 pf for SW, I have used 2x 1N60 Ge-Di AM 40v 50ma diodes, 1 for MW and the other for SW. Tuning on MW is very sharp I can tune from one loud station move about 1mm and tune to another station without any ghosting. I carried out some tests in my original location with untuned antenna and the local station came in about 359mV, station 8.75 kms away, another station 153 kms away registered 2.2mV. There is much improvement with a very good tuned antenna and better grounding. SW - I wound 2 coils to help cover a good range.

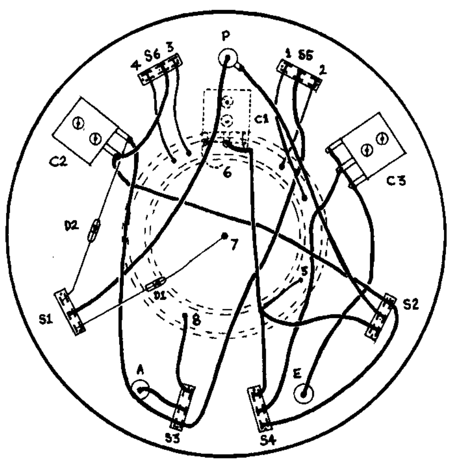
Structure
3 acrylic plates, acrylic tube, acrylic cupboard knob.

Full Wave detection crystal Set
The circuit for this set came from a small book 'Electronics Simplified - Crystal Set Construction' by F. A. Wilson, pub by Bernard Babani, England. I measured every little detail to make sure everything mirrored each other, 2x OA47 measured to find 2 reading the same mA reading, both coils wound to read the same mH reading,this crystal set drives a speaker horn which registers about 50 to 60 db using a sound meter at 200mm in front of horn.

Structure
2 x acrylic bowls,acrylic tube and the tuning knobs I turned from acrylic rod.

I have a number of high impedance headphone sets I use,I love the BTH 4600 ohm set which I use a lot , I have a set of Baldwin mica, Brush and have just acquired a set of Navy RCA sound powered, these are amazing.





'2 TIER' MW/SW Ge-Di Set,Parts List		
ITEM	**QTY**	**DESCRIPTION**
		—— ELECTRONIC ——
C1	1	15.2-159.3pf PVC dielectric,gang variable,TTWM *
C2	1	13-551pf PVC dielectric,gang variable,model PVC-2 J20T, MITSUMI ELEC.CO LTD**
C3	1	22.1-225pf PVC dielectric,gang variable,model PVC-20Y, MITSUMI ELEC.CO LTD**
D1,D2	2	1N60 Ge-Di AM 40V 50mA
S:123456	6	DPDT miniature slide switches,50VDC 0.5A
A,E,P,	3	RCA Gold plated single hole panel mount sockets
	29m	Magnet wire: .81mm ∅
	5m	Magnet wire: 1mm ∅
		—— CHASSIS ——
B	3	192mm ∅ Transparent Emerald green acrylic bowls
CK	1	39mm ∅ Clear acrylic cupboard knob
IK	3	26mm ∅ Aluminum indicator knurled edge knob
	6	2.5mmx5mm M/PAN Head zinc plated screws
	10	2mmx6mm M/PAN Head zinc plated screws
	3	2.5mmx10mm Lenghts of 6mm ∅ plastic knitting needle
SP	8	13mm ∅ clear vinyl self-adhesive surface pads
		—— ADHESIVE ——
		IPS WELD.ON#16 cement for Acrylic Loctite Permatex 5 minute E-POX-E glue
		—— MW INDUCTOR ——
MW		FORM:clear acrylic tube,3mm wall thickness,70mm ∅,230mm lenght WIRE:magnet wire .81mm ∅ INDUCTOR:165mmlenght TURNS:117 total DIODE TAP:22 ANTENNA TAP:54 13 BANKS of 9 turns each 5mm spacing between each Bank
		—— SW INDUCTORS ——
		FORM:clear acrylic tube,3mm wall thickness,89mm∅,131mm lenght WIRE:magnet wire 1mm ∅
SW1		**INDUCTOR#1**;45mm lenght TURNS:8 5mm spacing
SW2		**INDUCTOR#2**:10mm lenght TURNS:4 2mm spacing
		*measurement made with;Jaytech QM1572,**DCM** **GANGS have been coupled together,measurement made with; Jaytech QM1572,**DCM**

How do they work? Part 5. Wattmeters & energy (kWh) meters

by J Patrick Wilson

Wattmeters and kWh meters both work by producing a force or torque which is proportional to the instantaneous current multiplied by the instantaneous voltage. In the former case this torque is opposed by a spring and the power is indicated by a pointer as in ammeters and voltmeters. For kWh meters, however, it is opposed by a frictional force proportional to angular speed. Thus the greater the power, the greater the speed, and kWhs are measured by the number of rotations and indicated on a series of dials.

For DC there is no real need for a wattmeter as it is easy to measure current and voltage independently and take the product. For AC, however, this gives apparent power, VA, which equals the real power only when the load is purely resistive and the power factor unity ($P=VA\cos\phi$, where $\cos\phi$ is the power factor). It follows from this that a power meter must not introduce phase shifts in either the voltage or current inputs as this would produce errors becoming greater at low power factors. Such errors are most likely to be due to the inductance of the coils in an electrodynamometer but can also result from eddy currents in large pieces of metal close to the coils. These factors are of less importance in ammeters and voltmeters.

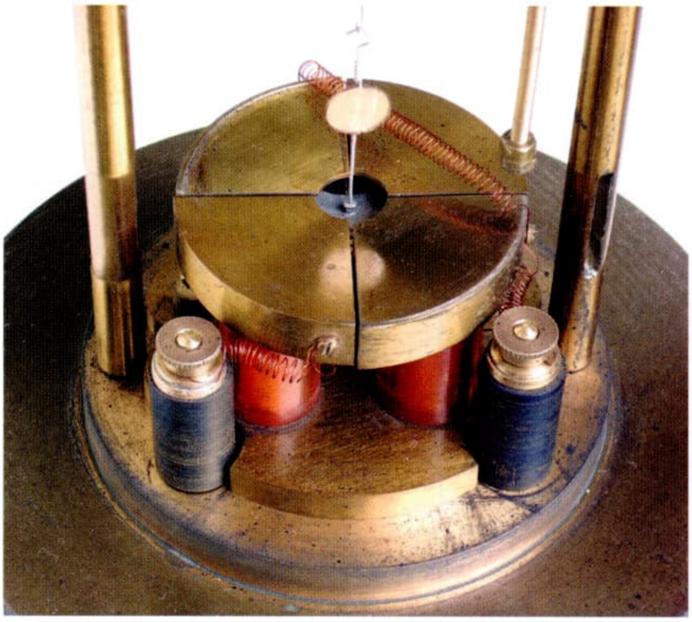


Fig.1: Quadrant Electrometer

Electrostatic power meter

Nearly all power or wattmeters are variations on the electrodynamometer but in 1867 William Thomson (later Lord Kelvin) devised the quadrant electrometer which it was later realised could be used to measure power. Fig.1 shows this device, already described in Part 2 (Fig.3, BVWS Bull. Vol.38 No.4). For a wattmeter the current is passed through a low resistance chosen to drop a volt or two which is fed to the pairs of cross-connected quadrants whilst the potential is applied between one quadrant, or preferably the mid point of the resistor, and the suspended aluminium 'butterfly' within the sectors. The torque on the butterfly is opposed by the very fine suspension and is proportional to the product of the potential difference between adjacent sectors and the higher potential between them and the butterfly. The response is fairly linear over the region where the butterfly bridges the gaps between sectors but sensitivity falls to zero when fully within a sector. The butterfly should therefore be positioned to give the greatest range of linear response and the mirror deflection read using lamp and scale. I have not yet come across a practical instrument based on this principle although I believe Hartmann & Braun produced one. With only a few pF capacitance it is excellent at high frequencies.

Siemens electrodynamic power meter

Weber invented the electrodynamometer in 1845 in which the compass needle of a tangent galvanometer was replaced by a small coil at right angles to the main coil. This was fed by a bifilar suspension so that the coil rises as it turns, providing a restoring force. Although it could have been used to measure power by passing the current

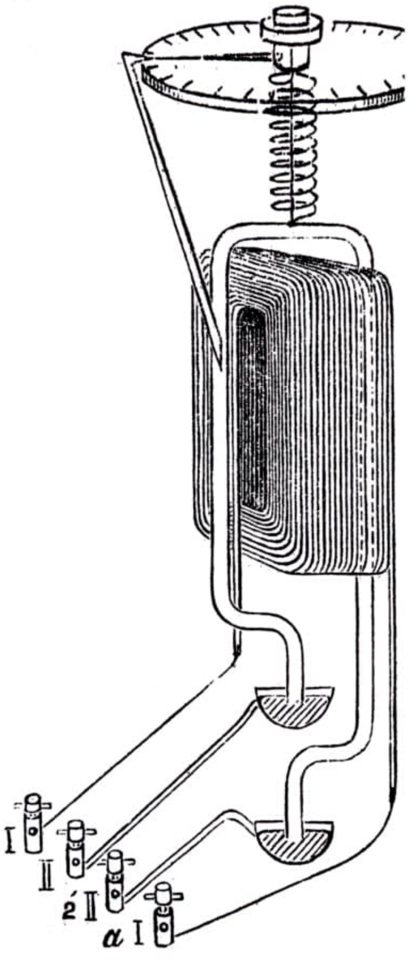


Fig.2a: Siemens Electrodynamometer

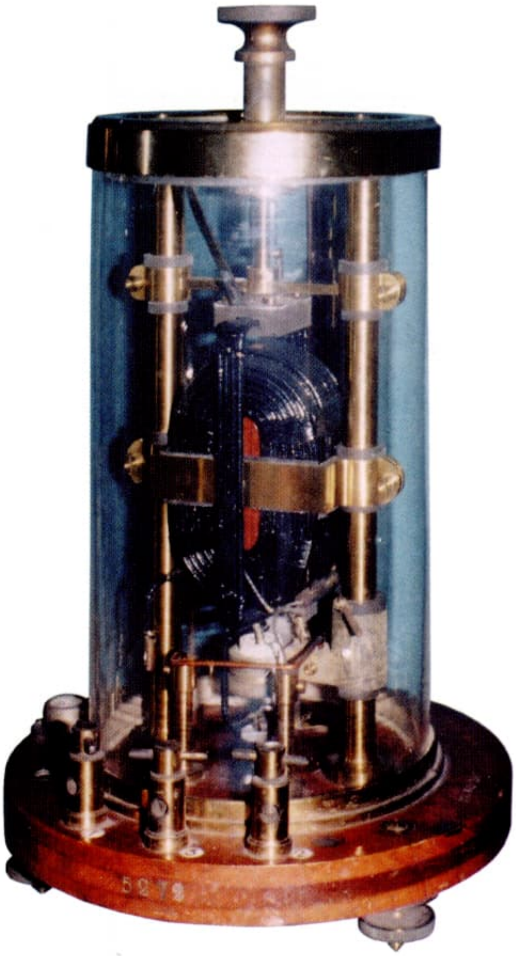


Fig.2b

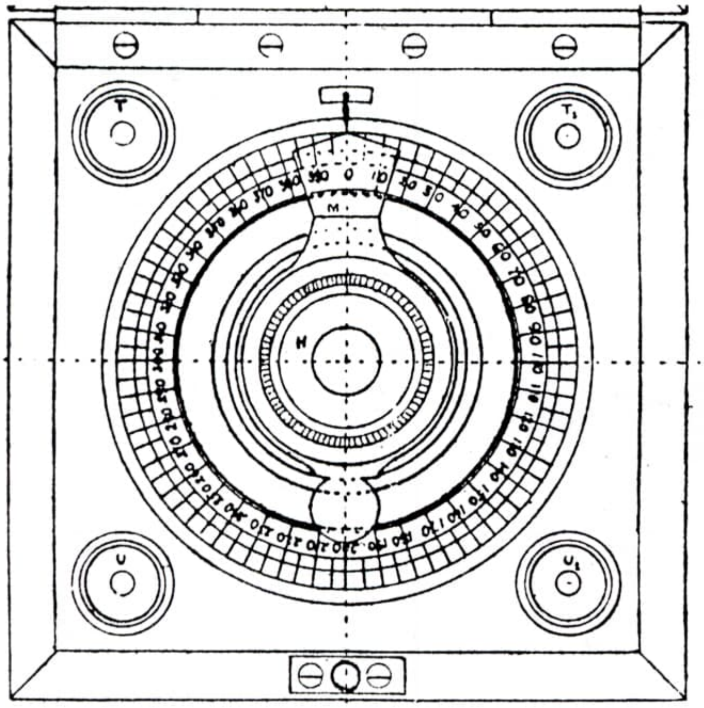


Fig.3a: Fleming & Gimingham wattmeter

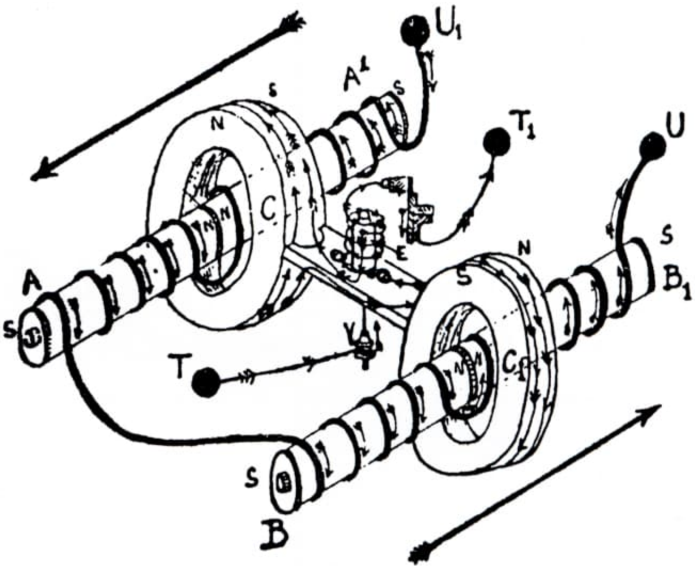


Fig.3b

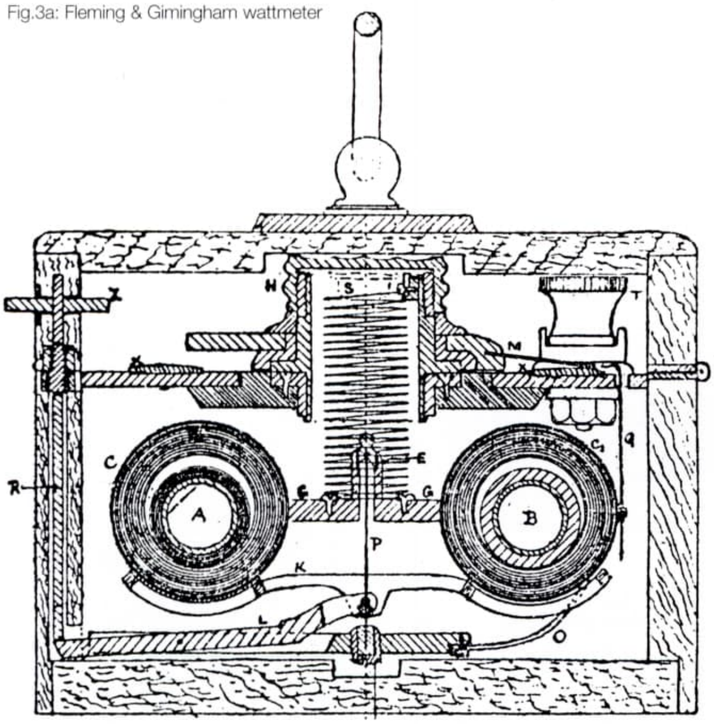


Fig.3b

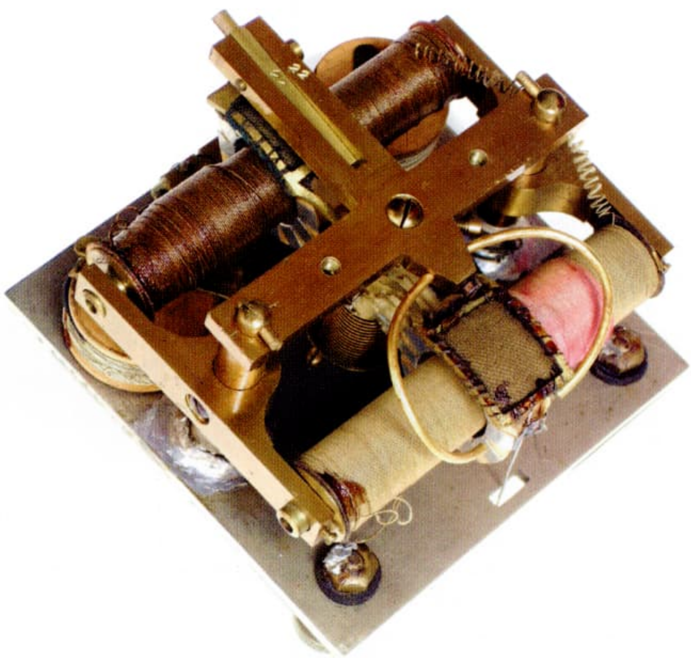


Fig.3d

through one coil and applying the voltage to the other via a swamp resistance, there was no application for this in that era.

In 1877 Siemens & Halske introduced ammeters and voltmeters based on the dynamometer principle (see Part 1, Fig.6), but it was not until 1882 that William Siemens suggested the name 'watt' and the following year introduced a wattmeter version (Fig.2a) of the same instrument. In this the voltage coil is fixed with many turns of fine German silver wire whilst the suspended current coil was a single turn of thick copper wire whose ends dipped into mercury filled cups below. An index pointer attached to the suspended coil showed when the two coils were at right angles. The upper end of the suspension was fastened to a second pointer moving over a degree scale and set to indicate zero when no current was flowing. On applying power the index pointer is deflected and then brought back to zero by rotating the second pointer. A calibration table then gave the power in watts and in horsepower. Fig.2b shows a later (ammeter) version of this instrument in the Whipple Museum.

Fleming & Gimingham wattmeter

Fig.3 shows a design introduced in 1887 and is seen in Fig.3d in the voltmeter form described in Part 2 (Fig.18). The main differences being the provision of two extra terminals and the use of a linear scale (Fig.3a). Fig.3b&c shows the thick current windings on the two parallel solenoids whose direction is reversed at their centres to give radial fluxes through the two suspended voltage coils wound with many turns of fine German silver wire. The coupled moving coils are suspended by a cup on an iridium point, which provides the voltage return, and controlled and fed by a large helical spring. As the fixed solenoids are wound in the same sense and the suspended coils wound oppositely, they both produce torque in the same direction but are astatic to external fields. Although the voltage version reads correctly on AC with brass formers for the solenoids, it is not known whether these pose a problem in a wattmeter. The pointer turning the spring has to be rotated to keep the coil index on its mark (seen above the 0° mark in Fig.3a) as in the Siemens and is not restricted to 360°.

Weston wattmeter

(Fig.4, 19x24x10, box 27x27x16, 13cm non-linear mirror-backed scale 0-150W, calibration certificate No.366, Aug.19 1895, 1/2 of 1%, 150V max, 2A max, volt coil 2778.3Ω, field coil 0.033Ω (0.3Ω measured)). Edward Weston patented his design for a wattmeter in

Fig.4a: Weston wattmeter

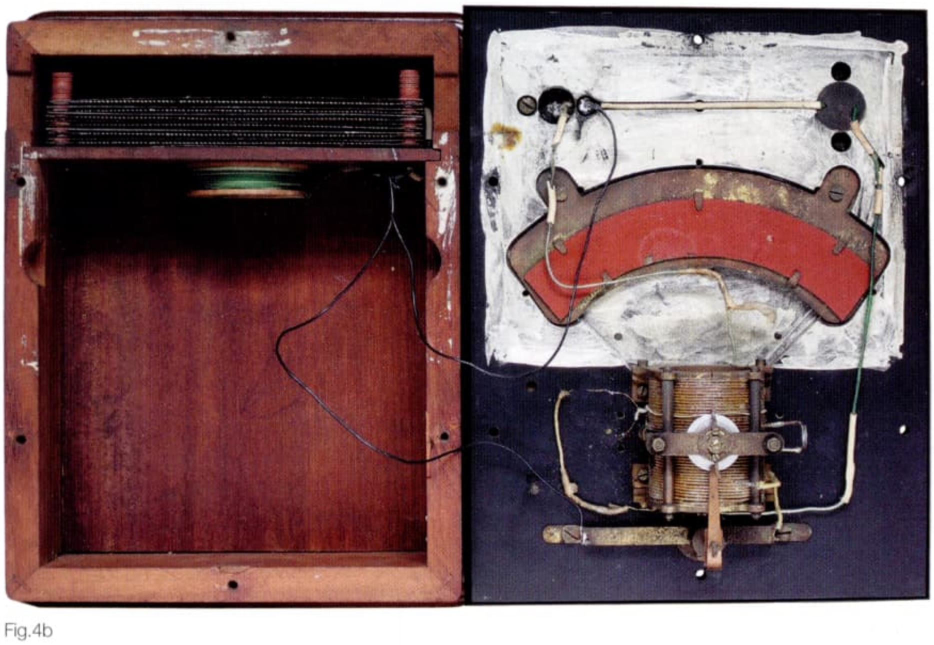


Fig.4b

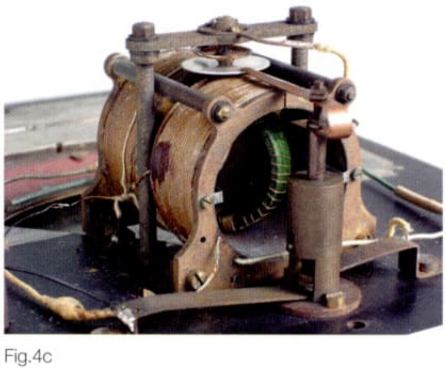


Fig.4c

1890 and most later manufacturers followed this pattern. This instrument is complete with instructions, mains leads for left socket with adapters for Edison, Thomson Houston, and Westinghouse lamp sockets, and sockets for Edison and Westinghouse lamps on right. Surprisingly after nearly 120 years the cotton covered rubber leads are still in good condition.

Fig.4c shows the two fixed field coils with the green voltage coil within and positioned for maximum deflection to give the best view. The coil and pointer are set so that the orthogonal position of the coil, giving greatest sensitivity, occurs at about 30% fsd, i.e. 50W. In the foreground is seen the press switch mechanism and movement clamp pressing on the aluminium disc. Voltage is not applied to the moving coil until the button is pressed and upon release the reading is retained.

The instrument is wired so that the current coils also carry the current of the voltage circuit but its magnetic effect is cancelled by opposing coils within the current coils through which the voltage coil current alone passes. This refinement is not necessary if voltage is measured from the supply side of the current coils which give very little voltage drop. The brass former is slit to avoid producing a shorted turn. The instrument was slightly out of spec reading about 1% too low. It is not astatic and instructions recommend reversing the currents and taking the mean.

Kelvin wattmeter

The Kelvin current balance of 1887 described in Part 1 (Fig.7) was, by 1894, available in a number of wattmeter versions extending up to 50kW. In these the moving voltage coils, at the ends of the balance, were wound oppositely with fine wire to be astatic (described incorrectly in Part 1). The fixed current coils of thick copper are wound in the same direction above and opposite direction below them, thus lifting on one side and lowering on the other. This force is counterbalanced by sliding weights with pointer and scale. As it requires careful levelling and balancing it is suitable more for laboratory use and the calibration of other instruments.

In the early 1900s, Kelvin, Bottomley & Baird Ltd introduced their Astatic Wattmeter (Fig.5, courtesy of Geoff Tomlin). This instrument (in effect two stacked and opposed Weston type wattmeters) can also be considered as an adaptation of the astatic galvanometer (Part 1, Fig.4) in which the magnets are replaced by moving coils in series and fed via hair springs. These are pivot-mounted on a vertical spindle with pointer and mirror-backed scale marked 0-100W and wired in series with swamp resistors for the voltage ranges. These are connected to the three terminals at the front for 100, 200 or 400V maximum.

Both moving coils are encompassed by a pair of current coils. Each pair is wired in the same direction so their fields add, but the top pair being opposite to the bottom pair. Current is fed to the brass terminals behind the insulated voltage terminals and also forms the return for potential. With the three diamond plugs inserted, the current coils are shorted. With the two outer ones removed the coils are in series for 1A max, and measuring 100, 200 or 400W and with the central one only removed they are wired in parallel at 2A max, for 200, 400 or 800W. One pair of coils is between the first and third brass segments and the other between second and fourth. As the scale is most open around the 45% region this is where the moving and fixed coils will be orthogonal.

Duddell-Mather standard wattmeter

Fig.6 shows an astatic design similar in principle to the Kelvin one, but using rectangular coils and instead of being direct reading, the pointer is kept at zero by the calibrated rotating head in the manner of the Siemens and Fleming & Gimingham instruments. Fig.6a is from the Robt. W Paul 1912 catalogue and the wood and glass panelled model in the Science Museum, Fig.6b, appears to be slightly earlier. The index pointer can be seen in the white area. The plug box is a commutator to connect the multifilar current windings in various series-parallel combinations and may also incorporate alternative voltage ranges.

Fig.5: Kelvin's Astatic Wattmeter

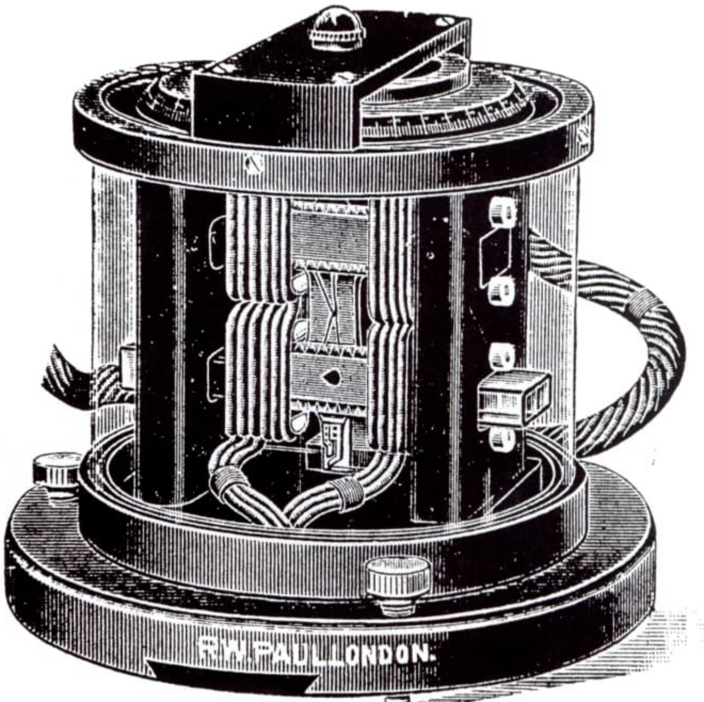


Fig.6a: Duddell-Mather Wattmeters by Robt W Paul

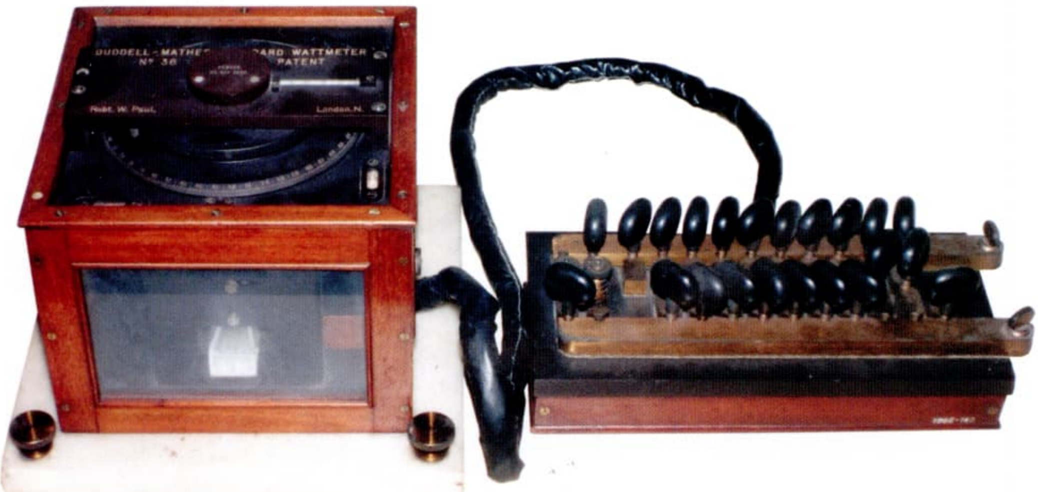


Fig.6b

Fig.7a: Irwin Astatic Dynamometer by Robt W Paul

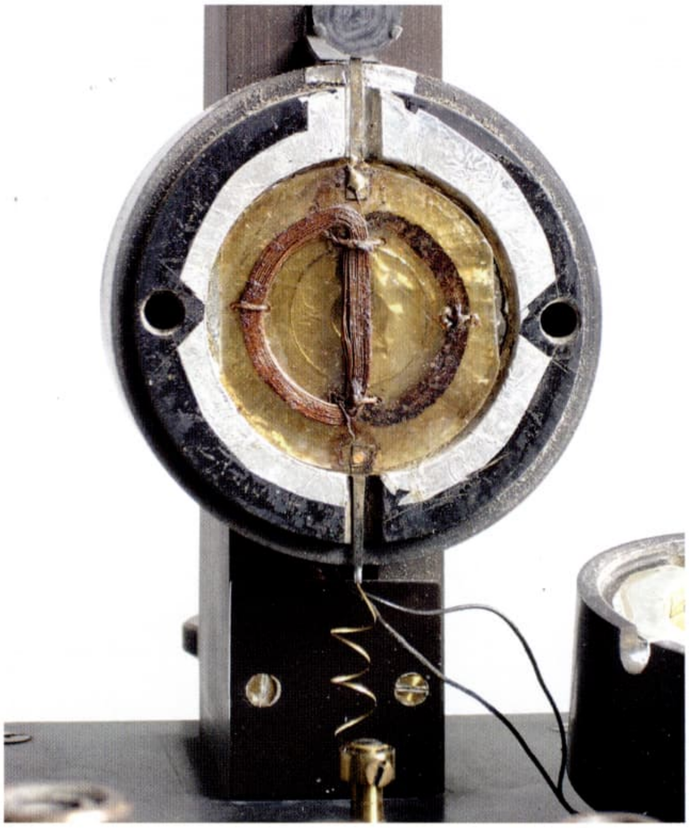


Fig.7b

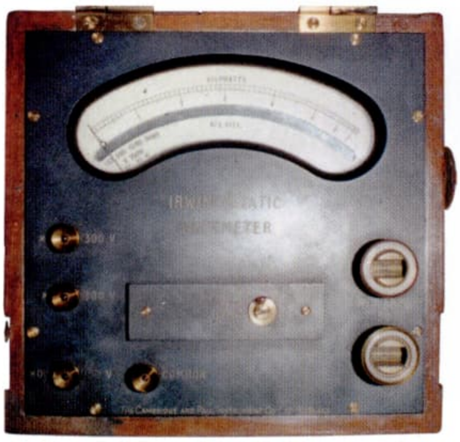


Fig.8: Irwin Astatic wattmeter by Cambridge & Paul

Fig.9: Elliott wattmeter Type PP

Irwin astatic wattmeter

Fig.7 shows the Irwin astatic mirror dynamometer (18x18x21, fixed coils 628 turns (5.3Ω), 0.4A max; moving coil 150 turns (18.5Ω), 0.1A max, Robt. W Paul, London N, No.19). Unlike the Weston or Kelvin instruments, the fixed coils embracing the moving coil are wound oppositely so that like poles face each other giving a radial field as in the Fleming & Gimingham and, of course, as in a moving coil loudspeaker. If, like a loudspeaker, the moving coil were circular it would simply move backward and forward. As seen in Fig.7b it is in fact made up of two back-to-back 'D' shaped coils, the one facing left being mounted on the front of a mica disc, and the other behind. Current entering through the top suspension wire passes down the spine of the left 'D', clockwise round the coil, leaving through the disc to travel anticlockwise round the right 'D' and leaving through the bottom suspension. Thus the current path, like a figure '8' on its side, is downwards through the spines and upwards on the outer limbs. The fixed coils are set into the ebonite case behind the foil electrostatic screening. When energised, one half circle is pulled forward and the other backwards, exerting torque. The mica disc also provides air damping. The maximum range of movement of ±12° (±24° reflected) is achieved with 38mA passing through both coils. As a power meter it would give a greater range with the zero offset as its direction will be invariant with respect to supply.

A portable direct reading version in the Science Museum, again by Robt. W Paul, is shown in Fig.8. It has three ranges with factors of x0.5 (3.75kW, 150V, 5kΩ), x1 (7.5kW, 300V, 10kΩ)(30mA), and x2 (15kW, 300V max, 20kΩ)(15mA) and single current range of 50A max. The greatest sensitivity occurs just below the 1kW mark.

Elliott wattmeter type P.P.

(20x23x16 excl. terminals, 13.5cm mirror-backed non-linear scale 0-750W, voltages 75 & 150V, currents 2.5A series, 5A parallel, AC & DC, Elliott Bros (London) Ltd, No.216389, Certificate: pressure windings 75V - 3651Ω; 150V - 7301Ω (20.5mA); current coil resistance 0.131Ω series, 0.0368Ω parallel, at 68°F; multiply readings by x0.5 (75V), x1 (150V), x0.5 (series), x1 (parallel); BSS 89 Grade Sub-Standard, 12 Feb 1936) This instrument (Fig.9) returns to a non-astatic design by including magnetic shielding and is basically the same instrument as the Elliott electrodynamic voltmeter described in Part 2, Fig.19. The scale is most open at 50%. It is scaled in a manner awkward to read with fsd of 187.5, 375 & 750W. It is accurate to within ±0.2% at half & full scale.

Elliott portable laboratory wattmeter

(24.5x32x23, 17cm angled scale 0-3.0W with light spot, taut suspension, dashpot damping, certificate: x0.5 - 30V, 2438Ω; x1 - 60V, 4876Ω; x2 - 120V, 9752Ω (12.3mA); series and parallel current coils 0.5 & 1A max, giving ranges of 1.5, 3, 6 & 12W, Elliott Bros (London) Ltd, Century Works, Lewisham, London SE13, No.A62744, for circuits where cosø=0.1, 0.6% of max scale at 20°C, 21.2.1953). Fig.10 is a mirror design with an internal lamp focusing a cross hair on to an angled scale As the mirror doubles the deflection, the scale is almost linear. After repair of the broken suspension it was found to read 7-8% too high with no obvious method of fine adjustment. The magnetic shielding can was also missing.

Weston wattmeter model 432
(13x13x8.5 bakelite case excl. terminals, 10cm mirror backed scale 0-30 & 0-60W, 150V 8,590Ω; 300V 17,180Ω (17.5mA); 1A LPF, Weston Electrical Instrument Corp, Newark, NJ, USA, No.5306). Fig. 11 is another standard type electrodynamometer closely enclosed by a shield of stacked laminations which may also increase the sensitivity by shortening the magnetic circuit. As both the moving coil and swamp resistors are open circuit no measurements were possible.

Cambridge multi range wattmeter
(26x33x15, 17cm linear mirror backed scale 0-25W, voltage ranges: 50, 100, 125, 250 & 500V (x1, x2, x2.5, x5 & x10)(6mA); current: 0.5A (1.34Ω), 1A (0.35Ω), 2.5A (0.13Ω) & 5A (0.03Ω)(x1, x2, x5 & x10); moving coil reverse switch, Cambridge Instrument Co Ltd, England, No.L 297 353, BSS 89 Grade SS). This instrument (Fig.12) is interesting because, like the Cambridge voltmeter described in Part 2 (Fig.20), it is effectively a moving coil instrument in which the permanent magnet has been replaced by an electromagnet energised by the current coil. Thus the response is linear and the sensitivity higher than in a non-ferrous dynamometer. Fig.12c shows the multifilar wound current solenoid, with poles top and bottom, embraced by the moving coil with internal pivots, and an outer laminated cylinder completing the magnetic circuit. Thus the radial magnetic flux density should be constant over the range of the moving coil. Both hairsprings are on the pointer side of the movement. The current windings pass via the tag strips to the current commutator switch seen top left in Fig.12b, with the voltage selector switch behind the voltage swamps. The pointer action is rather sticky and reads about 2% low.

Fig.10a (below): Elliott Portable Laboratory Wattmeter

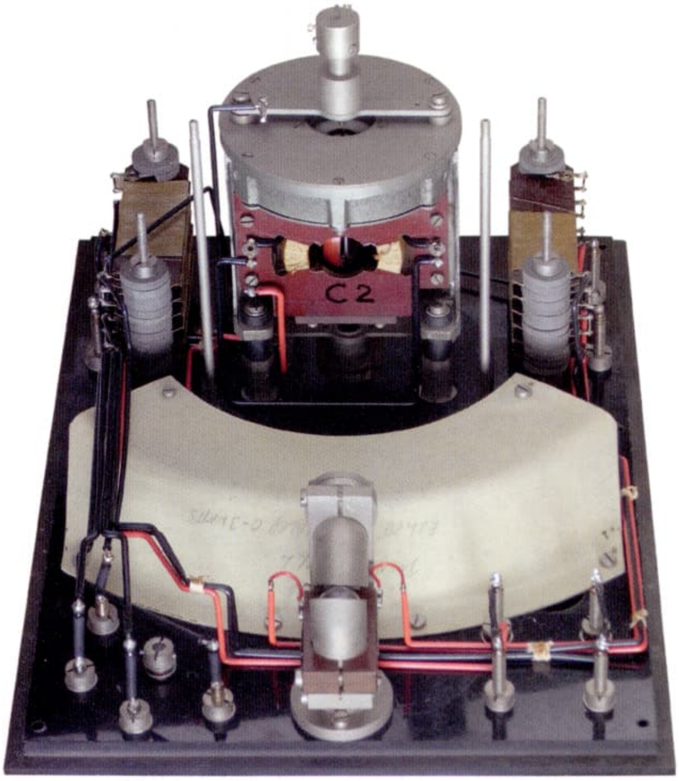


Fig.10b

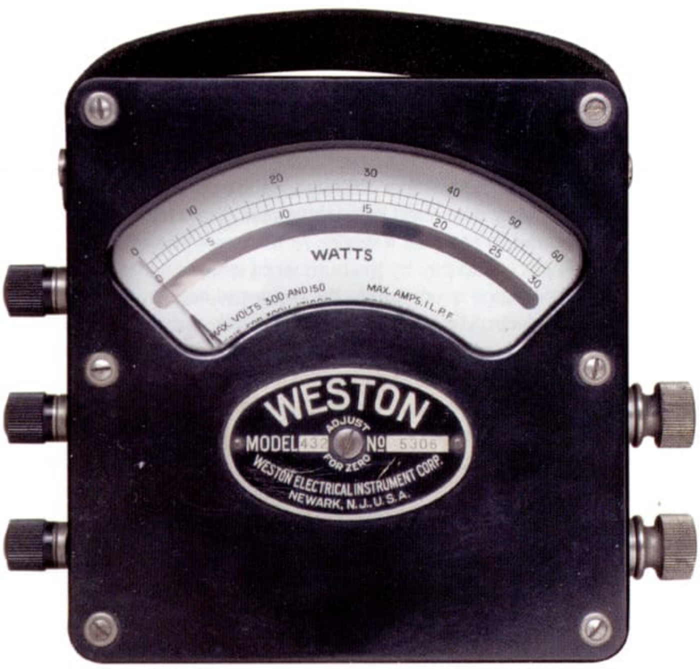


Fig.11a: Weston Wattmeter

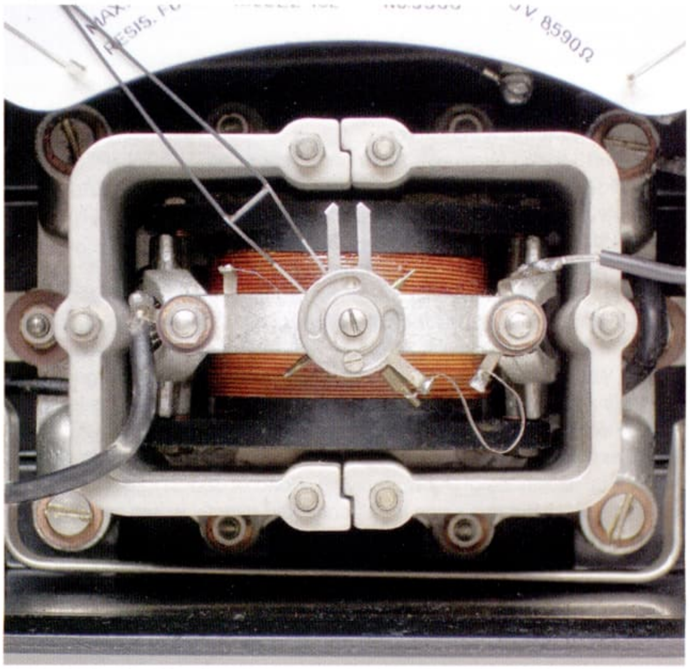


Fig.11b

Fig.12a: Cambridge Multi Range Wattmeter

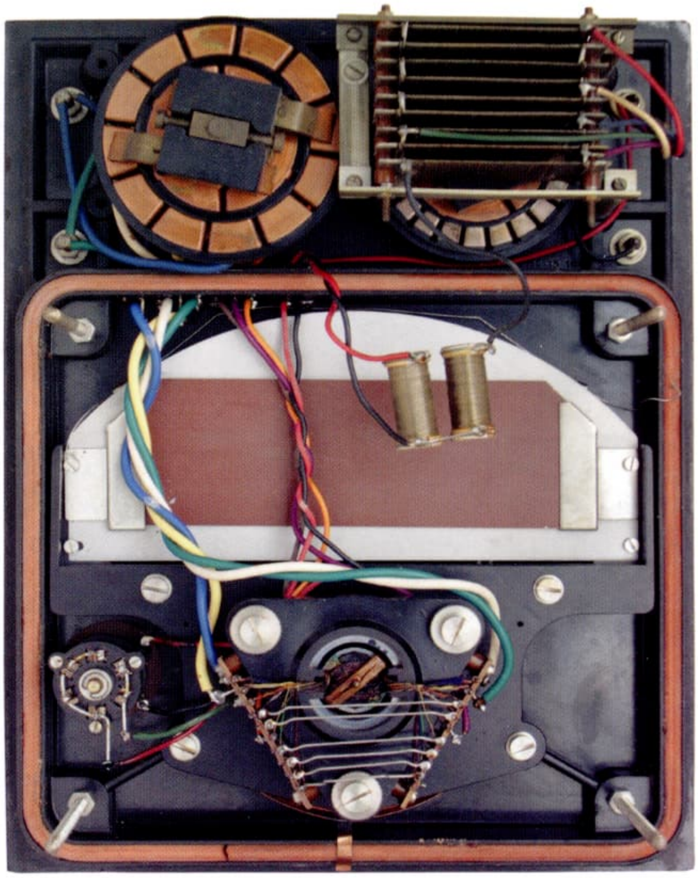


Fig.12b

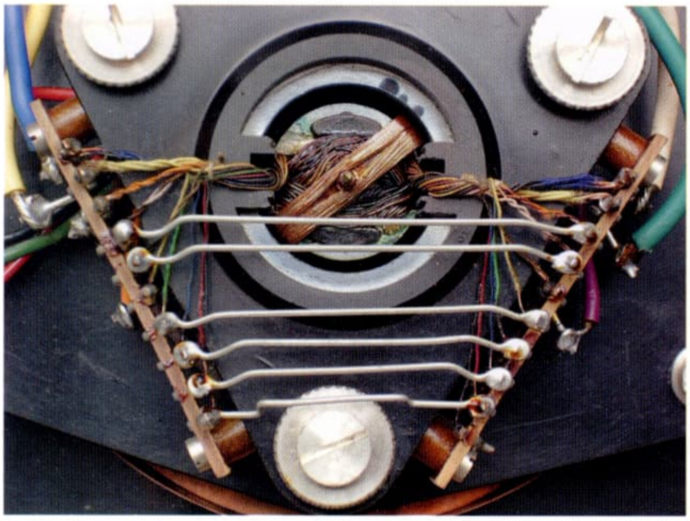


Fig.12c

Everett Edgcumbe wattmeter

(20x33-5x13.5 excl terminals, 13cm non-linear scale 0-150W, voltage circuit 8kΩ, 300V max; current coils - series 37Ω, 0.5A max, 75W; series-parallel 9.25Ω, 1A max, 150W; parallel 2.32Ω, 2A max, 300W; Everett Edgcumbe London, Single Phase Type H.P., No.509585).

This instrument (Fig.13) again follows the Weston pattern but has been wound with rather thin wire so that at maximum current a significant voltage drop occurs across the current coils (18.5V series, 9.25V series-parallel, 4.64V parallel) which interferes with the measuremnt. Excepting the first Weston (see above), wattmeters are wired with the voltage terminals across the supply and the current coil in series with the load, thereby indicating the power being dissipated in the load plus that in the current coil. In the worst case (37Ω at 0.5A) 75W will be registered with a total resistance of 300Ω, implying a load of 300-37=263Ω, and supply of 150V. But this same load connected directly would actually consume 84.7W (13% error). By contrast for a voltage drop of 0.5V, typical of the other meters, the error would be only about 0.3% (Weston 0.6V@2A (but see above); Elliott PP 0.33V@2.5A, 0.18V@5A; Elliott Spot 0.45V@0.5A, 0.22V@1A; Cambridge 0.67V@0.5A to 0.15V@5A). Apart from this the Everett Edgcumbe over reads by about 1.5%.

Swinburne inductor type wattmeter

This late 19th century instrument (Fig.14) in some respects anticipated the Cambridge instrument and was available in ammeter, voltmeter or wattmeter versions. It is however an AC only device. 'IC' in Fig.14b is part of a rectangular laminated core around which the voltage coils 'C1' & 'C2' are wired in series forming the primary of a transformer which induces a current into the single rectangular shorted turn 'C4'. This is pivoted on its upper side and is free to rotate in the gap between the inner curved edge of the core and a central laminated limb which carries the current coil 'C3'. Thus it behaves like the lower half of the Cambridge movement with 'C3' acting like its central fixed coil, whilst the induced current in the moving turn derives from the voltage coils. Presumably 'C4' is hair spring controlled which would give a linear scale as a wattmeter. Fig.14a illustrates the voltmeter version which appears to follow a square law but, contrary to other electrodynamic meters, has its coils in parallel, and as an ammeter simply uses much thicker wire.

Energy meters

Energy comes in many different forms which can be converted from one type to another with varying efficiencies. It is a commodity which is bought and sold so it is important to meter it accurately.

Unlike the meters discussed so far, almost every household and business has an electricity meter although, as the threat of a £2 fine on the Ferranti meter described below intimates, the customer is not free to take it apart to see how it works. At the beginning of electricity supply customers would pay by the number of lamps installed, and the first attempts to charge according to the electricity actually consumed were based on electrolytic action. This was a silver, zinc, or mercury voltameter in which the amount of metal deposited could be weighed to calculate the number of ampere-hours supplied to the customer. As well as being restricted to DC, this did not depend upon voltage which, if low, benefited the supplier and, if high, the customer. This led to the development of true energy meters which were also easier to operate.

Aron clock-type electricity meter

In 1882 Ayrton & Perry suggested using a clock pendulum to meter electricity. The idea being that if a pendulum bob were magnetised vertically and a vertical solenoid placed below it, current through the coil would apply an upward or downward force on the bob adding to, or subtracting from, the force

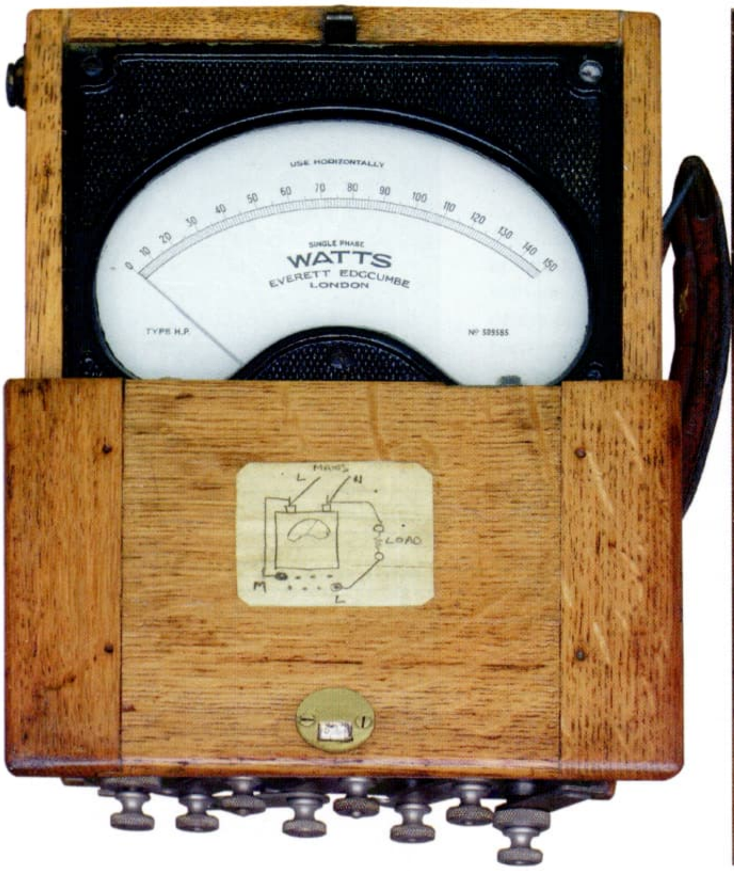


Fig.13a: Everett Edgcumbe wattmeter

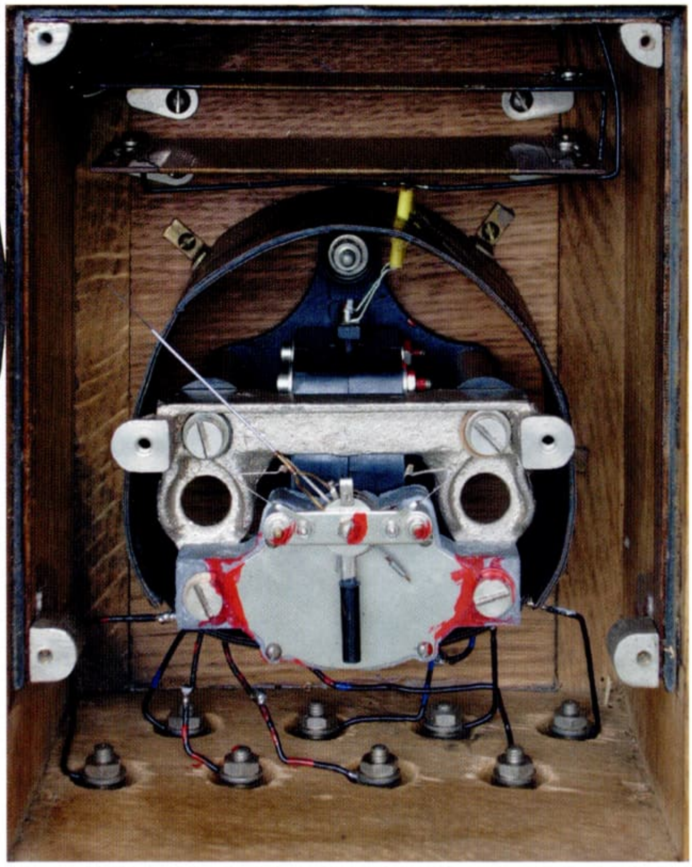


Fig.13b

of gravity. The frequency of a clock oscillation is given by the formula, $f = 1/2\pi(l/g)^{1/2}$ where l is pendulum length and g the gravitational acceleration force. Thus if g increases the clock gains, if l increases the clock loses. The time gained or lost during the measurement period becomes directly proportional to the total charge in coulombs (1 Ah = 3600 coulombs or amp-seconds).

By replacing the permanent magnetism of the bob by a vertical coil, fed from the voltage supply via a non inductive high resistance, they derived their 'Gaining Clock Joulemeter' measuring energy consumed. It should be stressed that the magnetic forces merely add to or subtract from the effects of gravity and play no part in driving the pendulum.

In 1888 Aron produced a practical amp-hour meter with a pair of clock movements so that the measurement clock could be compared with a reference pendulum using a differential gear between the two clock trains (Fig.15). Later, this was improved to become a kWh meter, and used coils on both pendulum bobs, one wired to increase the rate, whilst the other decreased it (Fig.16a). The design was, however, still sensitive to small errors which accumulate over time. The final version (Fig.16b) overcame this by reversing the voltage coils on both sides together with the differential gearing every ten minutes, and also used shorter pendulums.

Although this instrument is the most accurate over a wide range of loads and was for many years used as standard in power stations, it was expensive, difficult to set up, and required regular servicing.

Other Amp-Hour Meters

The Forbes instrument (Fig.17) actually bears more resemblance to a gas-meter than most electricity meters and evokes the improbable vision of a combined gas and electricity meter! It consists of two concentric thick copper rings bridged by a series of finer wires which become heated by the load current passing between the two rings, giving a convection up-draft which causes the thin angled mica blades to rotate. These are suspended from a paper cone connected to a series of gears and dials recording the number of revolutions. The Schallenberger meter (Fig.18) is a type of induction motor (see below) in which the heavy current coils 'c' induce a phase-retarded current into a short-circuited coil 'b' set at about 45°, thus generating a rotating field in this region. This drags a thin iron disc around its pivoted axis and is controlled by the air friction of four light vanes 'd&e' below. The number of rotations is recorded by the gears and dials above. This and most of the following meters work only on AC.

The Wright-Ferranti meter (Fig.19) is essentially a shaded pole induction motor whose speed is again controlled by air friction acting on radial mica vanes. It consists of two vertical solenoids through which a fraction of the load current is passed. The resulting flux passes along two laminated comma shaped pole pieces around each of which is wrapped four shorted copper bands giving progressively greater phase lag towards their points. This produces sectors of rotating flux some of which passes inward through a copper ring in which eddy currents are induced, dragging it round, and recording on a series of gears and dials.

Fig.14a: Swinburne Inductor–Type Wattmeter

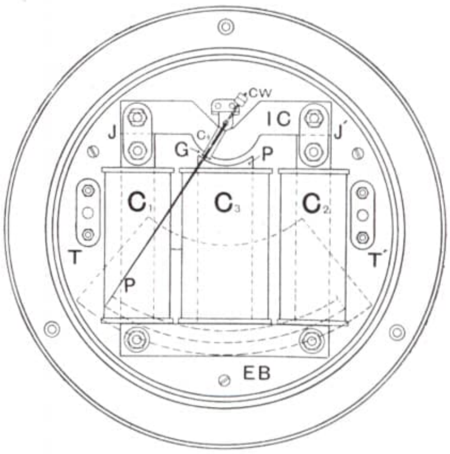


Fig.14b

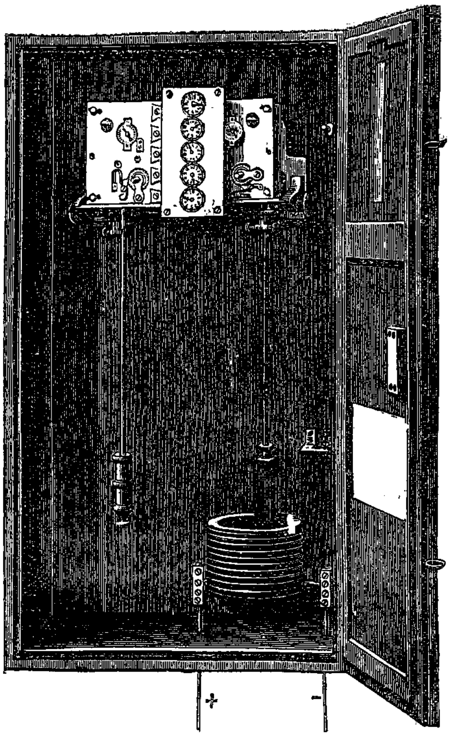


Fig.15: Aron clock-type amp-hour meter

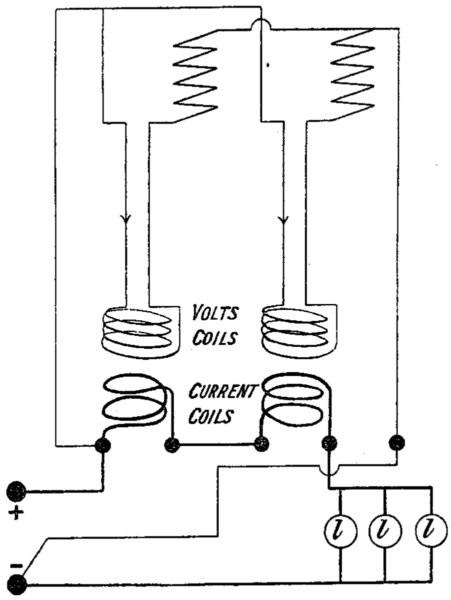


Fig.16a: Aron push-pull clock-type kWh meter

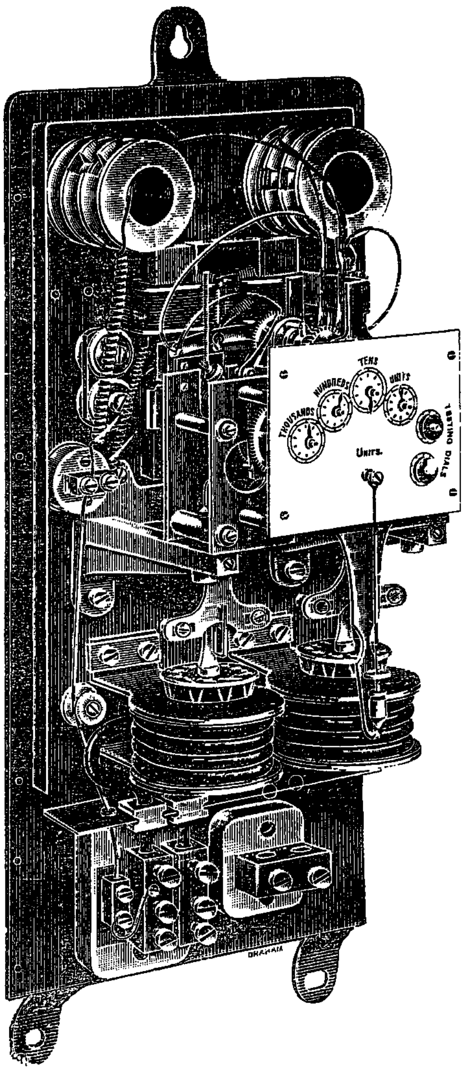


Fig.16b: Aron Reversing clock-type kWh meter

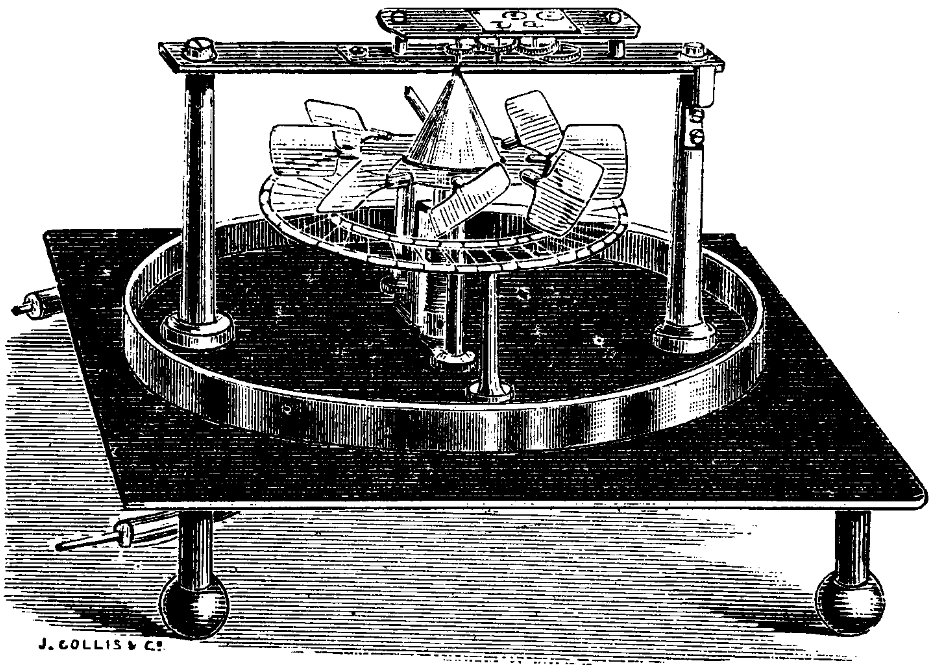


Fig.17 Forbes 'Windmill' amp-hour meter

Elihu Thomson motor meter

In the motor meter (Fig.20) there is a fixed pair of vertical coils of thick wire carrying the load current. At the centre lies a vertical armature with coils set at regular angles around the spindle and fed from a commutator to allow each coil in turn to react with the current coil when at right angles to it. Thus, like the wattmeter, the torque is proportional to the product of the two currents and therefore the power. The commutator is fed from the supply voltage via a large non inductive swamp resistance.

Without a mechanical load the armature would continue to accelerate as in a series motor. A braking force proportional to speed is provided by eddy current damping in an aluminium disc, below the coils, as it passes between the poles of a powerful magnet (or three magnets as illustrated). Above the coils the spindle carries a worm gear driving a clockwork train recording on a number of dials, the energy consumed. This meter like the Aron works equally well on AC or DC. The design must be linear for all loads, able to start on low loads, but not creep unloaded.

Mystery meter

Fig.21 was photographed at UCL during the Fleming Valve Centenary Conference in the hope that its workings would later become clear. It has dials on the right side and appears to be a French kWh meter but may record amp-hours. Is is possible that the black coils on the left enclose a motor meter whilst the large balance wheel, electrically driven, clockwork mechanism on the right serves some other function. Does anybody know how this magnificent instrument works?

Synchronous & induction motors

These can best be explained by reference to Fig.6 in Part 3 of this series. This 'model of a tangent ohmmeter' was originally constructed to illustrate how a synchronous electric motor, as used in a mains driven clock, works.
The two vertical coils were fed either from a sine/cosine potentiometer via two emitter followers or from a low frequency oscillator with quadrature outputs. This arrangement produces a horizontal magnetic field, which is the vector sum of the fields produced by the two coils, which remains constant in strength and rotates around a vertical axis. Thus when fed from the potentiometer the direction of the needle follows the direction of the sine/cosine potentiometer or when fed from the oscillator

it rotates at that frequency. Without inertia or friction the needle would remain in phase with the flux. With friction the needle lags behind although its speed of rotation remains the same. Once the phase lag exceeds 90° the torque will decrease, stalling the motor. In fact once up to speed it is possible to disconnect one coil without the needle stopping because the flux will then be increasing at the correct position in each cycle. Even with both coils the model will only self-start at low frequency. Most clock motors are multipolar giving correspondingly slower rotation of the spindle and, of course, should not be self-starting.

In an induction motor instead of a permanent magnet we have armature pole pieces with shorted turns around them forming a 'squirrel cage'. If the armature rotated at the same speed as the field no current would be induced in the squirrel cage, producing no magnetic driving force. The induction motor relies on the armature slipping behind the field, the greater the slip, the greater the magnetisation produced and the greater the driving torque. Thus a balance will occur between slip and mechanical load but the greatest efficiency is normally achieved with a slip of a few percent.

Induction type electricity meters
In the universal consumer unit of the induction type conditions are slightly different. There is no ferrous metal in the armature or rotor, which is a plain horizontal disc of aluminium through which flows a vertical magnetic flux generated by the voltage and current coils (Fig.22). This flux moves across the disc setting up circulating eddy currents which react with the flux and drag the disc. However, as the disc moves a vertical 'C' shaped permanent magnet at the opposite side produces eddy current braking controlling the speed so that this is proportional to the power being consumed. Even at maximum power the disc is dragged at a much lower speed than the traversing flux.

One can consider the driving pole structure either as one segment of a multipole field coil or like the rotating field model above cut through one of its voltage poles and opened out into a linear motor acting tangentially on the disc. The voltage coil has many turns wound on the central limb of a set of 'E' laminations and, being predominantly inductive, the current and magnetic flux lag the voltage by 90° with the outer limbs in opposite phase to the centre. In the current coils, however, the inductive reactance is negligible and the phases of its poles will be 0° and 180°. Thus there will be an orderly progression of phase across the array tending to drag the disc in this direction. Under no load conditions there will be no flux in the current poles and although there will still be flux in the voltage poles it will have no lateral motion. Any current flux will generate a lateral force whose *strength* is proportional to the product of voltage and current but whose *speed* is constant, taking 20ms (1/50Hz) to cross the array. It can be seen from this that if the load is either purely inductive or purely capacitive the two sets of poles will be in phase and there will be no driving force.

In practice the voltage coil will not be purely inductive and one or more of the poles will have adjustable shorted turns (not shown in Fig.22) to set them in exact quadrature as well as some adjustment for overall sensitivity. This is essential for the customer to be charged for the real power used and not for the reactive component, although industrial users can be penalised for reactive loads because these still cause power loss in the supply cables.

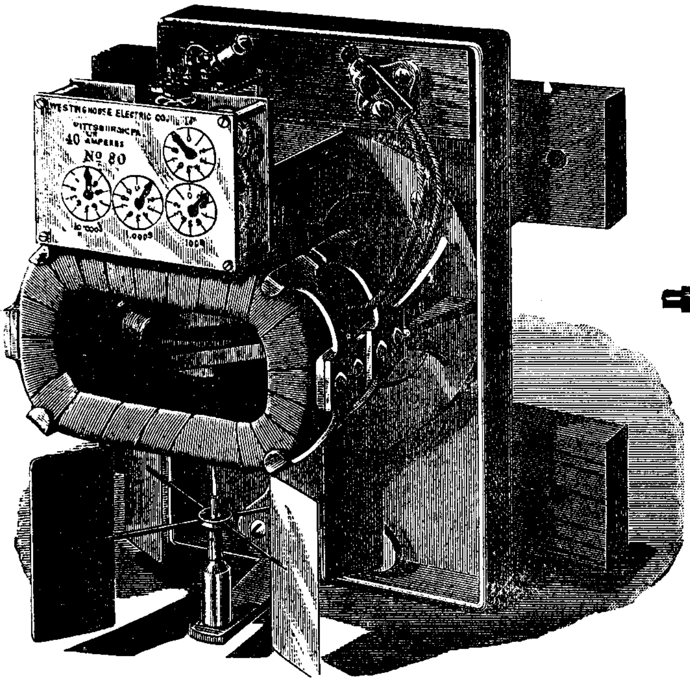


Fig.18a Schallenberger Inductor amp-hour meter

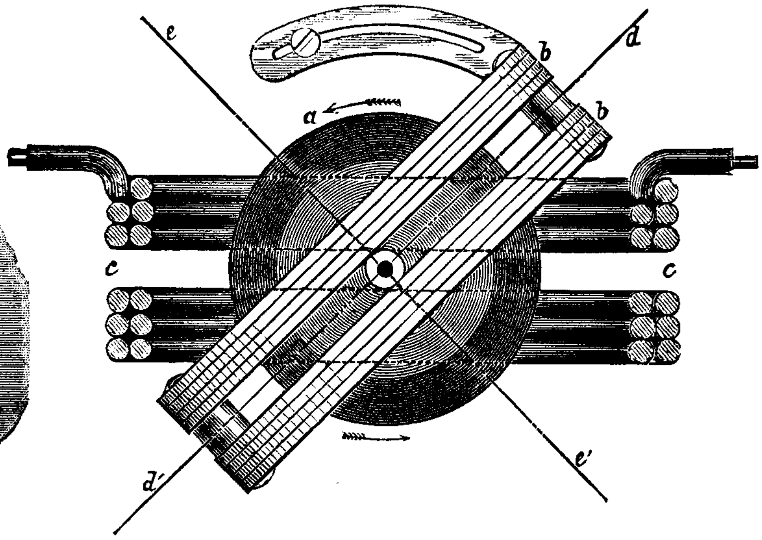


Fig.18b

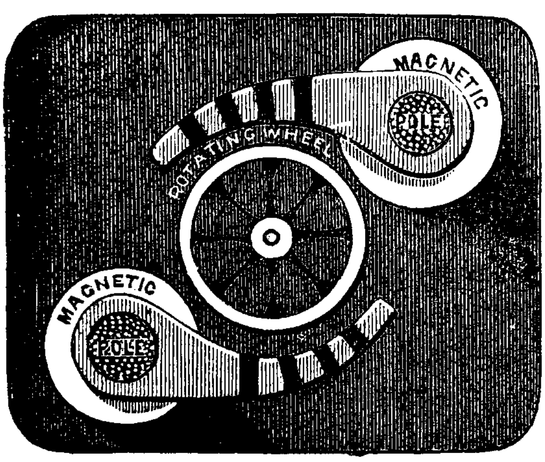
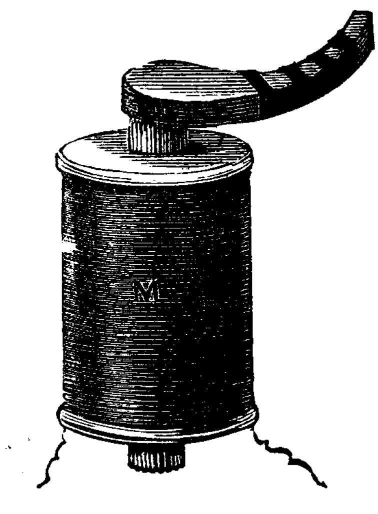


Fig.19 Wright-Ferranti amp-hour meter



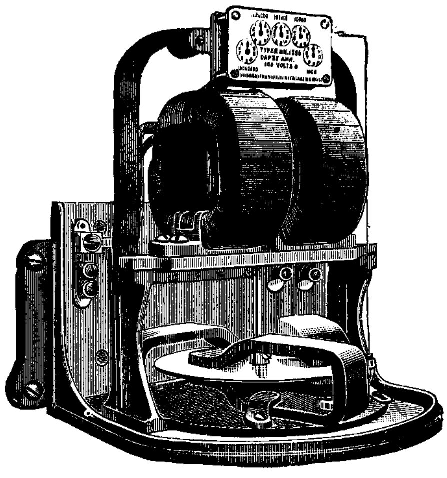


Fig.20: Elihu Thomson motor kWh meter

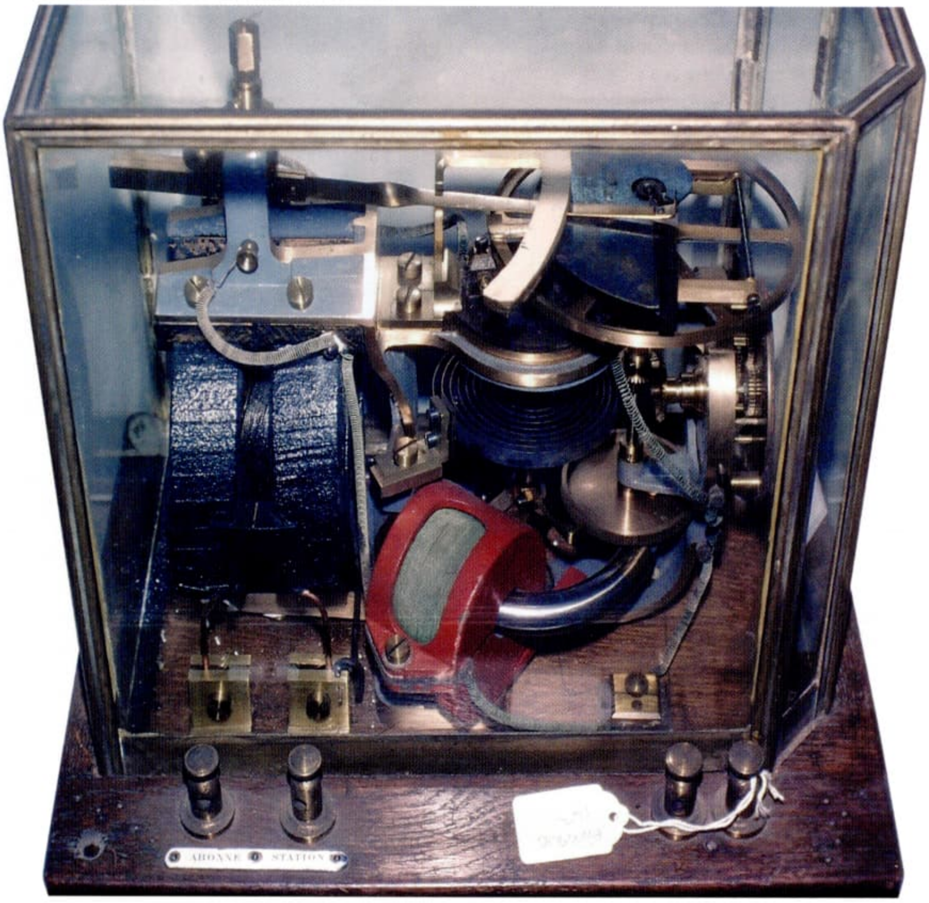


Fig. 21: (Left) Mystery kWh meter

Fig.22: (Below) Induction kWh meter

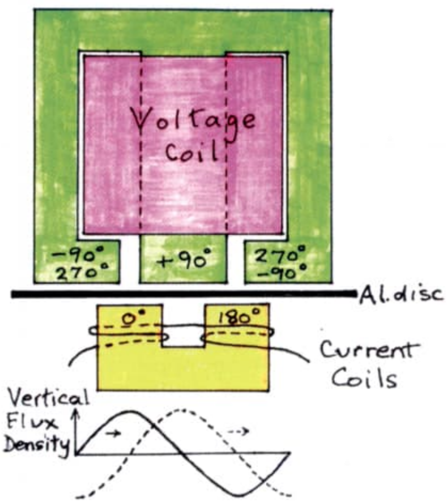


Fig. 23a: (Below) Ferranti 25A kWh meter

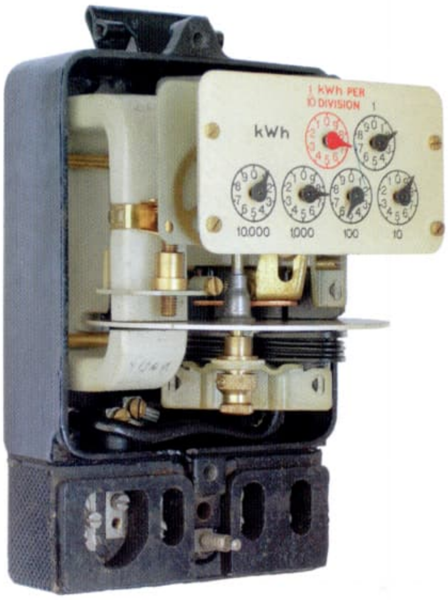


Fig. 23b (Below)

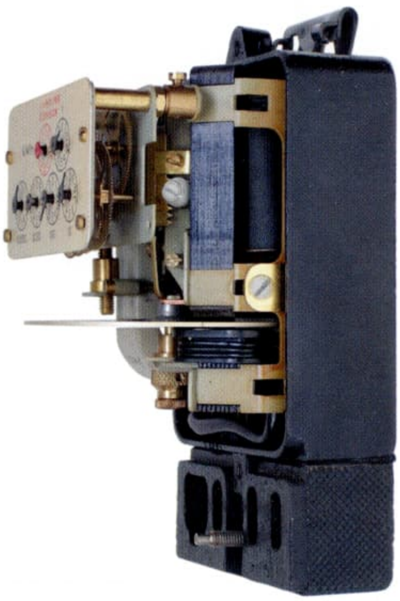
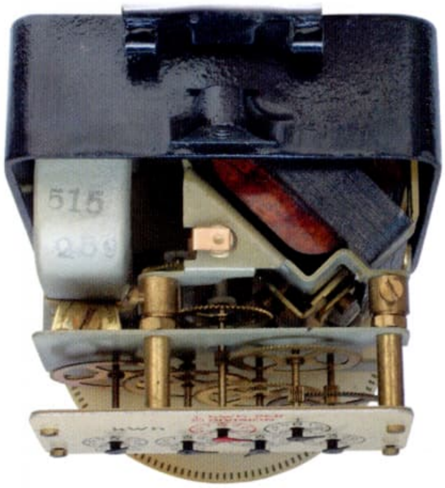


Fig. 23c (Below)



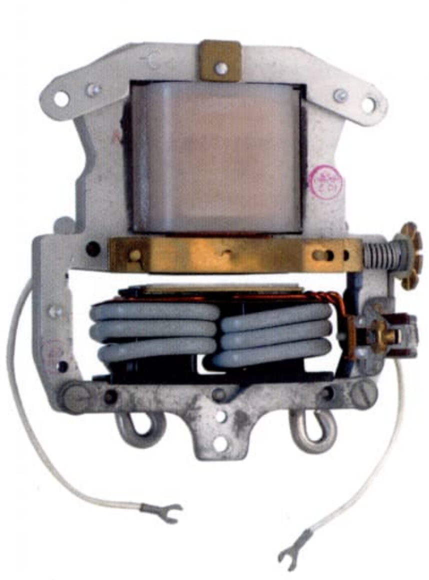


Fig. 24a: Sangamo-Weston 40A Floton kWh meter

Fig. 24b

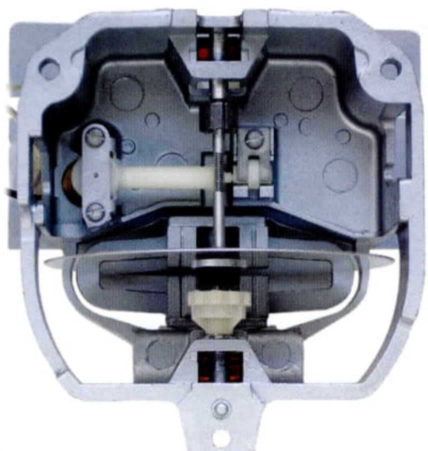


Fig. 24c

Ferranti 25A electricity meter

In 1955 I spent my summer vacation at the Hollinwood Meter Factory with a week in each section of their manufacture and assembly. I recollect the satisfying loud 'clunk' as the magnets were magnetised and how the hardened pivots were polished by tumbling for days in a small rotating drum. According to Mr Sebastian de Ferranti, whom I met 51 years later, this had been their most profitable works, but not I think, as a result of my efforts. I had assumed that their major profits lay in transformers, although not their distinctive intervalve transformers, but the gigantic three-phase ones hauled by multi-wheel low-loaders. But of course every good home has an electricity meter.

The Ferranti instrument (Fig.23) follows the pattern outlined above with a single solid copper phase-bending turn which can be adjusted in height by the white screw head just to the left of the voltage coil stampings in Fig.23b. The overall sensitivity is adjusted by a brass screw moving a magnetic shunt up or down the top permanent magnet pole (Fig.23a). At the 25A rated maximum load the disc turns only half a revolution per second whilst the flux speed will be about 11 revs/s, i.e., 95% slip.

Sangamo-Weston 40A floton meter

This is an ingenious design (Fig.24) in which the weight of the disc is frictionlessly supported by a pair of magnetically opposed ferrite rings, one within the white plastic cup (Fig.24b), the other seen in dark grey below the disc. The worm drive to the plastic wheel train is seen above the disc and will also take some of the weight as it rotates. The other difference from the previous instrument is that the stampings of the voltage and current coils are continuous, giving greater mechanical stability. It does, however, also alter the phase relationship between them so that the phase adjusting shorted turns are now the enamelled wire forming a figure-of-eight on the current poles. Their ends are attached to the ends of an arrow shaped piece of resistance material (Fig.24a and c) with a slot which can be bridged by a nut and bolt whose position along the slot can be adjusted.

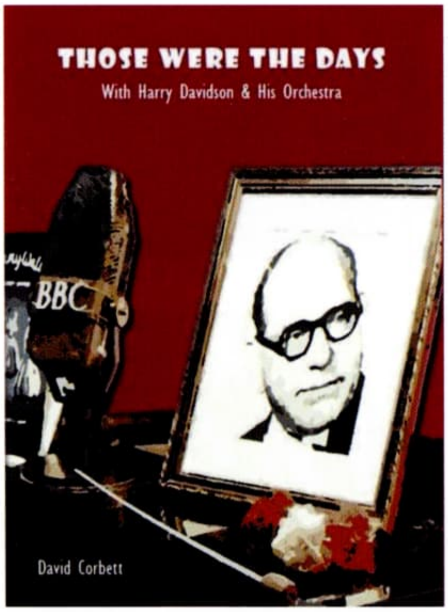
Overall sensitivity can be adjusted by moving the letter box shaped magnet supporting frame (Fig.24a) towards or away from the centre of the rotating disc. The current is connected to the two thick aluminium wire loops below the back of the instrument (Fig.24c) whilst the voltage is fed to the white wires with spade connectors. The three wires on the right seen in Fig.24a are from switch contacts operated by one of the clockwork wheels to indicate when to switch off the prepayment part of the instrument (not shown). Some types of induction meter have a short radial cut in the edge of the aluminium disc which is provided to prevent the instrument creeping under no load conditions.

Book review

Those Were The Days with Harry Davidson and his Orchestra

Author: David Corbett (2013)
YouCaxton Publications
ISBN 978-1-909644-12-0

Reviewed by Tony Clayden



It is quite a few years since the publication of Brian Reynolds' book ' Music While You Work – An Era In Broadcasting '. This recounts the story of that eponymous BBC 'institution' – together with several associated programmes- from the time when live light music was a mainstay of the Corporation's output. *[That situation was very different from today's radio broadcasting scenario, with its personality presenters, interminable pop records, and a distinct 'sameness ' - and lack of imagination- in its programming schedules].*

Inspired and encouraged by Brian Reynolds, David Corbett has recently produced this handsome new volume, chronicling the fortunes of yet another BBC phenomenon that achieved a great deal of popularity for nearly half-a-century, viz :- programmes of Old Time Dance Music. These commenced in the dark days of WWII and continued until the last decade of the Twentieth Century.

One is immediately struck by the sheer size and scope (and indeed weight!) of this book. Within its glossy A4 – size covers are contained no less than 606 pages – inclusive of a comprehensive index.

It is an amazing mine of information about the original 'Those Were The Days' programme on the Home Service/Radio 4, (subsequently moved to Radio 2), together with its rival siblings, 'Take Your Partners', ' Time For Old Time' and finally 'Sequence Time' on the Light Programme/Radio2.

TWTD came about almost by accident. Its progenitors, Fred Hartley (then Head of Light Music at the BBC) and one of his producers, Douglas Lawrence, (who would eventually occupy the same post), had, on a number of occasions, suggested an 'Old Time' dance music programme. The planners were not impressed –they didn't much like 'nostalgia programmes'! However, towards the end of 1943, a scheduled broadcast by the famous organist Reginald Foort had to be cancelled at short notice, (due to the non-availability of a suitable instrument), and to fill the gap, it was – albeit reluctantly - agreed that a hastily- arranged 'Old-Time' programme could go on air. This would take place on the evening of Tuesday November 2nd; to be broadcast from London on the BBC Forces Programme and compered by the well-known sports commentator Raymond Glendenning.

It seems that Hartley was very keen to engage Harry Davidson to be in charge of the music, and the latter's orchestra, (which had been regularly appearing on 'Music While You Work'), was augmented by extra strings. The venue was the Methodist Mission Hall, Marylebone, with BBC secretaries recruited to take part in the dancing . The show's title, 'Those Were The Days', was 'borrowed' from Osbert Sitwell's book on manners! The broadcast was a success, and following some further (intermittent) appearances, the programme was eventually accorded the status of a regular series in the schedules, this situation continuing until March 1971!

David Corbett charts in considerable detail the career of Harry Davidson. He had started in the music profession at the age of fifteen, pounding away on the piano in a Croydon cinema and worked his way up, firstly as an organist and then as Orchestra Director, in various UK cinemas, before becoming MD of the prestigious Commodore Grand Orchestra in Hammersmith. This had a regular weekly broadcast slot on the pre-WWII BBC National Programme and was also relayed via the Empire Service to Australia and the Far East. When Davidson retired in 1966, he had taken part in more than two- thousand live broadcasts.

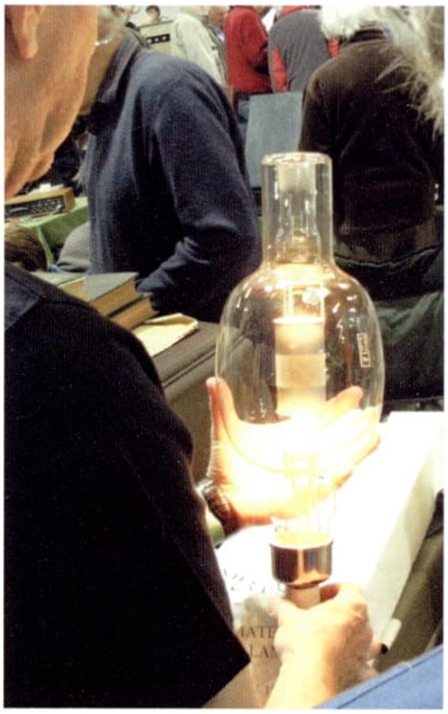
Later chapters concentrate on Harry Davidson's successors- Sidney Davey (his one-time pianist and deputy conductor) – Sydney Thompson, Sidney Bowman and finally Bryan Smith.

Here we have a real 'labour of love', which has been painstakingly researched by its author, who is an acknowledged authority on, and a passionate devotee of, his subject. He must have burned a good deal of 'midnight oil', (much of it, I suspect, at the BBC Archive at Caversham), to assemble such comprehensive programme information, together with listings of the personnel involved and the music performed.

Copiously illustrated, it describes how the character of that music changed over the years and how the popularity of 'Old Time' dancing developed and ultimately declined, eventually metamorphosing into modern ballroom dancing.

This magnificent book surely deserves a place on the shelves of all serious students of radio broadcasting, lovers of light music, and devotees of 'Old-Time' dancing.

NVCF 2014 photographed by Lesley Curwen




APPROVED TRADER
GREAT
BRITAIN
AND THE
MARCONI
VALVE

Werner Siemens and his contributions in the field of telegraphy

by Fons Vanden Berghen

The motivation for writing this article was the recent acquisition of a very rare and very special 'high-speed telegraph' that was made by the Siemens & Halske company and was used in the Crimean War. First I'm going to outline briefly a part of the life of Werner Siemens. Then I will explain in short his work in the field of telegraphy, thereby concentrating on his first telegraphs, which will bring me to the Crimean War. And finally I will show, with some small comments, pictures of different telegraphs made by Siemens & Halske.

A Little History

The globally known company of Siemens was founded by (Ernst) Werner Siemens, the fourth child of a family of fourteen. He was born on 13 December 1813 at Lenthe near Hannover. After his grammar school education he began graduate studies at the Prussian army's School of Artillery and Engineering in Berlin. After three years of ardent study he left this institution with the rank of lieutenant. In the autumn of 1840 he was transferred to the garrison at Wittenberg, where he could devote himself to scientific studies, making his first major discovery as early as 1842. He managed to develop a system that made it possible to silver and gild small metallic objects by electrolytic means and for which he got his first patent.

A little later he was transferred to the artillery workshops in Berlin. This move was decisive for his future career. Berlin then was one of the most beautiful capitals in Europe and offered many ways to relax. But Werner preferred to remain in the company of people who liked to enhance their knowledge of everything related to science and technology. So he spent whole evenings in the 'Physikalisches Institute' [Physics Institute].

In the army he was confronted with the problems of long distance communication (the word 'telecommunications' was not yet known at that time; it was first coined by Professor Edward Estaunié in 1904 in his book Traité Pratique de Télécommunication Electrique). Back in the 1840s Germany was using mechanical-optical telegraphs (semaphores, like the 'Pistor' system), whose drawbacks are well known. And Siemens, as a result of his research, learned about the existence in England of the electric ABC telegraph (also called dial telegraph) developed by William Cooke and Prof. Charles Wheatstone and which seemed to offer excellent opportunities. He started a project with a lot of assiduity to make a version of his own that avoided the major problem of the English telegraph, namely the great risk of losing synchronisation between the transmitter and the receiver (the same problem was present also in the dial telegraph by Louis Breguet in France). In 1846, when he was 30 years old, he could show an operational model to his friends of the 'Physikalische Gesellschaft' [Physical Society]. He had managed to solve the problem of synchronisation through the use of a simple principle already used in each electrical bell of that time!

One of his friends, (Johann) Georg Halske (1814-1890), a talented mechanical engineer, was so excited that he offered his services for the production of such telegraphs. Then, Werner Siemens, still active as an officer in the Prussian army, together with Georg Halske opened a small workshop in a rented house. And on October 1, 1847 the 'Siemens & Halske Telegraphen Bauanstalt' company was formally established. His nephew Werner Johann Georg Siemens, adviser to the royal court, took care of financial funding. A week later, Werner got a patent on his dial telegraph. Then in 1847 he was appointed by the Prussian army as a delegate of the 'Committee for Telegraphy', which was to pave the way for the conversion of the optical telegraph into the electric telegraph; a very interesting proposition indeed. Also in 1847 he developed a press tool for covering metallic cables with a sustainable insulating jacket of 'gutta-percha' (a kind of rubber). This latter invention proved later to be extremely valuable, particularly for submarine cables.

With these achievements and other testimonials it was not surprising that the young company Siemens & Halske was commissioned to install an important telegraph line, more than 500km long (the longest line at that moment in Europe). It had to interconnect Berlin, the seat of government, and Frankfurt, where the first parliament was located. The project was completed successfully and so the future of the young company was assured. Werner was also instructed in 1849 to extend this line to Cologne and Aachen, and then further down to Verviers in Belgium. The ultimate aim was to connect Berlin to London via Brussels and Paris. In 1850 France achieved a connection with England via the Calais-Dover cable and in 1851 Belgium was interlinked with France (the line Brussels-Paris). Note that the Ostend-Dover cable became operational 'only' in 1853.

Back to the year 1849. Involved in all those commercial activities, Werner Siemens found that combining these with a position in the army was becoming untenable, so he resigned for logical reasons. Early in 1850, on the occasion of the interconnection of the two networks, he received an invitation from the Belgian king Leopold I. He was to give a presentation on the electric telegraph at the royal court. But alas, it did not give commercial results; Belgium was too involved with Wheatstone and Cooke and continued using their needle telegraphs. The same year he went to Paris, where he could give a lecture at the Academy of Sciences on the same subject as in Brussels. He earned the admiration of all present and also got an interview with Louis Breguet, the authorised provider of telegraphs to the French administration. So he achieved no commercial results here either. In 1851 he went with his brother Wilhelm (who later on called himself William, see below) at the first world exhibition that was held in London's Crystal Palace (built especially for that occasion in Hyde Park). There they received the highest distinction, the Gold Medal awarded by the Council of the Society of Arts, for their dial telegraph, which was well deserved.

When competition arose in Germany, Werner Siemens turned his gaze to the vastness of Russia, which he considered should certainly have communication problems to be solved by 'modern means'. He went on a long trip, made mostly in stage coaches and troikas, to the distant city of St. Petersburg, where Tsar Nicolas resided. He succeeded in obtaining an order to install a line between St. Petersburg and Kronstadt. He put his brother Carl at the head of the team that had to build this line and to connect the telegraph apparatus. In 1855 he established an independent subsidiary in St. Petersburg under the direction of Carl. Later in 1880, he built a factory for the manufacturing of cables and telegraph equipment.

In 1854 the Crimean War broke out. Use of the electric telegraph was slow in being assimilated into military planning, and had to await the urgent requirements of the Crimean campaign in 1854-56, at a time when its commercial use was already well established. For the allies — Britain, France (under Napoleon III), Sardinia and Turkey — a major aim of this war was to check the expansion of Russia towards Constantinople (now Istanbul), and preventing the disintegrating Ottoman Empire from falling within the Russian sphere of influence. To

this end, capturing the Russian naval base at Sevastopol near the Black Sea was seen as an essential first step. Even before the start of the campaign the Russians held the advantage in communications since a working semaphore system, based on the Chappe system, was in place between their headquarters in Moscow and Sevastopol. (A little reminder, we know from the Crimean War the heroine Florence Nightingale, 'the lady with the lamp'; and it was also the first war in which newspapers reported in detail to the homelands by telegraph. But these are stories for another time…)

In early 1854 the Russians placed an order with Siemens & Halske to construct, as quickly as possible, an overhead telegraph line from Warsaw to St. Petersburg. This was followed by extensions in the north and by a long extension in the south from St. Petersburg to Odessa and Sevastopol on the Black Sea. This telegraph network now covered a total distance of 10,000km, extending from present-day Poland and Finland down to the Crimean Peninsula (see the map). These lines, completed by 1855, were of considerable assistance to the Russian authorities in controlling the movement of troops and war material, and, not least, in enabling direct communication with Berlin to arrange for the shipment of heavy war equipment from Germany. The high-speed telegraph from Siemens & Halske, my latest acquisition, which I will describe below, was the standard equipment on this huge network. The allies began installing telegraph circuits only in 1855. The French arranged for a 'mobile' network that could follow the movement of the troops. The English laid a submarine cable of 550km on the bottom of the Black Sea between Varna (Bulgaria) and Sevastopol. Also, and with the help of the French telegraph regiment, they built a connection to London (the War Office) and Paris, making use of the existing Austrian network.

Siemens & Halske had established a representative office in London already in 1850. This situation came to an end with the creation of its own subsidiary in 1858 under the direction of Wilhelm Siemens who as of then named himself William. And in 1863, under the direction of William, a cable manufacturing plant was erected in Woolwich, near London. It was in 1865 that the company name was changed into Siemens Brothers (the brothers being Werner, William and Carl). Two years later Georg Halske took retirement amicably. The company retained his name in the name of the company until 1967, in recognition for his enormous contribution to the success of the company.

I would like to mention here another 'tour de force' of Werner Siemens related to telegraph networks. Between 1867 and 1869, he managed to make a connection that brought worldwide fame to the company: the telegraph line from London to Calcutta. The realisation of this vast project was supported by the cooperation of Werner's two brothers, William and Carl. Of this 10,000km-long Indo-European line, some 6,000km still remained to be completed. The project, awarded to the consortium of Siemens & Halske and Siemens Brothers, put this line in service in 1870 (it remained operational until 1930). Regarding this line from Europe to Asia, a book was published by the Museum of Telecommunications in Bern with the title In 28 Minuten von London nach Kalkutta (London to Calcutta in 28 Minutes). This title obviously refers to the time required to transmit, via many intermediate stations, a short message from one end to the other; an incredible performance in 1870 indeed.

So that was a short retrospective of part of the life of Werner Siemens. I now turn to the last period of his life. In 1888 he was knighted and from that day on he became Werner von Siemens (in German names the word von implies aristocracy or nobility). And it was at the age of seventy-four (on 31 December 1889) that he decided to withdraw from company management. At that time the company had 6,000 employees, including those from the subsidiaries in London and St. Petersburg. He could now use much of his spare time to write his memoirs. On 6 December 1892, a few days after the publication of his book Lebenserinnerungen, following a brief illness, Werner von Siemens died at his home in Charlottenburg (near Berlin). Among the mass of flowers at the foot of his coffin was a floral tribute from Thomas Alva Edison.

For the many other interesting achievements of Werner 'von' Siemens, I refer you to the many books that have been written about him, and especially his own work which had already been translated into English in 1893: Werner von Siemens - Recollections. In 2008 his book was reissued with amendments and it is still available.

His telegraphs

Here I present some telegraph instruments that were designed by Werner Siemens and, in part by his colleague and great expert in the art of manufacturing, Georg Halske. I have tried to be concise and as simple as possible (the purpose of my article is not to teach a course in telegraphy ...). So it all started in 1846-1847 with the dial telegraph. Its basic design was brilliant in its simplicity with a 'self-interrupting' electrical circuit (as used in electrical trembler bells). With this 'trick' he ensured that the transmitter and the receiver remained constantly in sync during the emission of the pulse trains

Photo 1: His first dial telegraph

Photo 2: His second model of the dial telegraph

Photo 3a: His first morse telegraph

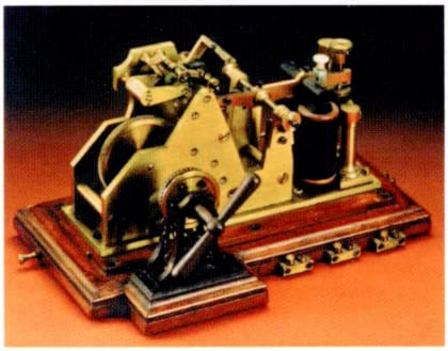


Photo 3b: Another view of his first telegraph

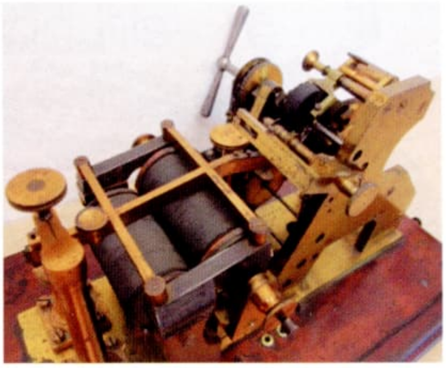


Photo 4b: Detail of his second telegraph

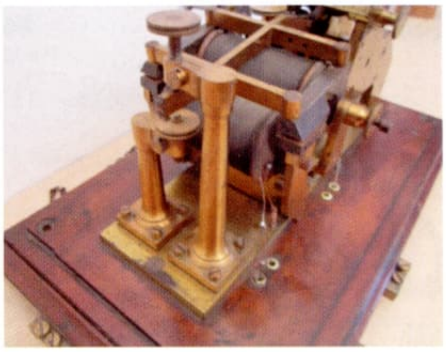
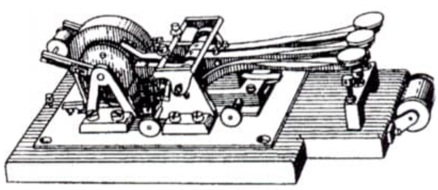


Photo 4c: Detail of his second telegraph

Photo 4a: His second telegraph

Photo 4d: Detail of his second telegraph



A drawing of the paper tape puncher

between each character. Photo 1 shows such a dial (ABC) telegraph of the early days. The model shown is a replica and is not in my collection. All other telegraphs that I will now present here are part of my collection (or have been previously).

Photo 2 shows the later model from 1856. Here no battery was required, as he used the motion of the crank (that had to be pointed successively to each character of the message) to drive a dynamo that was placed inside the telegraph box.

Already in the early 1850s, Werner began also to develop the manufacture of Morse telegraphs. The Morse system, launched by Samuel Morse in 1844, was indeed becoming a competitor to the telegraph dial. Its big advantage was that the message was 'printed' on a paper tape in the form of the well-known 'dots' and 'dashes'. A small disadvantage of the Morse system was that one had, after having received the message, to decode those dots and dashes. Below you can see in the photos what are the very first two models of telegraph instruments that were made by Siemens & Halske. Note that initially the Morse signals were not printed with ink on the paper tape, but embossed in it. That was done with a steel point that impressed the Morse signals in the paper tape, somewhat like the Braille system. This was the case with all Morse devices of that era, also in the U.S.A. The Austrian Thomas John developed in 1854 a relatively simple method for printing Morse signals with ink on the tape. It was the French company Digney (in Paris) that bought the rights and launched the first telegraph with this device. A few years later Siemens and Halske brought out new products using this novel system. Over time, where possible, the company updated existing instruments, replacing the old 'relief writing' system by printing in ink, this was indeed a relatively simple procedure.
We see the very first Morse telegraph, from 1850, in Photos 3a and 3b (after the modification). Its serial number is 115!

Photos 4a and 4b to d show a companion telegraph instrument, the model from 1852. This is the model that was used primarily on the Russian network as explained above. I will describe it a little more in detail, especially as it is the reason that led me to write this article.

For a long time it was the only model of telegraph that could work at 'high speed', only the second design of telegraph by Werner Siemens. Therefore — and here I become sentimental! —it must certainly have passed through the hands of Georg Halske (and possibly those of Werner as well) and have been on active service during the Crimean War. It too has a very low serial number (360) and was the first that I saw after some 25 years of searching (where have all the other instruments gone?).

There are many similarities between the two designs but the striking difference between the two is the way the electromagnets are mounted. The assembly of the coils of the first electromagnets is vertical, the standard in all subsequent models because it is the easiest way, and horizontal in the second model (with a rotating iron core in one of the coils). This is one of the 'tricks' that Werner and Georg employed to make this receiver operate faster. During the design process they thought that they could achieve speeds of 300 characters per minute (I think that this was very optimistic but don't know what the rate was in reality…). To make the entire system rapid, obviously the transmitter had to operate faster too. This was done by making it 'automatic'. The way chosen to achieve this was to prepare a punched paper tape 'off-line' and then transmit this tape automatically using a paper tape reader (more or less the same principle as used by the telex system in the 20th century).

Drawing puncher

The three-key punch was similar to that of the later Wheatstone automatic system (patented in 1858, put into use only as of 1867). Indeed, Werner Siemens noted that, "Wheatstone made good use of my three-key punch for his electromagnetic express writer, without however naming the source whence he derived it". Of course by using the automatic paper tape reader, telegraphists could send messages much faster than manually with a Morse key, thereby making maximum usage of the capacity of the line.

The left-hand tapper was used to send a Morse 'dot' and when actuated, it punched a single round hole in the paper tape, followed by a small forward movement of the tape. The tape transmitter detected this hole and responded by applying a short electric pulse to the line. The second tapper corresponded to a Morse 'dash' and made two holes in the tape and also advanced the paper tape. When the reader detected two holes in the tape, it sent a longer electrical pulse on the line. The third tapper did not create a hole but merely advanced the paper tape a short distance. So this was the 'space' key and served to separate one Morse character from another. I know that the museum of Deutsche Telecom has a punch, but not a paper tape reader/transmitter). So if you ever find such a puncher and/or reader in your attic, then just send it to me!).

Here are two pictures of Siemens & Halske 'embossers'. The one in Photo 5 is the older design; it was used by the railways in Germany. Photo 6a shows a later one -from 1872- and Photo 6b the detail of the 'dry point'.

Strange at first sight, the latter model Relief writer has been very long in service. I think that this example was used probably in hot countries, where ink might dry too rapidly. They were certainly more reliable and demanded less maintenance and attention (there was no need to mess around with ink). On the other hand, it was less easy to distinguish the dots and dashes of Morse code clearly.

Photo 7 shows a telegraph of 1861. It was the first model by Siemens & Halske using an ink-well.

Photo 8 shows the 'Normalfarbschreiber der Deutsche Verwaltung' It became the standard model of the German telegraph administration as from 1867-1870, according to which source you believe. This is the model in which the spring of the motor is mounted on the outside, contained in a cylindrical enclosure made out of brass. In addition it has an 'integral relay' function, enabling received signals to be relayed automatically direct to another receiver connected to the same line (either in cascade along the line or at the distant end). The black 'block' on the left is the ink-well. The horizontal part contains the ink and the vertical part can be raised if the ink level drops too low. As it was the standard model, it was very popular and was manufactured by a number of other manufacturers (e.g. Lorenz). In the second version, the spring was incorporated within the engine block.

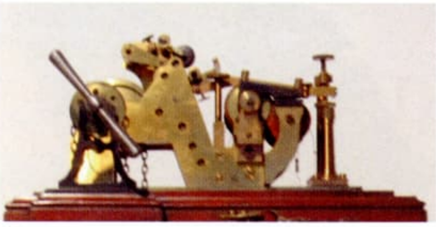
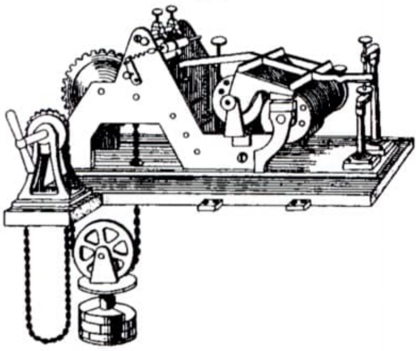


Photo 4e: His second telegraph



4d: His second telegraph showing detail underneath

Photo 5: Relief writer

Photo 6a: Reliefwriter from 1861

Photo 6b: Detail of reliefwriter from 1861

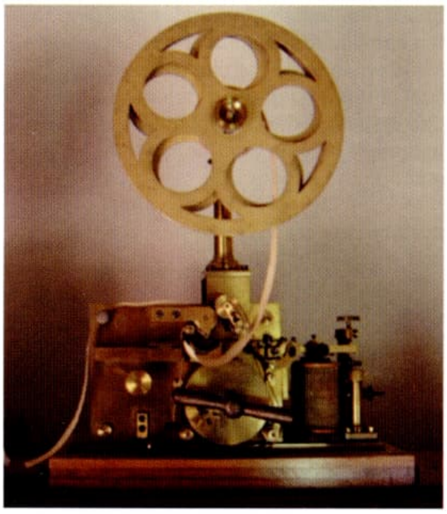


Photo 7: The first inkwriter

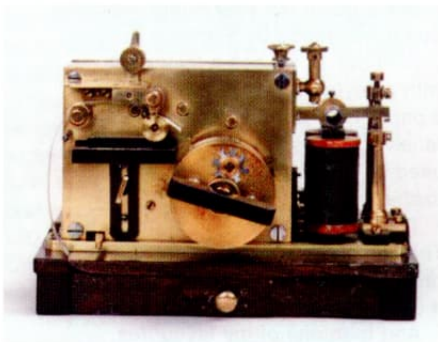
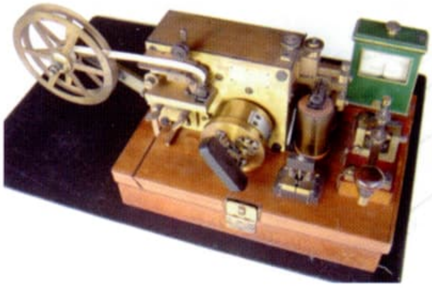


Photo 8: The model for the German administration



9a: A telegraph from the factory in St. Petersburg

9b: A detail of the St. Petersburg telegraph

Photo 9a shows a model that was manufactured in St. Petersburg. And in Photo 9b you can see the name of Siemens & Halske in Cyrillic script.

And here is a receiver manufactured at Woolwich by Siemens Brothers (Photo 10).

The following Photos (11a -d) show what is called 'small telegraph tables'. They always have the Morse key on board (the transmitter) and, according to the specific application, a galvanometer (which measures the current in the line), a relay, a lightning detector, a changeover switch or commutator. The telegraph table in the Photo 11a has the name of the vendor: 'De Mey, Ostend'.

In Photo 12 we see a nice small portable telegraph (most probably for military use) in its transport case.

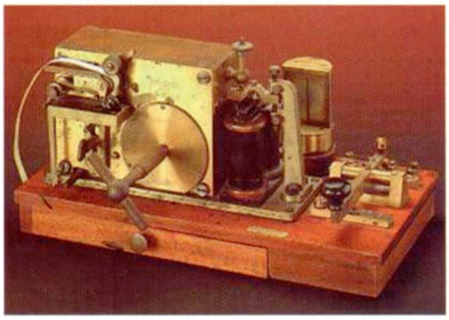
Photo 13 shows an intermediate station capable of transmitting to and receiving from one of the two stations at each end of the line. The operator can also interconnect those two remote stations (the so-called 'translator' or 'repeater' function), while observing the transmission. The two relays are present for this purpose. Both galvanometers can act as 'single-needle' receivers. This set had no maker's name but everything indicates that it was made by Siemens Brothers.

In Photo 14 we see a telegraph with a keyboard as transmitter and a paper tape printing system as receiver. It was, amongst others, used as a terminal for receiving stock exchange prices and information.

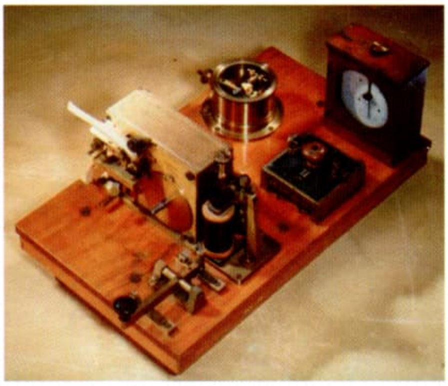
Then we see two test instruments. The one in Photo 15 is a 'universal tester' from 1901 and Photo 16 shows a cable test system from 1888.

And then one of my favourites (together with the Crimean telegraph) in Photo 17: a Hughes printing telegraph (patented in 1852) made by Siemens & Halske. The model shown is the oldest model whereby the mechanism is driven by weights (60kg in total...).

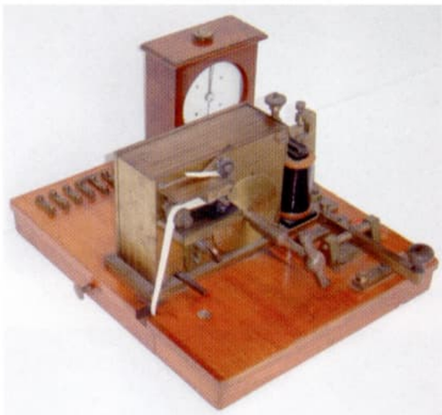
10: A telegraph from Siemens Brothers



11a: A telegraph table

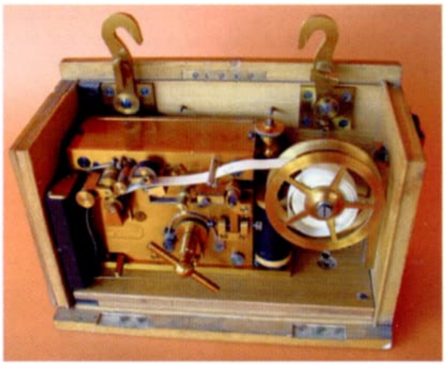


11b: A telegraph table



11c: A telegraph table

11d: A telegraph table

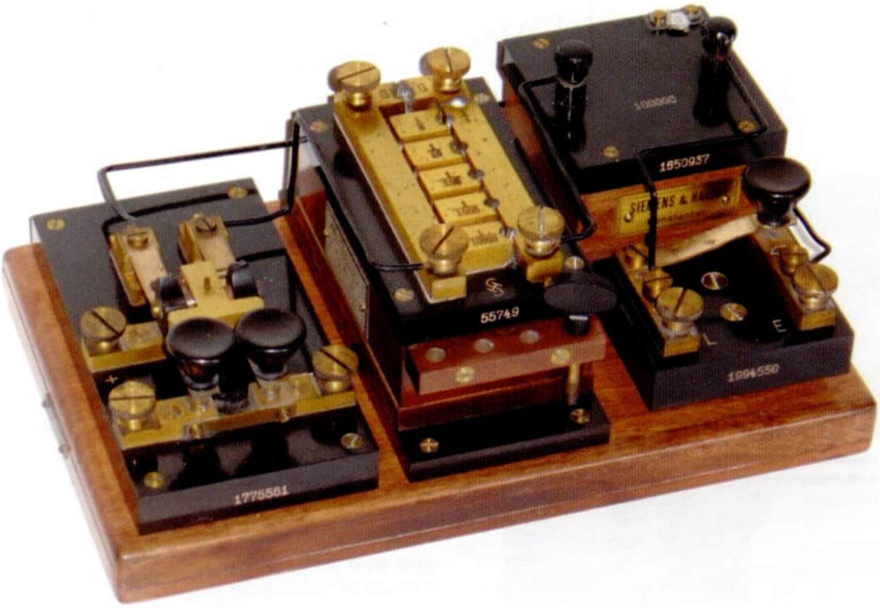


12: A portable telegraph

13: A repeater station

14: Keyboard and paper tape printer

15: Universal tester



16: Cable test system

17: Printing Hughes telegraph

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With thanks to Andy Emmerson for the help with the English text.

Halle (Belgium); May 11, 2014

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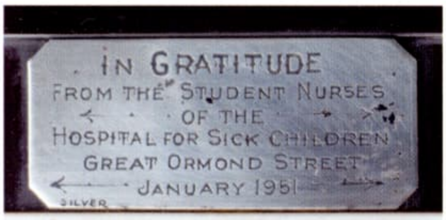
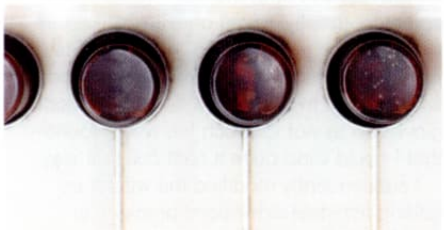
The first edition of my second book, Het Internet van de 19-de Eeuw in Dutch, with 434 pages and 650 colour photos (these illustrations are in an international language!) can be downloaded free via: http://dl.dropbox.com/u/43366363/TELEGRAFIE%2025%20APRIL%20Fons.pdf

GOSH a Bush DAC10!

The short tale of a radio with a curious link to Great Ormond Street Hospital. by Lorne Clark





Some time ago a friend gave me a Bush DAC10, in remarkably good condition and with a curious silver plaque on the top, inscribed with the following:
IN GRATITUDE FROM THE STUDENT NURSES OF THE HOSPITAL FOR SICK CHILDREN GREAT ORMOND STREET JANUARY 1951

A friend had been helping clear a house and had found the set tucked in a corner of the attic. He knew that I collected vintage radios and asked if I wanted it, the owner being happy for it to go. Naturally I said 'yes'.

I had been after one of these sets for quite a while, as I found the styling rather appealing. I kept the set for a while but, having a queue of other restoration projects, I did little more than clean and polish the cabinet, which really did look very good once nicely burnished. All the time, I had a curiosity to find out more about that silver plaque, with its enigmatic inscription. Who was the set presented to and on what occasion? Retirement perhaps ….. or more likely a gift from the student nurses to a much respected figure involved with their training. However, in either case, one would have thought that the recipient would be named on the inscription. My favourite theory is that the set was presented to the hospital itself, perhaps for use in a Common Room.

I contacted Nick Baldwin, Archivist and Curator at GOSH, to ask whether the hospital might have information about the recipient of the radio. He told me that the last Matron to leave had been Dorothy Lane in 1948, which seemed too early to have been her. He suggested that perhaps it was to one of the tutors at the Hospital's former Charles West School of Nursing. To date I have been unable to establish just who the radio was originally presented to. However, a recently discovered 'School of Nursing' forum on the web may lead to further information becoming discovered and I have recently posted an appeal for information there.

I had thought of donating the set to GOSH but they don't have a museum as such and so I felt the best thing was to put the radio up for auction and send the money so raised to GOSH as a donation from the BVWS.

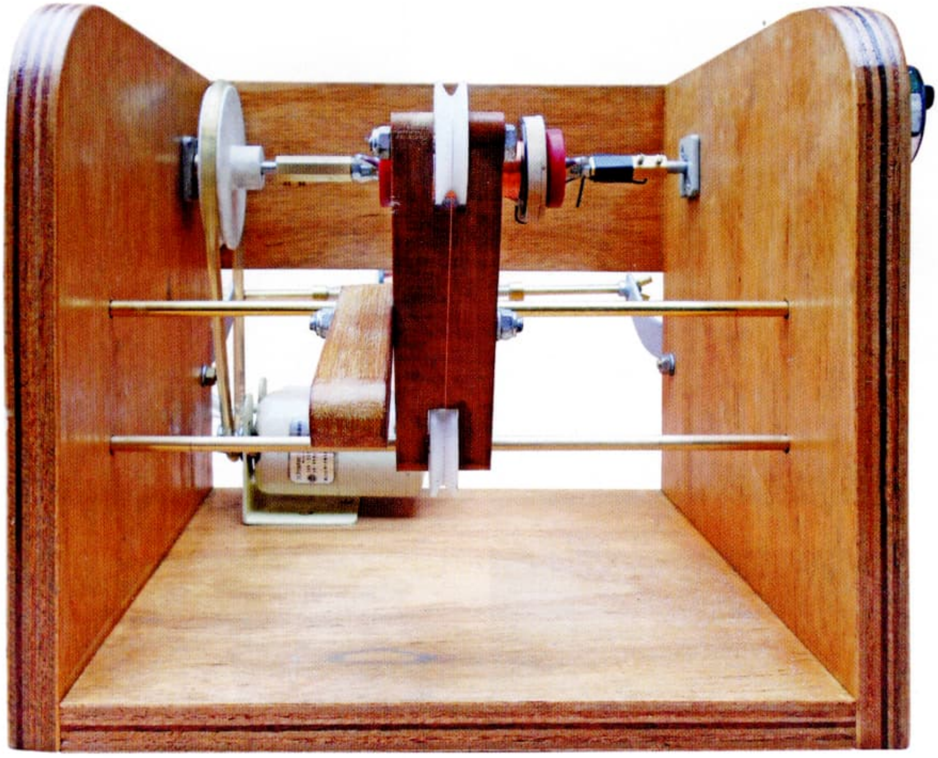
I took the set along to the Summer Harpenden event on 1st June 2014 and, whilst carrying it in, I heard the comment 'ooh, that's nice and shiny'! Mike Barker duly auctioned the set for a respectable £80. This amount was donated to the Great Ormond Street Hospital for Sick Children who were very pleased to receive it.

The auctioning of the set was captured by Alex Hewitt, and his video is on YouTube (search: BVWS Harpenden Auction 2014).

My thanks to everyone involved with the auctioning of the set, especially Mike Barker and, of course, the person who bought the set ... I hope you enjoy it.

A simple coil winder powered by a sewing machine motor with foot controller

by David Taylor



I'm in the process of restoring a pre–war Bakelite Ekco AC77 radio and it came as no surprise to discover that the field coil on the mains energised speaker was open circuit, (though luckily the speech coil and hum-bucking coils were intact). The AC77 is not a sought after radio and is of no great value, so it didn't merit getting the coil professionally re-wound. There was nothing to lose in attempting to rewind the coil myself, for which I would need to make a coil winder capable of winding on many thousands of turns of 0.152mm, (6 thou – approx 38 SWG) enamelled copper wire. Wire of this thickness (or rather 'thinness'!), is 5,588M in length per kG, and has a resistance of 0.85 Ohms per Metre – 4,750 ohms per kG. Thus, for my 2,000 ohm field coil I would need 2,353 Metres (2.3 km!) so a 500G reel (2,794 ohms) would be sufficient. With such a length of wire and many thousands of turns, a hand-powered winder was out of the question, so I set about making a winder powered by a sewing machine motor and a foot-operated speed controller.

The winder I made is very similar to one that Gary Tempest designed and made that featured in a two-part article the in Summer and Autumn 2007 editions of the Bulletin entitled 'Making a Coil Winder – Mostly from Junk'. Gary powered his winder by using a part dismantled battery drill and made an electronic turns counter using an opto-interrupter and slotted disc. The actual number of turns for my field coil was of no relevance – all that mattered was that the finished coil was as close to 2,000 ohms as possible, so a turns counter in this instance wasn't essential but I thought it would be a useful feature to add a turns counter if at some time I needed to wind a transformer or an RF coil, where the turns ratio and inductances are important.

I found a cheap second-hand sewing machine motor and foot-operated speed controller on ebay, which I adapted to my purpose by removing electrical fittings and a light, and wiring the foot controller and motor to suit my needs. Diagram 1 shows how the motor and controller are wired. (If a second-hand motor and speed controller can't be found, new motors complete with controllers are typically under £30 on Amazon and eBay). I didn't have much idea of how fast I would be able to wind on the turns and had assumed that I would have to wind the coil quite slowly due to the fragility of the wire, so in addition to the speed controller, I geared the speed down still further by making and fitting a 75mm diameter pulley on the coil former shaft so the speed of the shaft was about six times slower than the motor RPM. By using a foot controller this 'step-down' pulley enabled the speed to range from as low as 50RPM to much faster than would ever be needed. In reality, the wire turned out to be less fragile than I'd imagined so I was able to run the motor quite fast, and luckily, I didn't suffer any breaks in the wire.

The main components of the winder are:

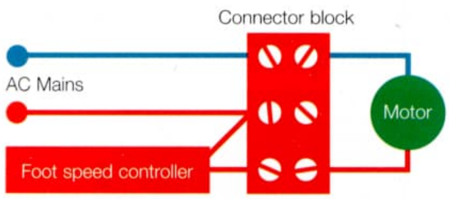
Wooden frame:

The winder is built on a frame 28 cms wide, 25cms deep and 25cms high, made from 18mm plywood, glued and screwed together. At the top rear of the frame I fitted a strengthening brace of 18mm plywood, 10cms wide. If it is desired to wind coils on formers longer in length than 50mm or so, the wooden frame would need to be wider to accommodate a longer coil winding shaft. I limited the width to 28mm as brass and steel rod sold retail is generally 30cms in length - just long enough to be able to thread the ends of the two front pulley guide shafts and fit wing nuts on the ends to secure the shafts. (Longer lengths of rod are of course available).

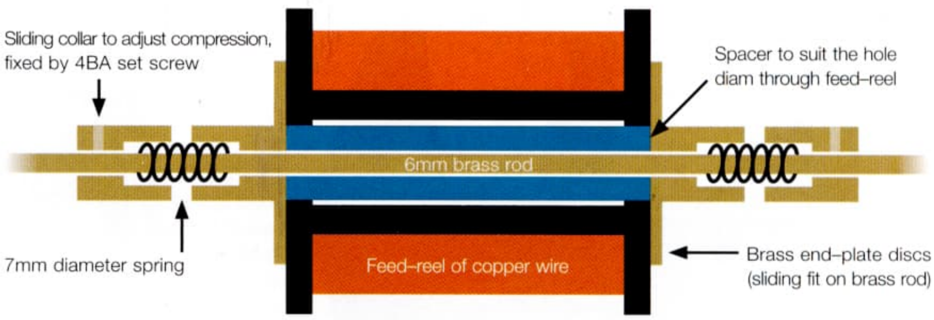
Feed-reel mounting shaft and wire guide pulleys:

Though it's unrealistic in a rudimentary winder such as this to expect to be able to lay turns of fine wire side by side, I still wished to have some means of laying the turns onto the coil as neatly as possible. However, my initial attempt at fitting a wire guide proved unsuccessful as I'd mounted the feed-reel shaft just above the motor with insufficient distance between the feed-reel and coil former shaft. I had naively assumed that if I added two 'guide pulleys' and a handle I could deftly guide the wire back and forth to lay the turns neatly side by side, but I soon discovered that come what may, the turns went where they had a mind to. Due to the short distance between the feed-reel and the wire guide pulleys the angle at which the wire came off the feed-reel onto the coil former was too acute as the wire may well be coming off the feed-reel from right to left, while the wire is winding onto the former from left to right, so it was back to the drawing board to modify this design. Gary Tempest had noted this difficulty when developing his winder so he increased the distance between the feed-reel and coil winder shaft to double the path of the wire to fifteen inches so that the angle of the wire coming off the reel and onto the coil former is not so acute. Initially, to get on with the task in hand I ended up removing the wire guide pulleys and handle and simply guided the wire through my fingers while wearing cotton gloves so as not to touch the wire. I found that I could wind quite a neat coil that way.

I subsequently modified the winder by adding flat steel extensions brackets to enable the feed-reel to be positioned to the rear of the wooden frame of the winder, 35 cms from the front lower pulley. (I cranked the rear ends of the extensions upwards to enable a larger feed-reel to be fitted if need be). Increasing the distance between the feed-reel and the front pulleys reduced the maximum angle at which the wire came off the feed-reel to where it met the pulley from 25 degrees to less than 10 degrees. I re-fitted the twin wire-guide pulleys & handle and wound a test coil, which confirmed that the modified arrangement was a success. (To store away the winder when not in use, the feed-coil extension brackets and shaft could of course be removed so as to take up less space).

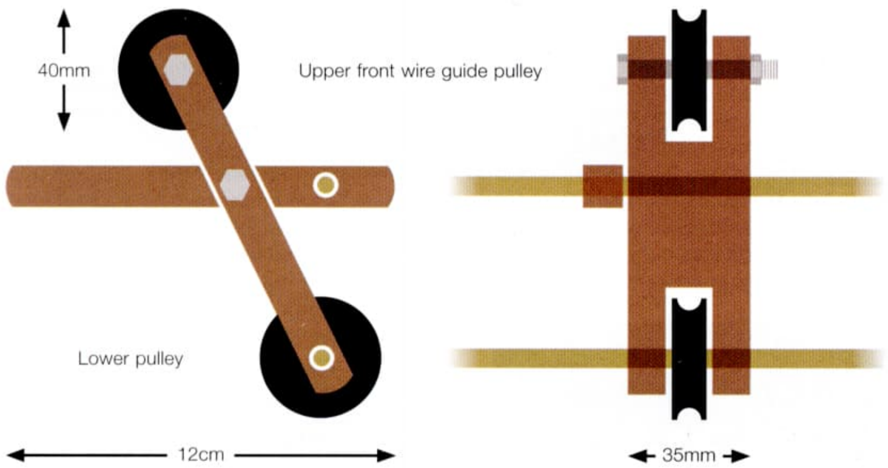


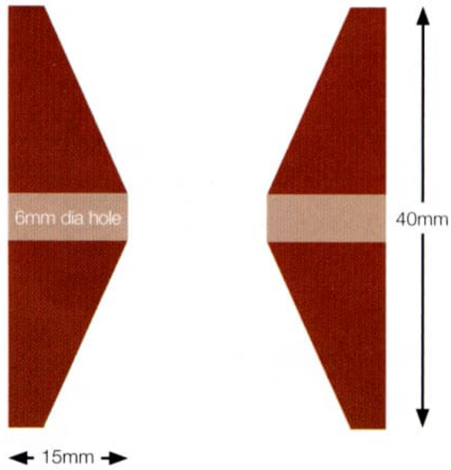
1: Sewing machine motor & speed controller wiring diagram



2: Feed–reel tensioning arrangements

The feed–reel must run smoothly on the brass rod, with just enough tension applied on the springs to prevent the reel from 'freewheeling' but not so much tension that it risks snapping the wire

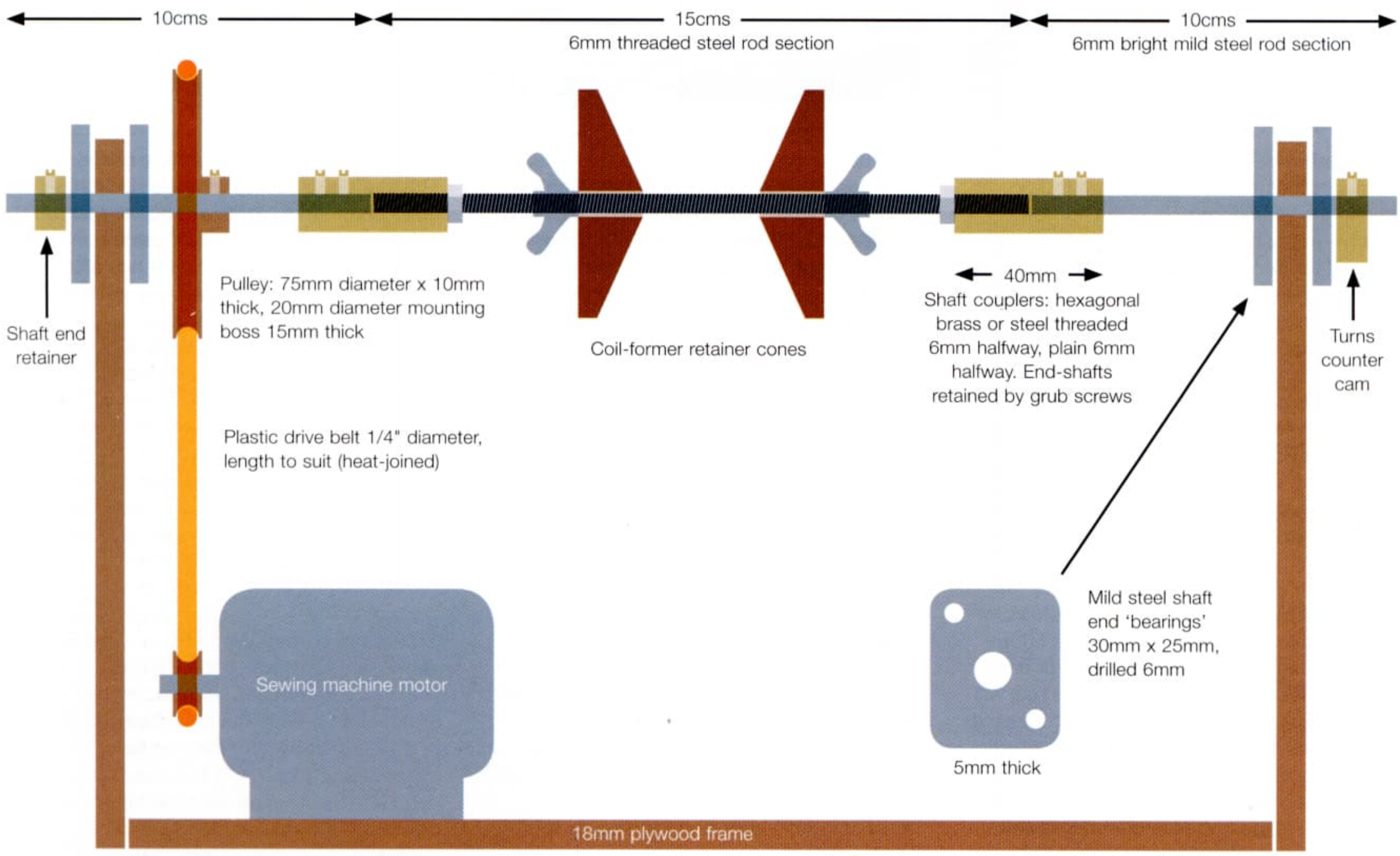




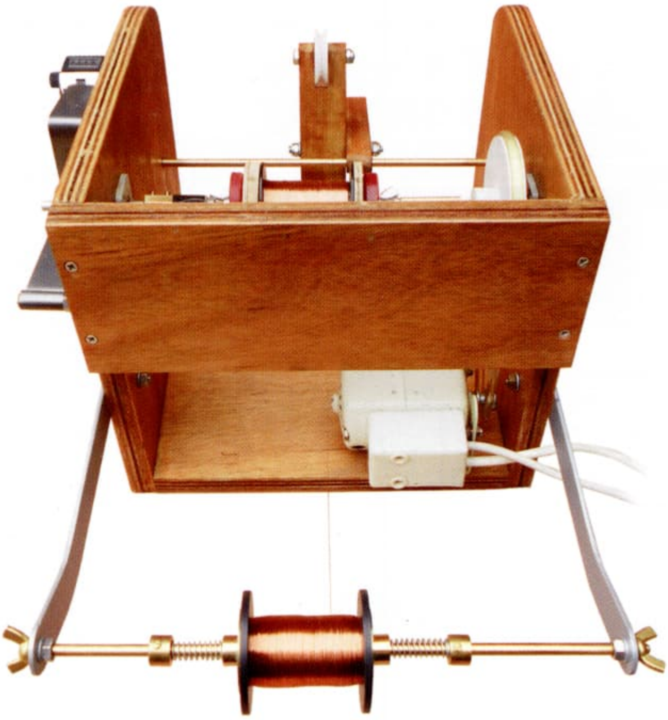
3: Guide pulley and handle design

4: Coil former cones (material: Tufnol, plastic, hardwood)

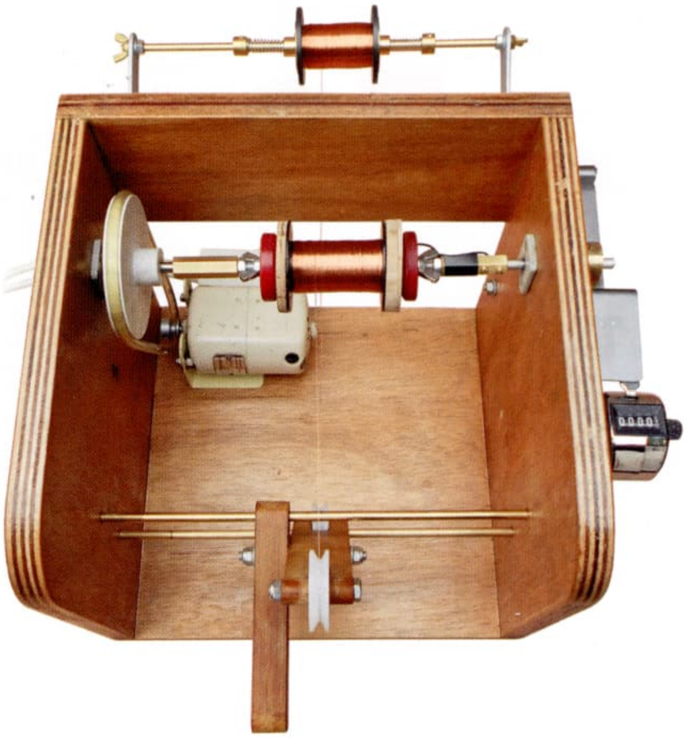
The pulleys are 12mm thick and 4cm in diameter, turned in plastic. Tufnol was used for the handle and pulley guide, but hardwood such as beech would be satisfactory. The handle is 2cm square and the pulley carrier is 3.5cm wide and 1.5 cm thick. The lower pulley and handle slide along the shafts – the upper pulley is outboard so as to increase the distance from the coil former.



5: Coil former drive shaft, motor and drive pulley arrangements

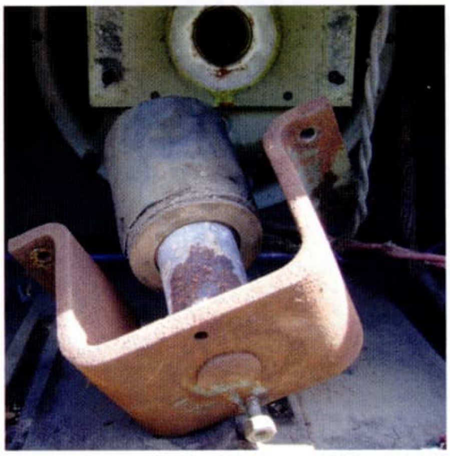


Rear view of winder showing feed reel



Overhead view of coil being wound

Motor and pulley view



Old field coil off the speaker

Close–up view of the new field coil

Tensioning device:
I thought that if I were to stop the motor during the winding process, the 'kinetic energy' in the feed-reel could risk causing the reel to 'freewheel' for a few seconds and unravel the wire, or that if I slowed down then speeded up the motor, the wire might go slack then 'snatch' and break. I therefore added tensioning springs with adjustable 'cupped' brass collars either side of the feed-reel to slightly tension the wire. In reality, that was perhaps a needless refinement, but it worked well and did enable the turning process to be stopped without the turns going slack if the doorbell or phone rang, or to attend to a call of nature.

Diagram 2 show the construction of the tensioning arrangements. I turned a Tufnol rod to fit the hole through the 500g feed-reel, and drilled out the rod to fit onto the 6mm feed-reel shaft, so that the reel will rotate freely on the shaft with no jerkiness. (I used Tufnol as I had it to hand, but a plastic or hardwood rod such as beech would be fine). To fit onto the shaft at each side of the feed-reel I made two 5cm diameter brass discs onto which I soldered two brass 'cups' to hold 7mm diameter weak compression springs. Then I added two 'cupped' brass bushes fitted with 4BA set screws for the outside ends of the springs. The bushes are slid along the shaft at the outer end of each spring and the set screw tightened, to allow just enough tension on the wire so that when the foot pedal stops the motor, the feed-reel will stop rotating rather than to 'free-wheel' with the risk that the wire could unravel, but with not so much tension that it would cause the wire to snap.

Front wire guide pulleys and handle:
To enable me to guide the wire from the feed-reel onto the coil former I fitted two shafts along which a pulley carrier and handle could be slid back and forth by hand. Diagram 3 shows how this mechanism was constructed and how it works. Again, I used Tufnol for the pulley carrier and handle as I had some to hand, but hardwood or plastic would I'm sure suffice. In use, I smeared a little silicone grease onto the two front shafts to enable the handle and pulley carrier to move smoothly back and forth so as to neatly guide the turns onto the coil former.

Coil former shaft and drive pulley:
The shaft is made up of three sections – 6mm diam steel shafts at each end, and a 6mm threaded rod centre section. The three sections are joined with two shaft couplers. These shaft couplers must be accurately drilled and tapped or the completed shaft will not rotate smoothly without wobbling about. I drilled and threaded the couplers on the lathe, tapping them with the tap held in the tailstock and the chuck rotated by hand. The outer end of each coupler is drilled 6mm diameter – the inner end is tapped M6.

Two cones to grip and centralise the coil former are a sliding fit on the centre section, with the former held in place by tightening the cones with wing nuts on each side of the former. Diagram 4 shows the dimensions of these cones. On completion of the coil, the right hand section can be removed to enable the coil to be withdrawn from the shaft. At the left hand end of the shaft a 75mm diam pulley is fitted, connected by a drive belt to the motor beneath. The plastic belting is simply cut to length and joined by heating the ends on a piece of heated metal - for example, a putty knife blade or wallpaper scraper. Alternatively, inexpensive nitrile rubber 'O' ring cord which is joined with cyanoacrylate 'superglue' could be used. At the right hand end, a cam is fitted 'outboard' to operate a cranked lever to press the button of an inexpensive 'tally counter' to count the turns with each rotation of the shaft

I made rudimentary 'bearings' at each end of the 6mm steel rod drive shaft from little squares of bright mild steel fitted on the inside and outside of the wooden frame, lubricated with a drop of oil. This simple arrangement proved quite satisfactory for the limited use to which the winder will be put.

Diagram 5 shows the coil former drive shaft arrangements, the positioning of the motor and the drive shaft pulley.

Turns counter options:
Though as stated earlier, a turns counter isn't really necessary to wind a field coil, I felt it might be useful for future projects. There are various options for fitting a counter - using an opto-interrupter chopper disc and associated electronics; using a pocket calculator; a mechanical 'tally counter', or possibly a digital keep-fit 'step-counter' wired to a micro-switch. Mechanical 5-digit re-settable shaft -coupled counters are also available as used in industry, but to date, I haven't found a cheap source.

The pocket calculator turns counter option:
I discounted the electronic option as rather too involved, so I initially I used a pocket calculator and micro-switch as a turns counter, with the micro-switch operated by a cam on the end of the drive shaft. If you press '1 + + =' on a calculator, thereafter with each press of the equals button it will increment by 1. (Try it!). Hence, by fitting a micro-switch operated by a cam for each turn of the coil winding shaft, and connecting the switch across the = button of the calculator, it will count up. I had a job to find a modern calculator which has an actual PCB for the keypad onto which to solder wires to the = button pads, as most calculators nowadays seem to use a plastic membrane rather than a PCB, to which contacts can't be added. The model I used is the 'KC-138AP' from Wilko costing under £2.00. It's a dual-powered one so has an internal battery, whereas many only use solar power.

As this was my first attempt at rewinding a field coil I approached the prospect with some trepidation, expecting several breaks in the wire. In fact I was agreeably surprised that the wire wasn't as fragile as I'd imagined. Once I'd got into my stride, I was able to wind the wire onto the former at about 300RPM and no breakages arose. However, at that speed the calculator had stopped counting. Furthermore, if you don't note the turns on the calculator right away, it auto shuts off and you lose the readout. Hence, I abandoned the pocket calculator idea due to it not working above about 100RPM and instead, I opted for a mechanical 'tally counter' used by coach drivers for example, to count passengers on and off the coach to make sure no-one is left behind.

The mechanical turns counter option:
Tally counters (sometimes called 'palm clickers') are widely available at under £5.00 on internet. Having abandoned the pocket calculator option I fitted a tally counter, operated by a cam on the end of the drive shaft and an actuator arm to press the button on the counter with each turn of the coil. It does clatter a little, but it's reliable and re-settable. Diag 6 shows the right hand end view of the winder including the cam and lever which operates the counter.

Winding the coil:
The original cheeks of the coil former were only made of cardboard, so I made some new cheeks from 2mm Paxolin sheet and fitted them to the tube ends with epoxy resin. I supported the cheeks with plywood discs during the winding process so that the wire didn't force the cheeks off the coil tube. (The tube of the coil former protrudes at one end to accept the hum bucking coil).

In this instance it isn't an RF coil or a transformer where the inductance or turns ratio is important - it's just a 2,000 Ohm field coil to energise the speaker and to act as a smoothing choke, so knowing the number of turns wasn't that important. I simply filled the coil former with solderable enamel wire, then applied the soldering iron to the wire to tin it for 5mm or so and tested the resistance, intending to either add or subtract turns to get it about right. As luck would have it, it was 1,997 Ohms! As the original coil was wrapped in black plastic, having fitted the lead-out wires, I put a couple of turns of black 'gaffa tape' around the coil so that it looked as near as possible to the original coil. The speaker frame was de-rusted, primed and sprayed a Halford's 'Ford Dove Grey' acrylic aerosol - a good match for the original - and was reassembled with the new field coil.

Scope for simplification:
For anyone wishing to build a winder but who doesn't have access to a lathe, there is scope for simplification. The feed-reel tensioning device could be dispensed with, as could the front guide pulleys and handle. The two shafts at the front could still be fitted and used as a hand rest to help guide the wire from the feed-reel by hand back and forth onto the coil former. Provided the winder isn't stopped suddenly, the feed-reel ought not to 'freewheel' and cause the wire to untangle. If it was desired to stop the winding process part way through, it would be as well to have some pieces of masking tape to hand to place on the coil to stop the turns going slack. Though I turned my own 75mm diameter drive shaft pulley, similar pulleys should be available ready made.

Sources of materials:
6mm threaded rod, flat steel, wing nuts etc are widely available from DIY stores.
Heat jointed plastic drive belt ¼" diameter (Ref PTB14) available from:
http://www.chronos.ltd.uk/acatalog/Engineering_Menu_Plastic_Transmission_Belt_46.html

Alternatively, nitrile rubber 'O' ring cord 6mm diameter joined with cyanoacrylate 'superglue'. At the time of writing, £2.80 per Metre post free from this source:
http://www.ebay.co.uk/itm/281283542823

Sources of brass and steel bar and hexagon:
http://www.metals4u.co.uk

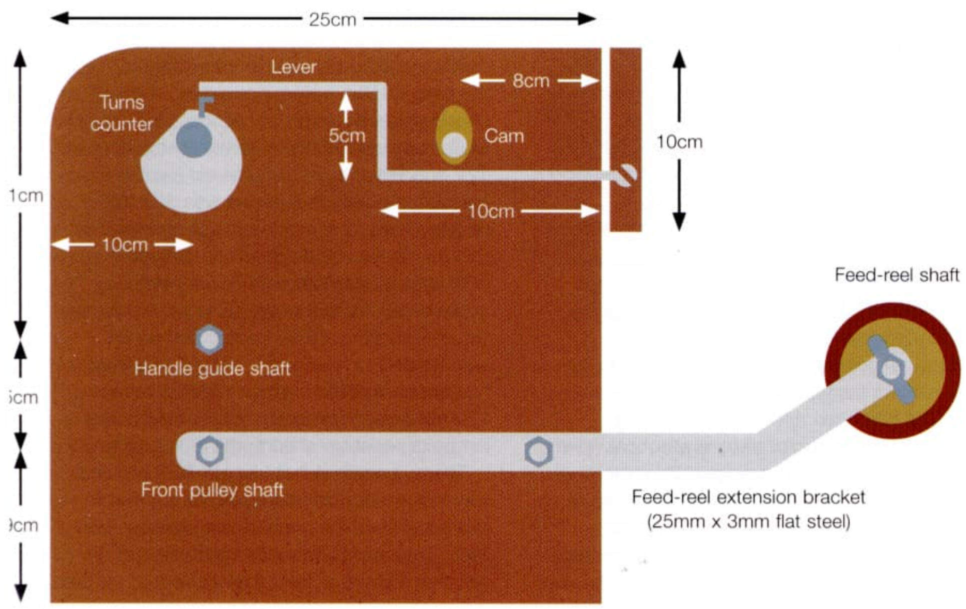
Possible source of a 75mm diameter winder shaft drive pulley which may be suitable, ref M019B:

http://www.meccanoshop.co.uk/acatalog/Online_Catalogue_Pulley___Flanged_76.html

Solderable enamelled copper wire (catalogued under 'copper magnet wire') from Wires.co.uk:

http://wires.co.uk/acatalog/SX_0140_0180.html

Acknowledgements:
Thanks go to Gary Tempest for his advice and suggestions, and to Tony Thompson for his encouragement.



6: Right hand end view. Turns counter, lever and cam, and feed–reel extension bracket

Building a cigar box radio by Stef Niewiadomski

Building radios into variously shaped surplus containers was once a popular pastime. One of the favourite containers used was a cigar box, which I presume used to be easy to obtain from your local tobacconist, or maybe you were lucky enough to have it supplied complete with cigars for Christmas. For example, in *Practical Wireless* for May 1955, 'A Cigar Box Receiver' was described, which was a TRF and used 3-off 1T4 battery valves as an RF stage, a regenerative detector and an audio output stage into headphones. Comprehensive coil details were given, covering the amateur and broadcast bands. The receiver was intended as a companion to a transmitter, based on the same valve type, described in the March 1955 issue of the magazine. A similar receiver design appeared in The Radio Constructor for September 1957, written by E R Harris.

Figure 1: A crystal set built into a small cigar box, as purchased recently at Harpenden.

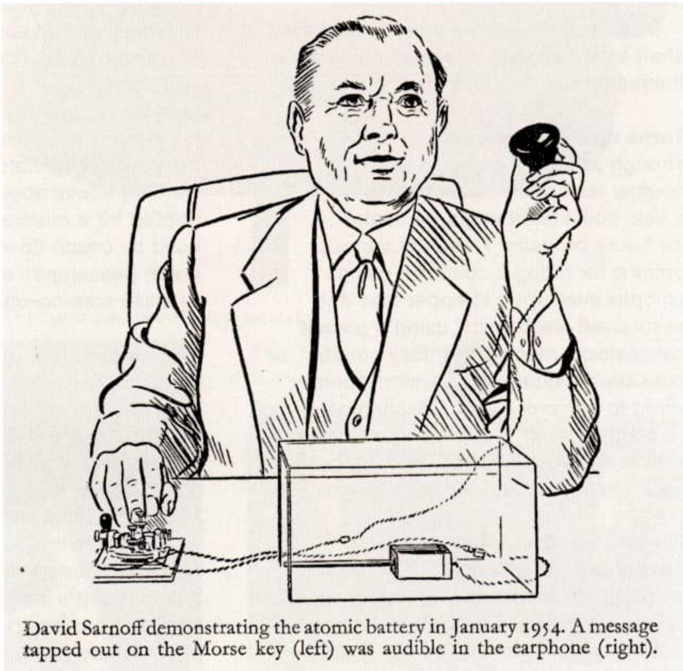


Figure 2: David Sarnoff (RCA's President at the time) demonstrating an atomic battery in January 1954.

See Figure 1 for a crystal set built into a small cigar box, as purchased recently at Harpenden. The radio uses a glass-encapsulated early-1950s 'crystal' diode. Note the tappable spiral coil arrangement, which allowed the radio to be tuned without using a variable capacitor, which would have been difficult to fit into such a shallow box.

This article describes a hybrid valve / integrated circuit radio which is powered from 12V and which I built in a cigar box. There aren't that many tobacconists around these days, but cigar boxes are easily obtainable on eBay, and no doubt from other sources, and so I don't anticipate any problem getting hold of a suitable box. It may be that you simply fancy building the radio on a more conventional chassis / cabinet arrangement, and that's fine of course.

The box I used was marked 'Por Larranaga Habana Cuba' (which apparently is a very good quality cigar) and was 151mm x 131mm x 100mm inside dimensions, with a sliding lid. It's probably the height of the box that's the critical dimension, so that you have enough height for the components that need to be accommodated, especially the tuning capacitor. I strongly advise that you obtain your box before building the chassis, making sure it has enough headroom to accommodate the biggest components, and adapt it to the exact size you manage to get hold of. Don't assume that the internal corners of the box will be perfectly square: mine weren't.

Valves with low voltage anodes

A newcomer to the hobby may have considered building valve equipment but have been put off by the need for a special power supply and the risk of electric shock from these high voltage circuits. However if you're reading this magazine, you can't help being exposed to valve technology and maybe you'd like to dabble and try building a valve-based project.

The design described here allows a relatively inexperienced constructor to build and experiment with a simple valve-based medium and long wave AM receiver. There is no risk of electric shock and the expense and inconvenience of generating an HT voltage of something like 200V, and 6.3V for the heaters (as typically needed for valve circuits) has been removed. This design allows the constructor to try a practical valve design that runs from a single 12V supply.

There is a range of valves specifically intended for operation with a low anode voltage, typically less than 30V. Some writers (including me) have previously mistakenly referred to them as 'space charge' valves, whereas this term formally refers only to a class of valves with two grids - with the first grid having a low positive voltage on it and the second grid used for the input signal – and the anode also operated with a low positive voltage. These valves were produced in the 1920s and 1930s.

There is also a class of valves specified to operate with a 12V anode voltage, so that they could be used in car radios in the early 1950s, before transistors became cheap enough for this application. In Europe, Mullard produced these valves, and a typical 12V anode voltage valve line-up used in car radios during this period was: ECH83 (triode / heptode) local oscillator and mixer; EBF83 (double-diode, pentode) detector, AGC and IF amplifier; and EF98 (pentode) audio driver. Note that the 'E' prefix for these valves indicates a 6.3V heater, and so the sets tended to have some valves with their heaters connected in pairs in series across a 12V car battery, and others with maybe dial lamps or resistors sharing the 12V supply.

There is some debate as to whether these valves were actually designed to run from low anode voltages, or as now seems more likely, they were 'standard' high voltage valves which were tested and selected on the

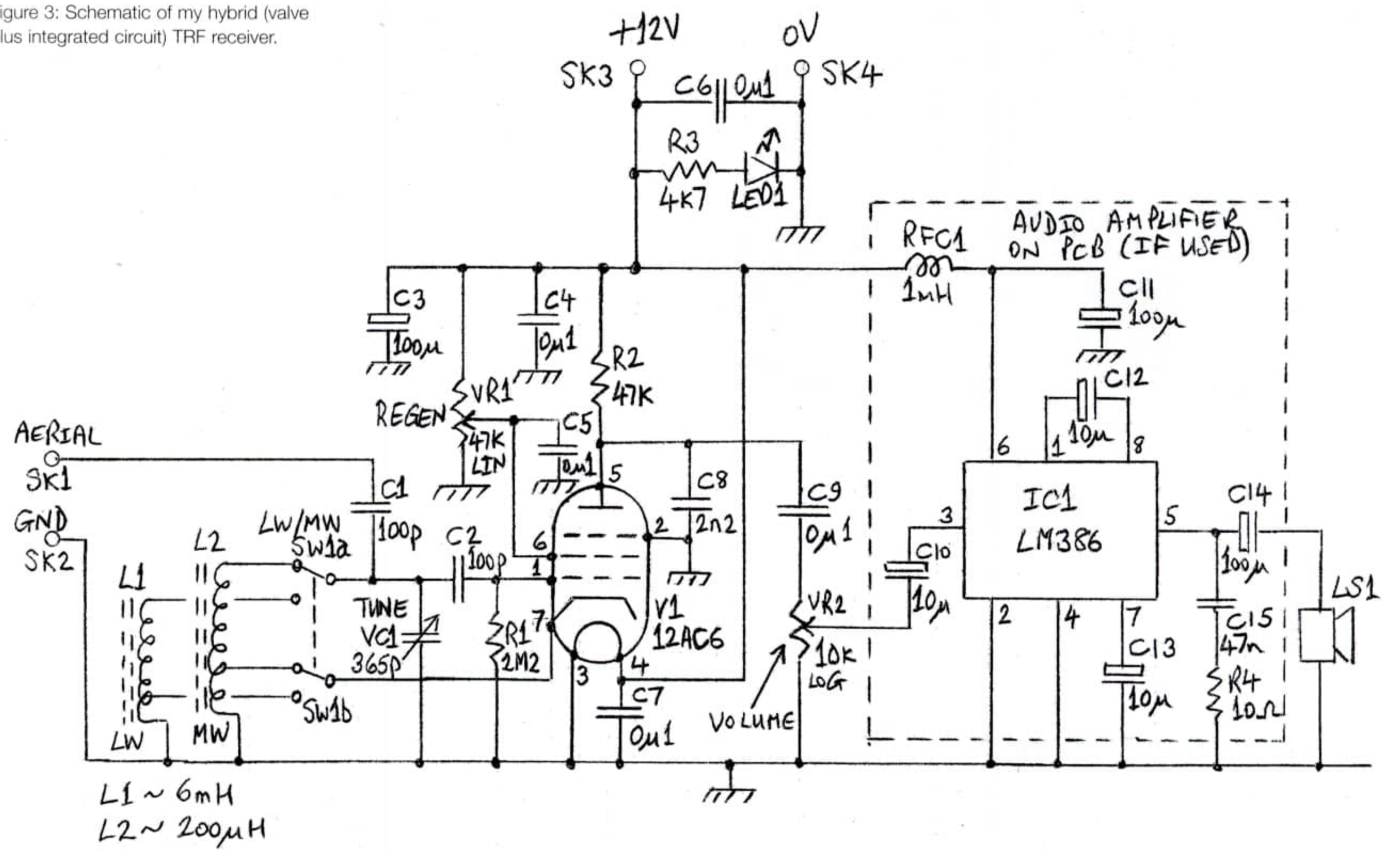


Figure 3: Schematic of my hybrid (valve plus integrated circuit) TRF receiver.

production line to be suitable for operation at 12V anode voltage. For example the ECH83 mentioned above is really the common-or-garden ECH81, simply tested and marked differently. It would appear that the EF98 was designed specifically for low voltage operation, rather than being a selected version of a higher voltage valve. If you take a look on the internet you can see radio designs where 'normal' valves (that is, those designed for working from high HT voltages) are being used with very low HTs, and so it would seem that many more valves than you would expect can work in this mode.

US valve manufacturers (Sylvania, GE, RCA, etc) used the '12' prefix to indicate a 12.6V heater (not to be confused with the anode voltage), and produced a comprehensive range of more than forty 12V anode supply valves. A typical line-up suitable for use in car superhet radios was: 12AC6/12BL6 (pentode) RF amplifier; 12AD6 (heptode) self-oscillating mixer; 12AC6/12BL6 IF amplifier; 12AE6 (double-diode, triode) detector, AGC and audio amplifier; and 12K5 (tetrode) audio driver. In fact the 12K5 is a true modern 'space charge' valve, introduced in 1956 (as were most of these low anode voltage valves), which was also manufactured by Brimar in the UK. Although these valves are typically run at 12V on their anodes, most are rated for operation up to 30V.

Heater voltage

The nominally 12.6V heaters of these valves were designed to operate safely over a wide voltage range, as might be encountered from a car battery in situ, which may be very cold or hot, almost discharged or fully charged. The Sylvania datasheet for the 12AC6 states '... the heater will operate satisfactorily over the range 10V to 15.9V, and that the maximum ratings provide a safety factor for the wide voltage variation encountered with this type of supply.' Therefore you have some safety margin if you're planning to operate the receiver from a 13.8V supply, though personally if I were planning to do this for a long period I might include a 12Ω or so resistor in series with the heater of the valve

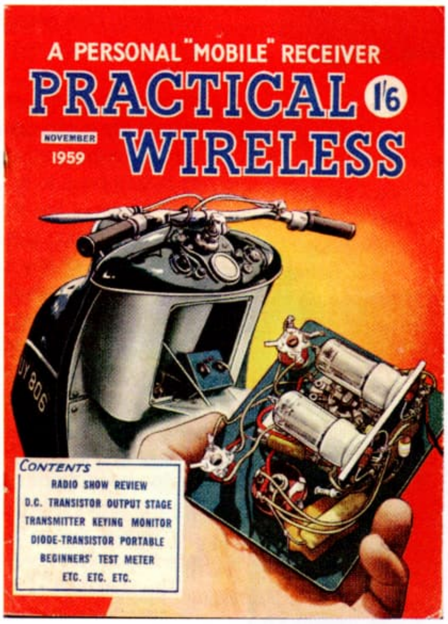


Figure 4: The cover of the November 1959 issue of Practical Wireless, showing the 'Personal Mobile Receiver' by F G Rayer, G3OGR.

to drop a couple of volts to prolong its life.

Even when transistors started to appear in car radios, at first they were only used in the audio stages, and the RF and IF stages continued to use valves for the active devices for a few more years, until high frequency transistors appeared and their prices became reasonable. Transistor audio output stages eliminated a problem that was never really solved with these low voltage valves - that of how to get reasonable audio output power with a 12V HT rail. Typically a valve like the 12K5 was used as an audio driver stage, though occasionally you see designs where the valve was used as an output stage, producing a mere 35mW of audio. Often two 12K5s were used in parallel to produce more output power, but this was never a very satisfactory solution.

These low anode voltage valves were first designed into car radios in about 1956, and by 1964 had all but disappeared, ousted by 100% transistor line-ups. Newmarket Semiconductors V30/20P, or Mullard OC16 / OC19 (all germanium of course) were typical power transistors (maybe driven by low power audio transistors) used in the audio output stages of British-designed car radios during this hybrid period.

In my receiver I dodged the issue and solved the audio output problem very simply by using an LM386 IC amplifier, hence the hybrid nature of the design. This is not intended as cheating, but just a way of showing how a valve can co-exist with an IC, each doing what it's good at.

Power supply

The power supply for the radio needs to be capable of supplying about 200mA at about 12V. This voltage can be generated from many sources, for example a general purpose power supply, a 13.8V supply, or even a 12V battery. I tried a couple of 12V mains eliminator 'wall-warts' (from Argos, or wherever), but I found that some of these eliminators generate a lot of RF 'mush' that tends to interfere with reception, especially

Figure 5: My cigar box radio showing the front panel controls, with the slide-on lid to the right. The aluminium front panel was covered with self-adhesive wood effect vinyl.

Figure 6: Top view of the deck in the radio, showing the general arrangement of the major components in my prototype.

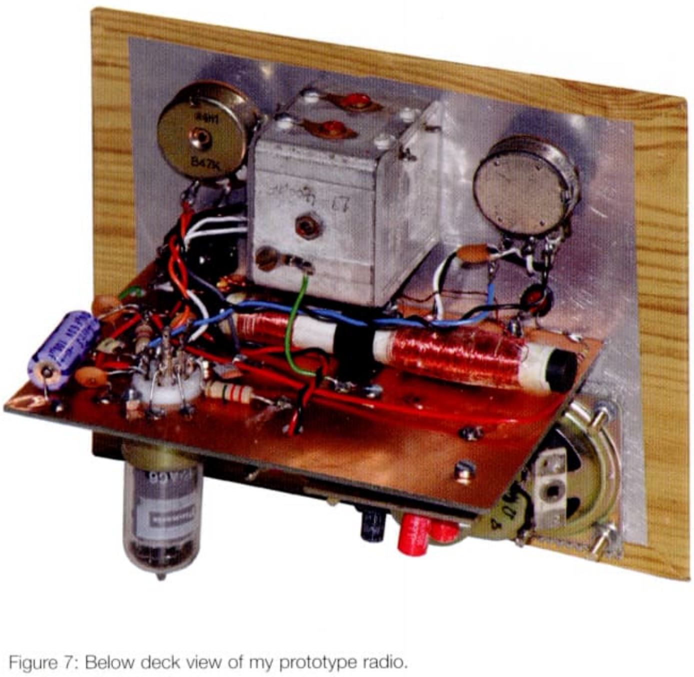


Figure 7: Below deck view of my prototype radio.

on weaker stations. You might have to experiment with a couple of makes until you find one that doesn't generate too much RF noise.

As I mentioned earlier, I used an LM386 for the audio amplifier in the radio. This device comes in a couple of supply voltage options: the -1 and -3 variants will operate between 4V and 12V, and the -4 will work between 5V and 18V. If you're not sure which variant you have, it's probably best to operate the receiver from no more than 12V. Unless you are able to handle surface-mount components I suggest you stick to the 8-pin dual-in-line package, as indicated by a letter 'N' after the '386' in the part number.

Atomic battery

As a slight diversion, I recently came across RCA's January 1954 view of the future (in Reference 1), which I thought was good fun. Figure 2 shows David Sarnoff (RCA's President at the time) demonstrating an atomic battery in January 1954. Mr Sarnoff had been a proficient Morse operator in his younger days and so no doubt he was able to tap out some code for the demonstration. The battery consisted of a wafer of semiconductor material whose back surface had been coated in a radioactive source, strontium-90 being a suitable material. The theory was that electrons emitted by the radioactive source released many more (the ratio of 200,000 to 1 is estimated) in the semiconductor and this constitutes a current in an external circuit. I assume that the box over the battery was protecting Mr Sarnoff and his audience from any stray radioactivity.

The prediction was given that within 50 years each home would be equipped with an atomic battery, and the distribution of electricity by cables would by then be obsolete. Sadly I am not yet able to specify an atomic battery to power this radio.

The TRF Receiver

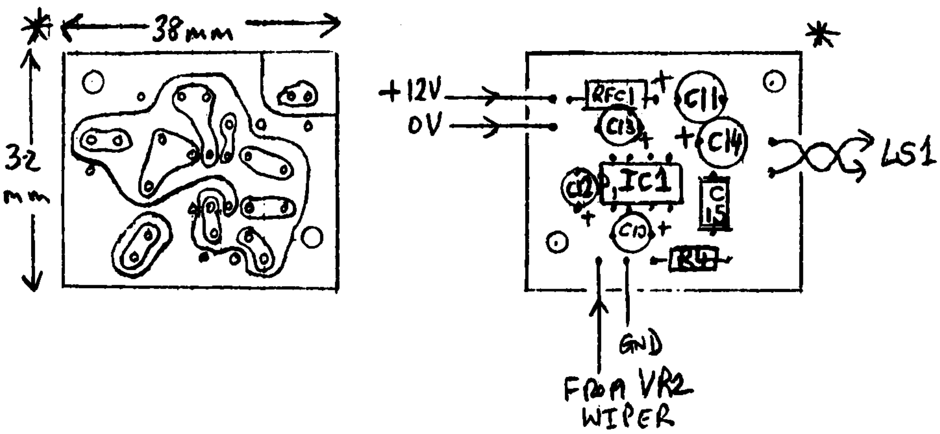
A classic configuration for TRF (Tuned Radio Frequency) receivers is the '0-V-1'. The first digit in the designation refers to the number of RF amplifier stages in the set. In a TRF receiver the selectivity is determined mainly by the number of tuned circuits tuned to the broadcast being received, and the sensitivity is mainly determined by the number of amplifier stages before the detector. Therefore in their heyday, before the superhet became the dominant receiver type, some TRFs were built with 3 or more RF stages, each with its associated tuned circuits, all of which needed to be peaked to the station you were listened to. With the radio described here, the first digit is '0', indicating no RF amplifier stages. It's surprising how sensitive a radio can be with no RF stages, especially if the detector has regenerative feedback, and this design is no exception.

The second digit, the 'V', indicates the detector stage: that is the point at which the modulated RF signal is rectified and filtered to extract the audio content from the broadcast. In many TRFs this stage is made regenerative which means positive feedback is applied from its output back to its input. This has two beneficial effects: firstly the overall gain of the stage is increased since the input signal goes round the amplification path many times, and secondly: the selectivity, or the Q factor, of any tuned circuit in the path is increased, thereby increasing the overall selectivity of the radio. Of course positive feedback brings the risk of inadvertently building an oscillator. The trick is to get the feedback to a high enough level where its beneficial effects are realised, but not so great that the stage oscillates and causes whistles and howls at the audio output. This regenerative effect can be so beneficial that a receiver can be built as an 0-V-0, that is without any RF or AF amplifier stages, with the detector stage alone driving headphones, and producing very good results. In the very early days of radio, 0-V-0 sets were used for world-wide communication. Remember that in those days there was very little manmade radio interference and only atmospheric noise had to be contended with.

The final digit in the TRF nomenclature indicates the number of AF amplifying stages after the detector. In this design I used an LM386 IC audio amplifier, which contains about 10 transistors. It would be unreasonable to call this receiver an 0-V-10 because each transistor in the LM386 doesn't operate as a discrete amplifier stage. More reasonably, I'll describe it as a 0-V-2, assuming an audio pre-amplifier and a power output stage inside the LM386.

Circuit description

My 0-V-2 receiver design is very simple, and Figure 3 shows the complete schematic. Capacitor C1 couples the aerial to the tuned circuit, using either L1 for long wave (LW) or L2 for medium wave (MW),



Figures 8 (a) and (b): Tracking and component layout for the PCB used for the LM386-based audio amplifier.

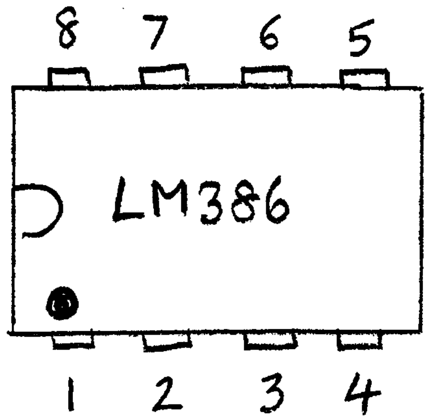


Figure 9: Pin numbering of the LM386 (top view).

both of which are wound on a short length of ferrite rod. The variable capacitor VC1 tunes to the desired broadcast. The windings of L1 and L2 are selected by SW1, the wave change switch. The MW tuning range I obtained was from about 690kHz (just below Radio 5 Live) to about 1450kHz (about the top end of the local stations in my area). I wasn't too concerned with the LW coverage, as long as Radio 4 could be received at about the mid position of the tuning capacitor. C2 couples the selected station to the signal grid of V1, whose DC bias is set by R1.

V1, a 12AC6 remote cut-off pentode, is connected as a regenerative detector, with the level of regeneration set by the voltage on grid 2 (pin 6), as controlled by potentiometer VR1. The circuit is based on the detector in F G Rayer G3OGR's Personal Mobile Receiver (see Reference 2) in the November 1959 issue of *Practical Wireless*. See Figure 4 for the cover of this edition of *Practical Wireless*, showing the receiver and the motor scooter with which it was intended to be used. The cathode of V1 is tapped into the bottom end of the tuning coil, giving feedback from cathode to grid to create regeneration, which increases sensitivity and selectivity, giving reasonable performance from the single tuned circuit.

The heater pins (3 and 4) for V1 are simply connected between the 12V supply and 0V. At 12V the heater current is nominally 150mA.

The audio output from the detector stage is developed across R2 at the anode (pin 5) of V1, most RF components are removed by C8, and the audio voltage is fed to the volume control VR2. The wiper of VR2 feeds the input pin 3 of IC1 via C10. IC1 is an 8-pin DIL LM386 connected as a standard audio power amplifier. The capacitor (C12) between pins 1 and 8 sets the amplifier's gain to 200 (46dB). Without this capacitor, the gain falls to 20 (26dB). The loudspeaker output from IC1 is taken from pin 5, via DC blocking capacitor C14. A Zobel RC network (C15 and R4) is connected to the output of IC1, which eliminates any possible instability with some loads. No sign of instability was heard on my prototype.

LED1 (which simply indicates that power is applied to the radio) is a bit of a luxury: it was intended to balance up the layout of the front panel, is not strictly needed and can be omitted if necessary. R3 limits the current through LED1 to about 2mA.

De-coupled and filtered supplies for V1 and IC1 are ensured by C3, C4, C6, C7, RFC1 and C11 in the 12V supply. You may wonder why the three 0µ1 ceramic capacitors are in parallel with each other: they are intended to be located physically close to the part of the radio they decouple. C3 and C4 should be close to the 'top' end of R2; C7 should be connected directly to pin 4 of V1; and C6 should be connected directly across SK3 and SK4. These could be overkill, but I was trying to keep any power supply noise out of the radio.

Construction

The prototype unit was built using an aluminium front panel with a piece of single-sided printed circuit board mounted at right angles to create a T-shaped chassis, as shown in the photographs. The front panel was 150mm x 130mm to suit my cigar box. My cigar box wasn't perfectly square, so I had to adjust the exact dimensions of the sides of the front panel to fit. I screwed (from the outside) and glued two narrow wooden strips to the inside of the cigar box to which the front panel was attached, making sure that there was enough room above the panel to accommodate the sockets and control knobs without fouling the sliding lid.

The front panel of my radio is shown in Figure 5. The general arrangement of the major components in my prototype can be seen from the photographs in Figures 6 and 7.

I used a very neat 4Ω, 2½-inch x 1½-inch speaker which gave very good sound when mounted in the cigar box. I mounted IC1 and its associated components on a small hand-built PCB. The PCB tracking and component layout for the PCB are shown in Figures 8 (a) and (b). This PCB was built for a previous project, and is much smaller than it needs to be for this radio, so make it bigger if you want to. Figure 9 shows a top view of IC1. Make sure you orientate IC1 and the electrolytic capacitors the right way round when mounting on the board.

I inserted 1mm terminal pins into the holes for the input, output and power connections to the board to facilitate unit wiring, rather than trying to insert wires into the board itself. This makes it easier to remove the board if necessary. Two mounting holes are provided which are used to support the board above the deck.

If you don't want to use the audio PCB, or want to use a different audio amplifier IC (maybe the good old LM380), the audio stage can be built 'ugly style' under the chassis, using a socket for IC1 supported about 10mm above the deck by its earth connections to pins 2 and 4, and the leads of C13 between pin 7 and ground. Remember to mentally spin the pin-out over if working from the bottom of the socket for IC1, if you are using ugly layout for the audio amplifier stage.

Make sure you have all the components before you start drilling the front panel and the deck: exact dimensions of speakers, controls and sockets from different suppliers, or from your 'junk box', will vary. The front panel layout isn't critical and the photographs show the layout I used on the prototype.

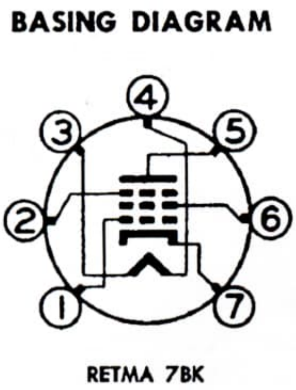
Headroom

V1 needs at least 50mm of headroom, when mounted in its holder, so make sure you allow for this when building the chassis. A 16mm diameter hole needs to be cut in the deck for the B7G valve holder. The neatest method is to use a Q-max cutter, but if this is not available simply mark out a 16mm circle, drill a series of 3mm holes just inside the line, join them up and then file to produce a clean circle. Fit the valve holder from the top of the chassis and mark and drill the fixing holes. You also need a few strategically-places holes (diameter not too critical) to pass wires between the upper and lower sides of the deck.

I didn't drill any ventilation holes in the cigar box or front panel. The whole radio takes about 170mA at reasonable listening volume, and at 12V, this equates to about 2W dissipation. I presume the heat just leaks out of the box, and I've had no problems running the radio for extended periods.

Figure 10 shows the pin numbering of the B7G socket for the 12AC6 (bottom view). There are several valves similar in specification to the 12AC6 which you might use if you have difficulty in sourcing this valve. The 12AF6 or 12BL6 look pretty similar, and happily they have identical pin-outs to the 12AC6.

The 365pF tuning capacitor I used for VC1 (an old Plessey type 1002 with a maximum capacity of about 400pF) had an integral 3:1 reduction drive, which conveniently obviated the need for an external slow motion drive. The only downside of this arrangement is that it makes marking station positions on the front panel difficult. You will need to use whatever mounting method suits the variable capacitor you have to hand, but I definitely recommend you use a slow motion drive of some type, either integral to the capacitor, or external, so that stations can be accurately tuned in.



TERMINAL CONNECTIONS

- Pin 1—Grid Number 1
- Pin 2—Internal Shield and Grid Number 3 (Suppressor)
- Pin 3—Heater
- Pin 4—Heater
- Pin 5—Plate
- Pin 6—Grid Number 2 (Screen)
- Pin 7—Cathode

Figure 10: Pin numbering (bottom view) of the 12AC6 (B7G-7BK) and similar valves.

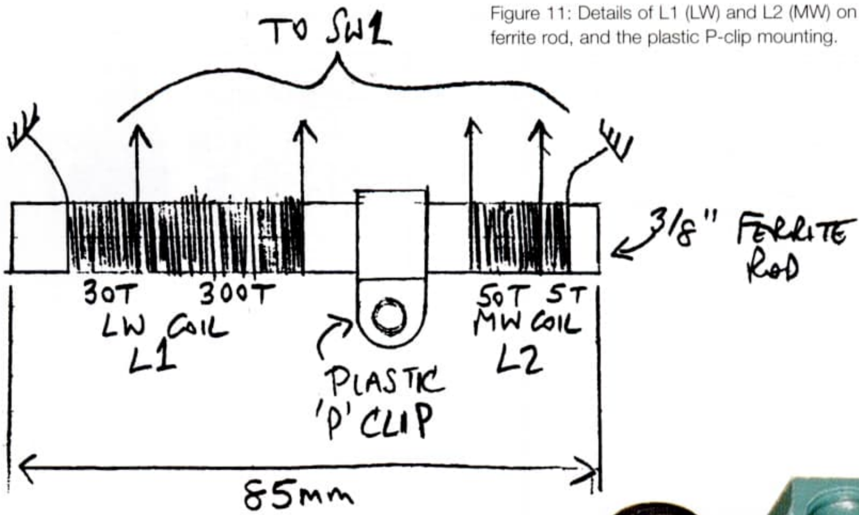


Figure 11: Details of L1 (LW) and L2 (MW) on the ferrite rod, and the plastic P-clip mounting.

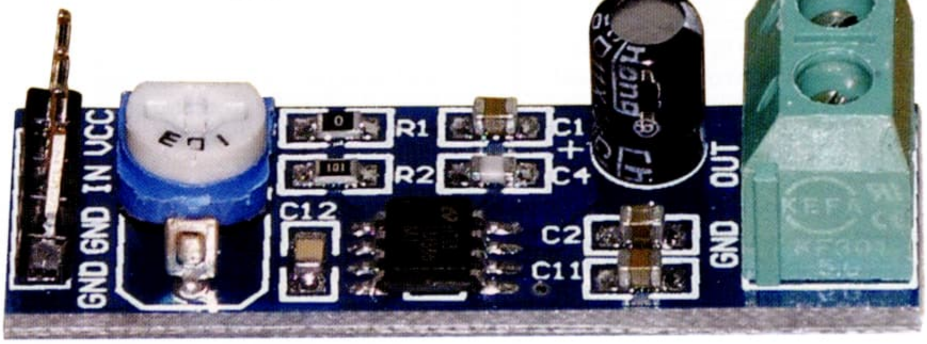


Figure 12: An audio amplifier module, bought on eBay, using the surface mounted version of the LM386. The module is only 40mm x 13mm.

Winding the coils

L1 and L2 are simple to wind: first, sellotape a layer of paper onto an 85mm length of 3/8-inch diameter ferrite rod. Then, using 30 SWG enameled copper wire, for L2 wind 5 turns starting about 10mm from one end, form a twist of wire (this will form the cathode tap) then wind another 50 turns on the rod. Cover the complete winding with sellotape to hold the wire in place and trim the wires to about 75mm long. Starting from the other end of the rod, you can now wind L1, this time with 30 turns to the tap point and then a further 300 turns. Again cover this winding with sellotape to stop it from unraveling itself. Don't worry too much about the tidiness of the 300 turn winding: it can be 'pile wound' to some extent to fit the available space on the rod without affecting performance too much. If you have an inductance meter handy, you need about 6mH overall for L1 and 200μH for L2. I used a Peak Electronics Atlas LCR Passive Components Analyser for measuring inductance. This is a very effective and easy to use instrument and completely takes away the often hit-and-miss aspect of coil winding.

The ferrite rod, with L1 and L2 wound on it, is mounted below the deck using a P-shaped plastic mounting bracket, spaced above the PCB material by at least 5mm to prevent the ground plane from damping the coil. I don't know if this is really a potentially significant effect, but it was no trouble to achieve this sort of spacing. Figure 11 shows the windings on the rod and the plastic P-clip approximately in the middle of the rod. Once the rod has been mounted, the ends of L1 and L2 can be soldered to the DPDT switch SW1, and wires from its wipers fed to the appropriate connections to the junction of VC1/C1/C2, and V1 pin 7 (the cathode connection).

The components around the tuning capacitor and V1 were connected point-to-point, using 'ugly-style' layout below the PCB deck which forms a very convenient solderable ground plane. The placement of the components is not critical and so other forms of construction could be used, for example, stripboard for IC1 and its associated components. In this case, axial or radial electrolytics can be used, whichever is to hand.

Use an assortment of colours for the sockets. On the prototype I used:

SK1	AERIAL	Yellow
SK2	GND	Green
SK3	+12V	Red
SK4	0V	Black

When you think all the wiring has been completed, thoroughly check the locations and polarity of all the components and check that all the solder joints are good.

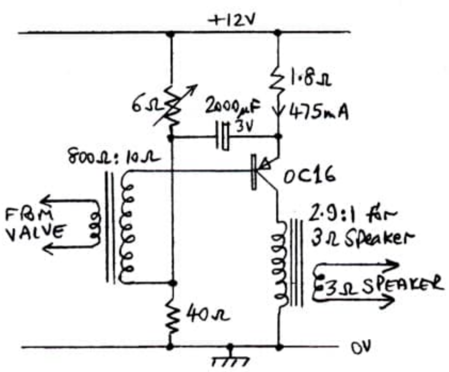


Figure 13: A typical OC16 transistor audio output stage which was used in many hybrid car radios in the 1950s.

Testing and using the receiver

The radio is very simple to test and use. Connect a 12V supply across SK3 and SK4, a long wire aerial to SK1 and, if available, an earth to SK2. Select the MW coil with SW1. Set VR1 (the REGEN control) to about mid-way, and VR2 (the VOLUME control) to about one quarter clockwise.

Switch on the power, check that LED1 lights, and check the current to the receiver. Don't worry if you don't get any audio from the radio immediately: remember you're using a valve whose heater needs warm up before it starts to work. The radio should take about 155mA at 12V, made up of about 150mA for the heater of V1, 2mA for LED1, 0.5mA for V1's HT current and 4mA quiescent current for IC1. After maybe five seconds of warm up time, you should hear at least a hiss from the speaker.

Tune around the band and several stations should be heard. When a station is tuned in, adjust the REGEN control for clear audio. Don't advance this control too far, but just below the level where audio distortion can be heard. Adjust VR2 for a comfortable volume level. The supply current to IC1 will rise as the output volume is increased. IC1 gives plenty of audio output and so you shouldn't need to have the volume level turned up too far.

The regeneration control is very smooth: as well as affecting the gain of the receiver, it also affects selectivity and so it can be used to sharpen the response to 'tune out' other close stations. You will probably need to adjust the control for each station as you tune around the band. Don't use the regeneration control to set the volume of the audio output: always set it just below the level where distortion begins and use the volume control for setting the audio output level.

When MW reception is working, switch SW1 to the LW position and tune to Radio 4 on 198kHz. This should come in loud and clear about half way through the tuning range of VC1. With a good aerial, you may hear a few other LW stations on either side of Radio 4.

At first I was caught out by the daily shutdowns of the BBC's Radio 4 long wave Droitwich transmitter, between March and summer 2014, and the reduction in power of BBC 5 Live on 693kHz. The long wave antenna and its supporting masts are being refurbished, which I suppose is encouraging for the future of this transmitter. This station is my usual first-stop for testing a radio and when it didn't appear where expected, the radio itself was under suspicion. I couldn't understand why the radio was working fine in the evening, and then next morning it seemed to have lost all its sensitivity.

Modifications

As with any unit of this type, there are many options available in the exact way you build it. Wider or narrower tuning ranges can be achieved by adding or removing turns on L1 and L2, using a different value tuning capacitor and/or adding a small-ish value capacitor in series with VC1. By reducing the inductance of L2 and the value of VC1 the receiver can be tuned to the SW broadcast bands. This type of radio isn't restricted to receiving only AM: SSB and CW can be resolved by advancing the regeneration control a little beyond what you would use for AM, to a state where the detector stage is just oscillating, fulfilling the role of a BFO in a superhet.

Better sensitivity and selectivity can be obtained by adding an RF amplifier with its own tuned circuit, before the detector stage. Maybe another 12AC6 could be used for this amplifier.

Reference 3 shows that the commonly available 6BA6 (EF93) and 6AU6 (EF94) can be operated at low anode voltages. These valves have the B7G-7BK pin-out, identical to the 12AC6, and so can be tried in an almost identical circuit to that in Figure 3. The difference is that these valves have 6.3V 300mA heaters, and so need to have an 18Ω resistor connected in series with their heaters to drop the 12V supply down to about 6.3V. I tried a 6BA6 valve in my circuit (with the 18Ω resistor fitted) and the results were very good, almost indistinguishable from the 12AC6.

Other audio amplifiers, for example the LM380, could be used, although I always find the LM380 to be noisier than the LM386. You can find complete LM386-based audio amplifier modules on eBay, either using the dual-in-line or the surface-mount (SMD) version of the IC, for very low prices. See Figure 12 for a photo of the SMD version: the PCB is only 40mm x 13mm. If you use such a module, you'd need to remove the on-board volume control and connect leads to the front panel mounted control.

A transformer-coupled discrete transistor amplifier (with, for example, an OC81D, 2 x OC81 line up) could be used if you want to re-create a 1960s-type audio path.

Figure 13 shows a typical transistor audio output stage, using an OC16, which was used in many hybrid car radios in the late 1950s / early 1960s, along with a low anode voltage valve front end. If you have suitable audio transformers (maybe salvaged from a scrap car radio of the right vintage) for the input to the base, and output from the collector of the OC16 (or similar power transistor) you might want to try to re-create this configuration. Note that the transistor operates in class-A: that is it has a large (typically nearly 0.5A) standing collector current, so you need to ensure that the 12V power supply can source this extra current and that the transistor has an adequate heat sink.

You could power the receiver from an even lower voltage than the 12V it's designed for. Remarkably my prototype worked down to 6V, taking about 100mA at this voltage, although the sensitivity and volume level had fallen off considerably. Radio 4 on the long wave and Radio 5 Live on the medium wave still came in loud and clear.

Conclusions

It was great fun building a radio, using a mixture of 1950s valve and 1980s IC technology, into a cigar box, resurrecting an old practice in the lore of wireless. I used a 12V anode voltage 12AC6 valve in my circuit, but I found that the 6BA6, and probably other 'high' voltage valves, worked almost as well. If you use the 6BA6, you need to be aware of its 6.3V heater, compared to the 12.6V needed by the 12AC6.

Hopefully you'll have lots of fun building and playing with this radio. Although it's very simple, it's capable of giving good results. You can use your fingers to poke around the chassis, if say you suspect a dry joint, in the knowledge that you won't get a nasty bite from this low voltage valve and IC-based design.

If you're looking for other things to do with a cigar box, there are collectors of the boxes themselves, attracted by the colourful and varied labels and the quality of the construction – some with mortise and tenon joints - and the type of wood used. Empty cigar boxes get used to store stamps, knick-knacks, and so on. Interestingly these boxes are used for much more: there is a whole class of guitars – with one or three strings - based on cigar boxes, finished versions and the paraphernalia of which can be seen on eBay. Take a look on YouTube if you want to hear the Blues played on such a guitar! You may also see cigar box tables and banjos, and a few radios.

There are some references on the internet to the LM386 being used as a guitar amplifier. Maybe a small, battery powered, amplifier could be built into a cigar box to match a cigar box guitar?

Component list

R1	2M2 0.25W carbon film	
R2	47k 0.25W carbon film	
R3	4k7 0.25W carbon film	
R4	10Ω 0.25W carbon film	
VR1	47k linear potentiometer	REGEN
VR2	10k log potentiometer	VOLUME
C1,2	100pF ceramic plate	
C4,5,6,7,9	0µ1 30V ceramic decoupler	
C8	2n2 ceramic plate	
C3,11,14	100µF 25V electrolytic (radial or axial … not critical)	
C10,12,13	10µF 25V electrolytic (radial or axial … not critical)	
C15	47nF polyester film	
VC1	10-365pF variable capacitor or similar (see text)	TUNE
V1	12AC6	
IC1	LM386	
LED1	5mm LED and bezel	
SW1	DPDT miniature toggle switch LW / MW	
L1,2	LW, MW coils. Wound on 85mm long 3/8-inch diameter ferrite rod, see text and Figure 11.	
RFC1	1mH radio frequency choke	
LS1	4-16Ω loudspeaker and grille material	
SK1	Banana socket (yellow)	AERIAL
SK2	Banana socket (green)	GND
SK3	Banana socket (red)	+12V
SK4	Banana socket (black)	0V

Miscellaneous

Cigar box
Aluminium for front panel
Wood-effect vinyl for covering front panel
Knobs for VR1, VR2, VC1
B7G valve holder for V1
8-pin socket for IC1
85mm length of 3/8-inch ferrite rod
30 SWG enameled wire for L1 and L2
Mounting bracket for ferrite rod
Insulated connecting wire
PCB (home-made) for the audio amplifier, if used
Printed circuit board material for chassis
10mm x 10mm aluminium angle for chassis
Screws, nuts and washers to hold chassis components together

References

Reference 1: Transistors Work Like This by Egon Larsen, published by Phoenix House Ltd in 1957.

Reference 2: 'Personal Mobile Receiver' by F G Rayer, G3OGR, published in the November 1959 issue of Practical Wireless. G3OGR's design uses two 12AC6 valves, one as the detector and one as the audio amplifier, driving headphones. I tried this valve audio amplifier, but was unable to get reasonable volume into a speaker from it via a valve output transformer, though the circuit will work well with high impedance phones in the anode circuit of the audio valve. The 'mobile' aspect of the article relates to a motor scooter, shown in the great magazine cover art of the period.

Reference 3: A two valve radio using a pair of 6BA6s running from 12V can be found at: www.qsl.net/kl7h/12v.htm

Other Useful References
An interesting website about low voltage 'tubes' is: www.junkbox.com/electronics/lowvoltagetubes.shtml

A two valve regenerative receiver using 12AU7 valves, running from as little as 8V, can be found at: www.qsl.net/k5bcq/REGEN2/regen3.html

A space charge superhet design can be found at: www.oldradiobuilder.com/12vsuperhet.html

Some designs for low voltage audio amplifiers can be found at: www.sophtamps.ca/mambo/index.php?option=com_content&task=view&id=25&Itemid=37

Garden Party at The British Vintage Wireless and Television Museum, West Dulwich

photographed by Carl Glover

Tony Clayden hosting the music quiz

The quadrangle sales area

Part of the television gallery

Adventures in Radio & Television by Peter Dolman (aged 61 1/3)

In the leader in the Spring 2014 BVWS Bulletin, Mike Barker asked for members' recollections of how they first became interested in the subject of radio and television. So here goes. Mostly written in the voice of my younger self, this essay merges memories of life at that age with some of my early TV related encounters, beginning during the mid 1950's. I hope that writing it in this way helps to convey the joy and enthusiasm I felt at the time – it's the tale of a young adventurer embarking on the first steps of what would become a life long passion...

Even as a little kid I was convinced that the Ekco TV standing in the corner of our front room was the most fascinating thing in the universe. Like all good baby boomers, I'd watch captivated as Bill and Ben's latest adventure unfolded, and whoop with delight as David Nixon astonished us with conjuring tricks on Crackerjack. Yet my interest wasn't purely about entertainment...compared to everything else in my little world, how that set did what it did was such a puzzle! And I loved trying to puzzle things out. The back had a warm, reassuring, cardboardy smell about it, there were little orangey lights glowing within, and if you glued your ear to the side of the cabinet, you could hear buzzing and whistling sounds coming from within, as if it had some kind of 'machine life' about it; but what could its insides possibly be doing? Neither a child's-eye view of cause and effect (gained by discovering that the rollers of mother's mangle could squash the water out of my shirts and the life out of my fingers with equal ease), nor my limited appreciation of mechanics (acquired through witnessing father's earnest attempts at double declutching), helped in my quest for clues as to the workings of this, the ultimate puzzle. The fact that no-one else seemed nearly as intrigued by it as I was made it all the more appealing ...the prospect of being a lone adventurer in search of the ultimate TV truth just served to spur me on.

Another thing that drew me to the set was how much I'd love hearing the tunes that were on in the daytime. Sometimes, when mother did her ironing we'd say to one another "let's put on some odd music, shall we?" I guess the expression came from 'odds and ends'. Anyway, it was just great! Once the telly had warmed up, an orchestra played tirelessly, whilst a mysterious criss-cross pattern with a circle glowed on the little screen. And as we listened I'd find myself imagining all those musicians arriving, come rain or shine, just to play all the 'odd music'. What if they went wrong today? I particularly enjoyed hearing music this way because the tones seemed much grander than those that trilled from the little wireless set up on top of the sewing cabinet.

Then there were our family holidays; these propelled me into a different and secret world, but my main fascination always came along for the ride. Mother would spend the best part of the day's journey re-checking her lists and praying for deliverance as father nursed our fume-filled Austin onward with an air of quiet desperation, briar pipe clenched between his teeth. Somehow we'd eventually reach the south Devonshire coast, and then the beach where, back in 1930, father had built a little chalet. The beach was very isolated, but there were always adventures to be had, despite (or probably because of) the complete absence of amenities, mains electricity or even a dependable water supply. Some folk that we met there were on holiday, like us, but there was also a handful of welcoming beach residents whose daily lives were spent far away from the normalities of 'civilisation' in every sense and who, on occasion, came to play an unwitting part in my television and musical enlightenment. In particular, there was a retired Colonel and an elderly married couple, Uncle Freddy and Auntie Nellie. According to my mother, the Colonel was in recovery, having had an unfortunate experience with something unmentionable whilst on duty in the Burmese jungle. He was a big man with a stentorian voice but he never used it to mention what the unmentionable event was, and I was a bit wary of asking him on account of his erratic behaviour. The three of them resided splendidly in his sprawling hand-built hardboard-clad chalet, which was elevated high on stone pillars (an enhancement reckoned to dissuade vipers and parasites from accessing their sleeping quarters). In order to avoid the need for unnecessary carpentry, multiples of 8' by 4' were the Colonel's chosen yardstick, so hence the dwelling featured such things as huge sliding hardboard doors which, having no top runner as such, pitched over perilously if pushed hard by little boys. It was all such fun!

One particular year, I discovered he'd acquired an ancient, oil dripping Lister milking engine and a dynamo which, when cobbled together, should provide something approximating a 240V dc supply to their residence. Compared to the mild-mannered mains supply at home, this arrangement was not for the faint-hearted! The Lister was installed in a spooky looking outhouse...

…which also doubled as the only toilet. Like its big hardboard brother, the spooky outhouse also teetered high on stilts, affording those engaged on any kind of personal business a degree of protection against the unwelcome attentions of inquisitive lifeforms lurking in the undergrowth beneath.

That first morning of our holiday, I stole up the steps into the engine room and, wide-eyed, took in the sight and smell of this motionless engine with its switchboard, huge lamps and curly-wired cables. This was a slumbering beast housed in a madman's laboratory and the sight of it filled me with both dread and excitement in the same way as did the huge steam trains that swept across the Fish Bridge and past our house each day. I wondered what would happen when the beast stirred…

Back in our little chalet our first night was approaching, the sun sinking slowly behind the west cliff. Mother set about her regular task of setting light to the stinky old oil lamp whilst my father prepared to do battle with the tuning knob of our Ever Ready valve portable. He'd almost got it twiddled when tranquillity was shattered by an ear-splitting pop-pop-pop-pink-pink-pink-thump-thump-thump-thump; rushing out to the edge of the lawn I was just able to make out the first plumes of black smoke belching upward from the thundering privy. As I watched, each and every window of the hardboard chalet began to illuminate unsteadily as the engine gathered pace. (A man unused to clouding issues with unnecessary detail, it turned out that the Colonel had seen no need to install light switches in any of the rooms when he'd wired the place up). Meanwhile, over in our chalet, a mere 250 yards away, it was becoming difficult to follow the gist of Dick Barton's exploits, despite a hasty battery transplant and then a precision retune. In fact, even normal conversation was becoming tricky for that matter, what with all that racket going on. Luckily, just as father was about to blow a gasket, Uncle Freddy's kindly face popped round the door and defused the situation. I liked Uncle Freddy. He did things that made the Colonel snarl, like breathing, and was always escaping over to us for a Park Drive and a chat before the next bellow sent him scurrying back to his duties.

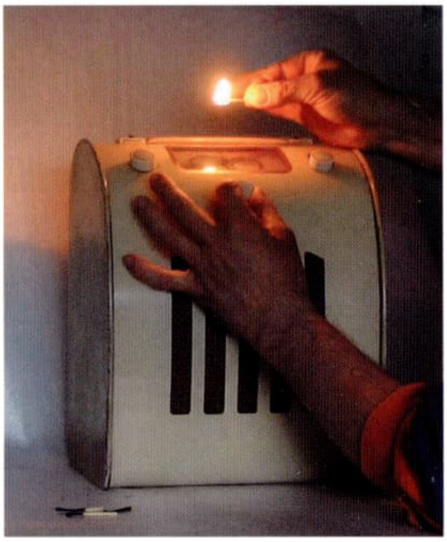
Within minutes we were all trooping through the gathering darkness, over to mark the mighty power station's debut. With waves crashing to our right and the sound of the throbbing engine echoing against the cliff face to our left, we were guided safely along the beach toward the pulsating lights of the splendid hardboard chalet. I couldn't wait…staying up late, and with luck they might even have some Tizer!

Later that week as I was down at the stream, fetching some milk from the cooler for a midday drink, the Lister fired up again; mixed with the sound of it, I could just about make out a lot of yelling going on. Torn between the prospect of a great adventure or an encounter with one of mother's impenetrable rock cakes I raced along the beach, in time to see what, on first glance, any boy worth his salt would identify as an invader from Mars, looming menacingly above the privy. However, on closer inspection it just turned out to be Uncle Freddy bracing himself astride the shuddering roof, twirling an enormous aerial. As he did so, the exasperated roar of mission control could faintly be heard floating through the nearby 8' by 4' kitchen window above the thumping of the engine. Every time the colonel yelled, the aerial would quiver even more violently and then there would be another yell. I waved, but for some reason Uncle Freddy didn't wave back, so I stole into the hallway and squeezed round the big kitchen door to see what was going on inside. Over on the table sat the strangest looking TV ever! It had a weird steppy sort of front, and from the side the cabinet was all sloping angles.

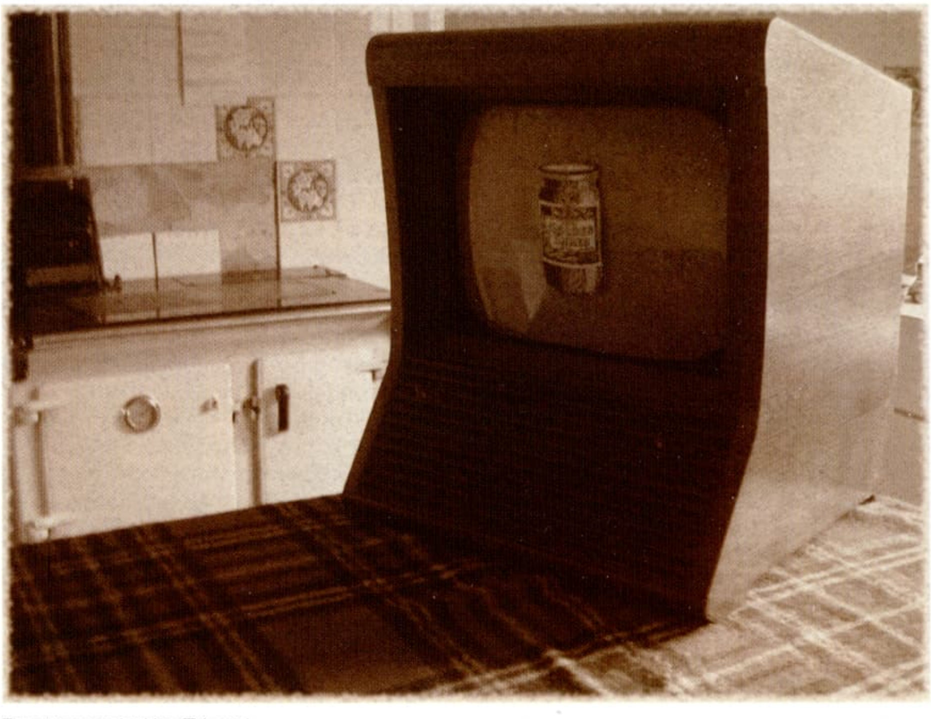
Occasionally, I'd make out fuzzy things on the screen, but as they came and vanished, the Colonel would leap across to the window and bellow 'stop' or 'back', or sometimes names from the Bible, even though it wasn't a Sunday. Suddenly there was some familiar music, which I knew came on whenever that white 'Watch with Mother' flower was closing up its petals. It had always made me feel safe and dozy, but it got the Colonel really excited and he started bawling 'stop' again and banging his fist down on the table, which made the flower sort of crunch up down the middle. It had never done that on our set at home, not even when the 3:30 to Devizes steamed by! I felt rather sorry for the flower and wondered what could have happened to make it do that. The Colonel looked pretty upset too and shot off outside and up the ladder to let Uncle Freddy know about it. Then they had a manly kind of tug of war with the aerial up on the roof of the privy, to cheer themselves up I guess. I remember hoping I'd still love 'Watch with Mother' that much when I grew up.

That evening we got invited over to watch Bronco Lane. Although most viewers would have probably watched it as a sensible western, we were just aching with hysterics when the Indians chased the cowboys across the face of the screen…because on reaching the middle, they'd suddenly double back and look like they were all colliding, then they'd all twist around again and off they'd go to the other side! I loved this set, it was far better than any other telly! Later on, during the romantic bit that they always put in for girls, the man and woman's noses were squashing back round on their faces every time they got close! We couldn't speak, we were just rolling about. All too quickly the programme ended, and as unreadable titles rolled up the screen, we all joined in with the theme tune, singing 'Bronco, Bronco…Bronco Lane!'. Between the second and third 'Bronco' there'd be this pause where the music skipped a beat, and at that moment Uncle Freddy thumped his feet down hard on the floor, which made the TV picture shake around like a jelly in a hurricane!

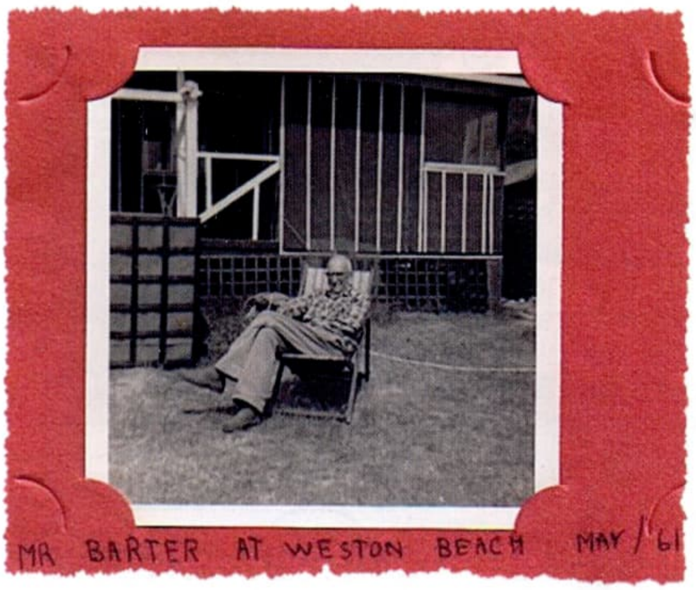
By now the Colonel seemed to have had enough laughter for one day, because he



Tuning by matchlight...



The strangest looking TV ever!



Uncle Freddy

sprang to his feet, big hands groping around behind the set. Then, grabbing one of Auntie Nellie's kitchen knives from out of the marmalade pot, he prised off the back, and began prodding around inside. Auntie Nellie made a face like she was about to have one of her episodes, but for me the chance to see an expert at work like this was smashing, and it got even better when the screen went all bright and he reeled back into the corner spluttering more biblical names plus other strange stuff…things we'd never have heard if we'd stayed back in our chalet listening to Dick Barton! I couldn't help thinking that, rather like the Colonel, the TV had experienced something unmentionable in the call of duty. And by the same token it dawned on me that like the TV, the Colonel would probably never be quite the same again...

As father dried his eyes and mother averted hers, I managed to sneak a look inside the back of the steppy set, and couldn't believe my eyes...all those glowing little glass things, the big grey cone, every bit of its insides a different shape and size like nothing I'd seen before, anywhere – ever. This really could be from the planet Mars! That moment, I knew I was right to be fascinated by the magic box, and the knowledge of this fact helped to map my future career.

Sadly, all too soon, the day came for us to depart, as beach visitors must. But I was heading home with the feeling of being firmly set on course for some great adventure. Television was fun! Back home, I'd often think of our friends down on the coast, particularly during the winter months. I'd imagine them going about their daily tasks, the beach all to themselves, watching the wind whipping up waves far out to sea as they ate their Christmas lunch, the Colonel firing up his generator as the sun set over the west cliff…

Wandering along that same beach in 2014, I find myself reflecting on our trade, a life in electronics and the meaning of life in general. Maybe a distant figure might chance into view, evoking memories of dear Uncle Freddy, rambling along the shoreline, collecting driftwood to burn in the stove, which warmed the heart of their splendid hardboard beach chalet - and that strange old TV set that dwelt within.

Despite the intervening years turning my hair almost as grey as Uncle Freddy's, my youthful inner self and I still look forward to returning home to an enjoyable life of electronics - and to my dear Maggie, who will have been ably running our workshop in my absence. We work from our home in Wiltshire, and on the workshop racks can be found all manner of equipment, which we maintain for those folk who care enough about their products to seek us out. From top end audio, personality-devoid flatscreens, the occasional jukebox, and - best of all - those much loved products of yesteryear (be they wireless, tape or vinyl based), all are queuing up waiting for TLC.

During my life's journey, I've seen huge changes to our industry and its products, yet I can't help reflecting that in some respects little has altered for me...because electronics is electronics, and a good grasp of the basics plus a perseverance buoyed up by plenty of enthusiasm, tea and biscuits can go a long way towards making the 2014 version of the job interesting. Grey hairs now? Oh gosh yes. Rich beyond my wildest dreams after spending decades in consumer electronics? Well, let's just say I don't think anyone would have been wise to enter that field if financial reward was their goal. As for me, well, whether I've been involved in servicing, teaching, working for minor or major retailers, freelancing for City and Guilds, the EEB and as a technical writer – or, best of all, working on television design at Decca, it's always been about passion. Our industry is unique, and so are those who have worked in it. And like every other BVWS reader, there are surely so many more tales and memories we could be sharing…but that's another story. So until then, it's time to return to the Test Card - and some music!

Making adaptors to extend the range of valves that can be tested in a Taylor 45D valve tester

by David Taylor

I have a Taylor 45D valve tester which has ten valve-holders, but - probably due to lack of space to have fitted them onto the test panel - it excludes several other valve-holders that I'd like to have. To extend the range of valves that can be tested, seven adaptors were originally available as accessories, which plugged into the B14E socket. These adaptors are now a rarity and if they do turn up, fetch exorbitant prices. All of the pins of the Taylor 45D test sockets are connected in parallel, (i.e: all pins 1, 2, 3 etc are wired to each other), so any test socket with the requisite number of pins could be used into which to plug the adaptors, rather than use the uncommon B14 socket.

The valve-holders that I wished to add to the range were B4, B5, B7 and Mazda Octal so I decided to make my own adaptors. Since none of these valves have more than eight pins, rather than try to source B14 plugs to make adaptors to plug into the B14 test socket, I decided to use the International Octal test socket on the valve-tester into which I would plug the adaptors. As valves with I.O. bases are plentiful, this meant that I could easily source scrap 'donor' valves from which to remove the bases to use as plugs for the adaptors. (I later discovered that high quality current production octal plugs with gold-plated pins are available for about £1.00 each from online shops on e-bay). Figure 1 clarifies how the I.O. plugs are wired to the chosen valve-holder, pin for pin.

A fellow forum member on the UK Vintage Radio Forum kindly provided me with the four valve-holders that I needed. I had some 75mm long off-cuts of 50mm diameter plastic bar which was ideal for making the couplers onto which to mount each valve-holder and I.O test plug to enable them to be wired together. As an alternative to plastic, hardwood such as beech, iroko or mahogany turned on a woodturning lathe would have been quite acceptable. The plastic coupler has to be of sufficient height to accommodate the valve-holder pins at the top end of the coupler, and the diameter of the hole in the top of the coupler should be wide enough for the valve-holder pins to fit snugly in the hole. Fig 2 shows the three components of the adaptors – the valve-holder, the plastic coupler, and the I.O. test plug. Fig 3 shows the top and bottom view of an assembled B7 adaptor.

Plastic turns well on a metalworking lathe so I turned a spigot onto which the I.O valve bases would fit. Valve-bases seem to come in a variety of diameters - the ones that I used were around 1.25"- about 35mm, with an internal diameter of about 30mm and a length of 15mm. There's nothing critical about the diameter and depth of the I.O. valve-bases - all that matters is that the individual couplers are turned to suit the bases and the valve-holders that are to hand. Having turned the plastic down to the internal diameter and length of the I.O. valve-base, using a Forstner bit in the lathe tailstock (a pillar drill would do just as well provided that the bit is accurately centred), I drilled a 20mm diameter hole into

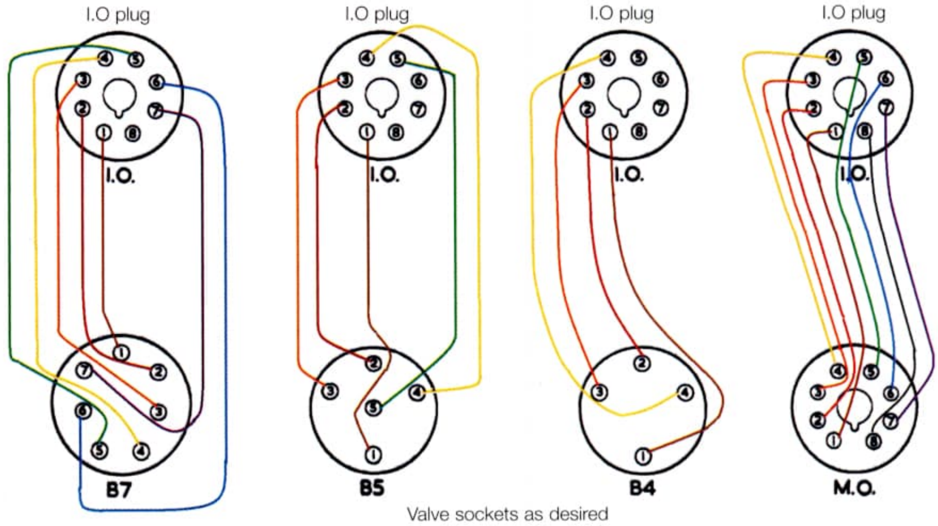
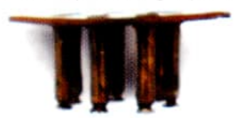


Fig 1: Valve Base Adaptor Wiring Taylor 45D



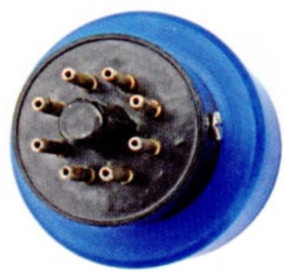
B7 valve holder

Plastic coupler

Donor Octal base

Fig 2: B7 valve base, adaptor coupler and Octal plug

Top view showing B7 valve holder



Underside showing Octal plug

Fig 3: Top & bottom of B7 adaptor

the valve-base end of the plastic coupler, I then reversed the coupler in the lathe and using another Forstner bit of a diameter to enable the valve-holder pins to fit into the hole at the top end, I drilled down to a depth at which the valve-holder tags could be accommodated. Fig 4 shows a cross sectional sketch of the dimensions of the Mazda Octal coupler I made, but I would emphasise that this is just a guide – the actual dimensions will depend entirely on the particular octal base and the chosen valve-holder socket for the desired adaptor to be made. The octal valve-bases which would be the plugs to plug into the I.O test socket on the valve-tester were fixed to the plastic coupler using 6BA pan headed screws, and likewise, the valve-holders were fixed into the top of the plastic couplers.

Having got to the stage at which the three components of the adaptor fitted together neatly, all that was left was

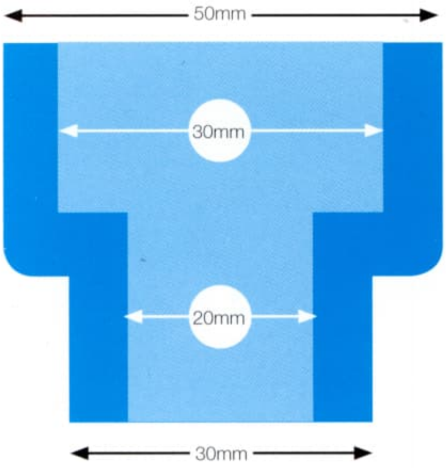


Fig 4: Typical dimensions of plastic coupler – sizes to suit actual valveholder and Octal base used

Fig 6: Four completed adaptors top & side view

Fig 5: Mazda Octal adaptor wired up

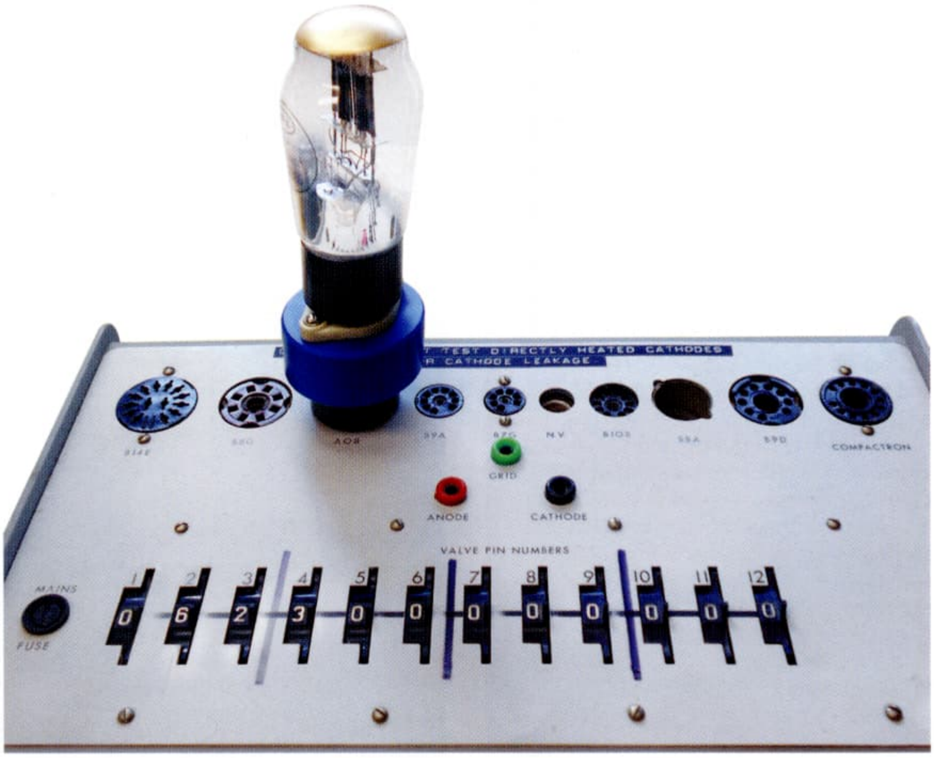


Fig 7: 1W4/350 rectifier valve (B4 base) under test in B4/Octal adaptor

to wire each octal base to the chosen valve-holders. The plug and valve-holder were dismantled from the coupler so as to wire the valve-holder to the octal plug, pin for pin. Care is needed here because though it may seem a simple task, it's easy to make a mistake in that the underside of the pins number 1 - 8 clockwise, whereas when looking down into the octal base, at risk of stating the blindingly obvious, they are of course 1 – 8 anti-clockwise.

The best way to avoid mistakes is to feed a 15cm length of tinned copper wire through each octal pin in turn, starting with pin 1. Bend the bottom end of the wire over to prevent it slipping out of the pin, then using the resistor colour code, (brown, red, orange = 1,2,3 and so on), slip a 25mm length of coloured sleeving over each pin in turn and solder the wire to the tags on the valve-holder one wire at a time until each colour-coded wire has been soldered to each of the tags. Hence, for a B4 valve-holder, tags 1 - 4 would be: brown, red, orange, yellow. The valve-holder can then be screwed into place on the top of the plastic coupler, and the octal base can be slid up the tinned wire onto the spigot of the coupler and screwed in place. Make a final check with the multi-meter that each of the octal base pins corresponds to the correct tags of the chosen valve-holder. Having checked out all of the pins to see that they match up correctly, the sleeved tinned wires protruding through the valve-base pins can be soldered and trimmed. Figure 5 shows a Mazda Octal adaptor wired up ready for final assembly so that the octal pins can be soldered and trimmed. Figure 6 shows the top and side views of the four completed adaptors I've made to date. Figure 7 shows the B4 adaptor in place in the I.O. test socket of my Taylor 45D valve-tester with a valve under test.

The same approach could be used to make adaptors for any make or model of valve-tester which is lacking in its range of test sockets. If preferred, for those without either metalworking or woodturning lathe facilities, the additional valve-holders could instead be mounted on a panel in a box, and the valve-holder tags parallel wired to each other, with an eight-way flexible lead wired to an octal valve-base to plug into the octal socket of the valve-tester test panel.

Acknowledgement: Thanks go to Jim, G4XWD on the UK Vintage Radio Forum for kindly donating the four valve-holders.

Letters

Dear Editor,

Many thanks for the latest BVWS bulletin which I received yesterday. However, to my surprise it was not delivered in the usual white envelope but instead was wrapped in a flimsy piece of polythene with an address sheet. Unfortunately this led to my copy being slightly damaged in transit.

I do not know why the bulletin was packaged in this way but on this evidence it is not adequate and I think we should expect to receive our bulletins in good condition to enjoy, especially as on this occasion it has a most impressive cover (somewhat spoilt by being creased as have about half the pages).

Please could you take my comments into consideration and try to ensure that this does not happen in the future.
[A replacement Bulletin has been sent - Editor]

Many thanks
Derek Burgess

Dear Editor,

I just want to say that I enjoyed Mr Niewiadomski's article on the early satellites very much. I found it very interesting and the illustrations were great. I am a nontechnical person and so I find this kind of writing very much to my liking. I have a colleague in work who actually understands electrical circuits (Ray) and I pass The Bulletin on to him when I have read it as he is able to appreciate it fully!

Ray's Dad was a bin man on the local council and he used to repair TV's and radios etc that people were throwing away. Ray and his brother then began building valve amps for use in halls and at parties. Ray has his hands full with work and domestic issues these days but hopes to return to building amps at some point in the future.

I have a couple of common valve radios at home which I occasionally attempt to adjust with my rusty screwdriver, with mixed results I have to say. We both thank you for the excellent Bulletin.

Yours sincerely,
Ian Evans

Dear Editor,

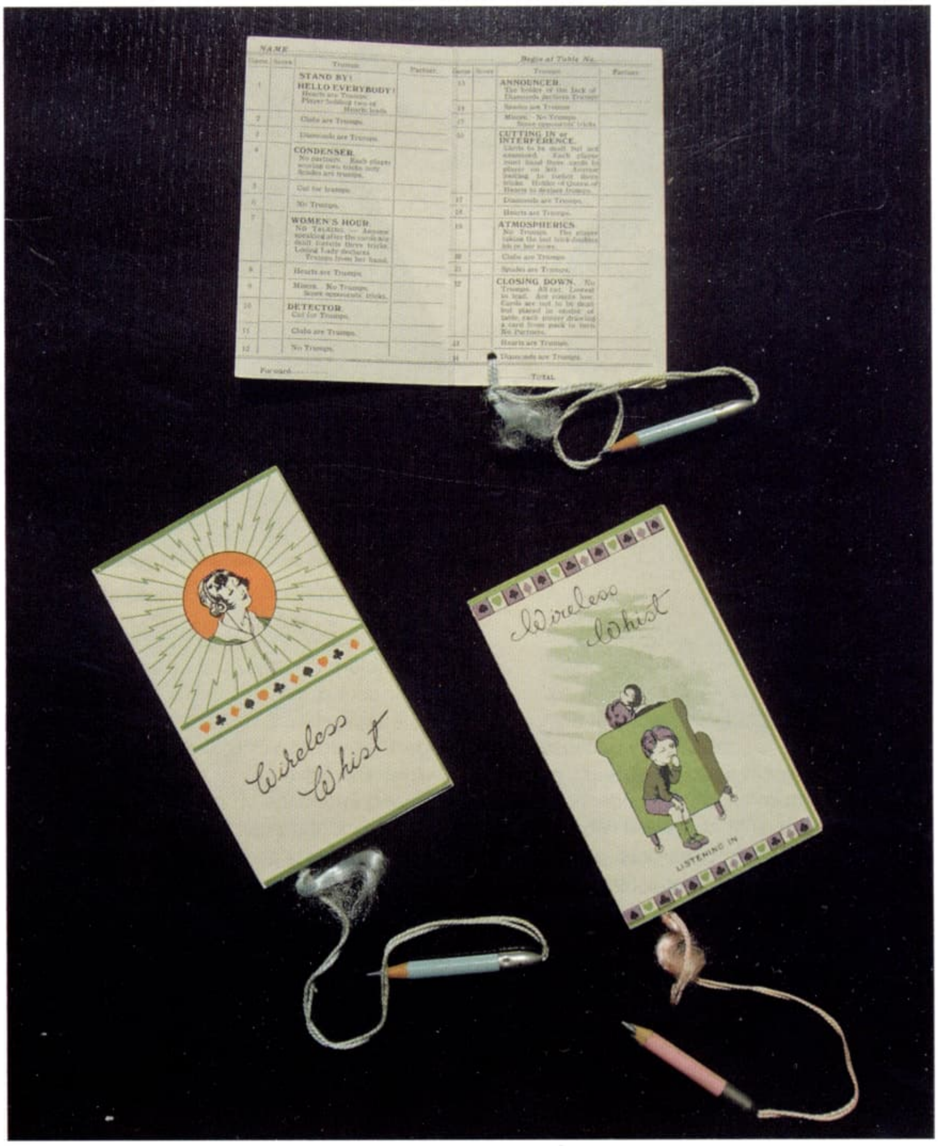
A friend came across these "Wireless Whist" scorecards in a junkshop in Cockermouth. They look to be from the mid twenties I would guess and are quite charming with their pastel shade pencils attached to the cards. They unashamedly utilise all the latest wireless jargon in an attempt to be up-to-the-minute. Delightful! Hope you enjoy them as much as I do!

Nigel Coulter

Dear Editor,

I was most interested to read Stef Niewiadomski's article on the Ever Ready 5214 pre-war portable radio in the Spring 2014 edition of The Bulletin as I have one of these sets in my collection and have been trying to identify the model number.

My set differs slightly from the ones illustrated in Stef's article. It has a brown/black



leatherette finish with plain brown knobs. The station nameplate has the wireless stations and manufacturer's name in white on a brown background. It was very generously given to me by a fellow BVWS member some time ago beautifully restored and in working condition.

My set appears to be a later version as it has octal valves (British Made) with no adaptors to suggest it was originally filled with side-contact types. The chassis layout and station names appear to be identical to the Dunstable Downs model as illustrated and the dial pointer and tuning knob rotate in the same direction.

When I opened the back of the set I found the remains of an Ever Ready guarantee card with the number 5217 written on it by hand. However, I was unable at the time to find any details about this model so I assumed it was a 5214 or one of the other known variants and that the number written on the card was a mistake. Using Stef's article as a reference, I do not think that my model is a 5214 after all. The Lucerne, Switzerland radiomuseum website lists the Lissen equivalent of the 5217 (model 8517) and in the accompanying notes it speculates as to the existence of the Ever Ready equivalent. Unfortunately no photographs or pictures are provided with this description.

Therefore, I have concluded that in the absence of further information, my Ever Ready set may be the elusive 5217 after all. The chassis number of this set is 2175519. I was informed by the person who gave it to me that the set came out in 1945 within weeks of the end of WWII. However in view of Stef's article and that my set still has pre-war station names it could date from any time between 1940 and 1945.

Regards,
Del Burgess

Dear Editor,

On a recent visit to the Orkneys I came across the Orkney Wireless Museum in Kirkwall. Opened over 30 years ago and still pulling the visitors in during the summer months. There is an impressive well laid-out collection of several hundred vintage radios plus some service transmitters and receivers and a large collection of early transistor sets.

The part played by the Orkneys during WWII in radio communication with the home fleet in nearby Scapa Flow is well illustrated and there is usually someone in attendance to answer questions.

For those who might be interested in paying this museum a visit when in that part of the world, details are as follows: Orkney Wireless Museum, Kiln Corner, Kirkwall KW15 1LB. Telephone 01856 871400.

Dear Editor,

The television pictured in the Summer issue of The Bulletin, Page 54, top right corner (a Pilot model?) was the type I repaired when I was in the fourth year at secondary school.

I remember changing the field output valve (due to frame collapse). As it was a single channel model, I didn't look for the cause of the valve failure, so after a while it needed changing again. Perhaps the second replacement valve didn't break down.

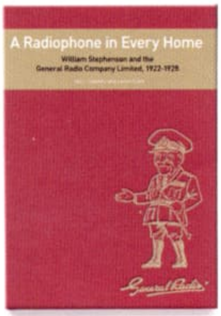
At a price of fifteen pounds, I wish I had been at the Golbourne swapmeet on April 14th. Our hobby is so interesting, at 68 I'm still learning.

Yours sincerely,
Norman Grant

Out Now!

A Radiophone in Every Home - William Stephenson and the General Radio Company Limited, 1922-1928

by Ian L. Sanders and Lorne Clark, with foreword by Jonathan Hill. Published by Loddon Valley Press. ISBN 978-0-570773-0-0.

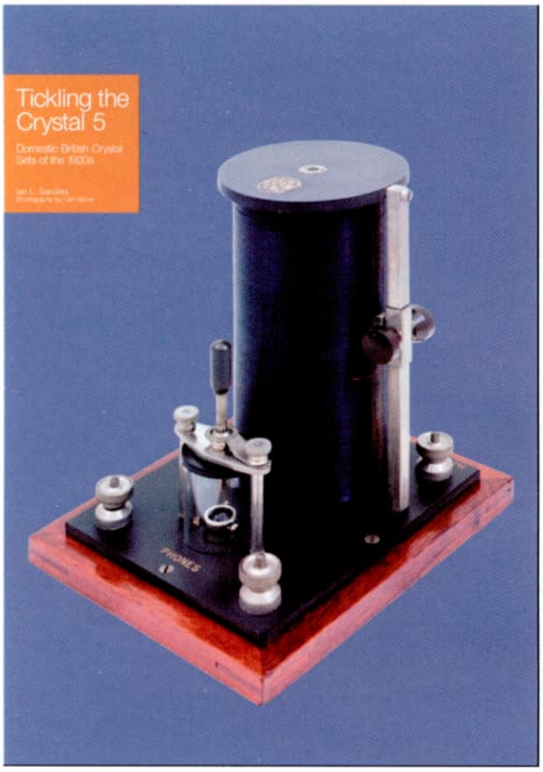


Between 1922 and 1927, during the life of the British Broadcasting Company (forerunner of today's British Broadcasting Corporation), literally hundreds of wireless manufacturing firms sprang up to take advantage of the new craze for 'listening-in'. In the fiercely competitive market of those pioneering days, many of these businesses were to disappear within just a few years. While much has been written on the history of the larger companies during this period of attrition, names such as Marconi, British Thomson-Houston, Burndept and General Electric – very little has been published about the smaller to mid-sized enterprises.

In their superbly illustrated new book, Ian Sanders and Lorne Clark tell the fascinating story of one of these smaller firms, the General Radio Company Ltd., and its enigmatic Canadian founder, William Samuel Stephenson, WWI air ace and WWII secret agent, thought to be the model for Ian Fleming's James Bond character. As well as producing an extensive range of radio receivers, the company also worked on the development of mechanical television.

This high quality publication is available for immediate despatch, price £19.95 (£17.95 for BVWS members) plus £4.95 P&P for UK, £7.50 P&P for EEC. BVWS members should quote their membership number in order to secure the discounted price. Payment via PayPal accepted.
For North America/Asia Pacific enquiries and orders: loddonvalleypress.us@gmail.com or write: Loddon Valley Press (North America), 1175 Teresa Lane, Morgan Hill, California, 95037, USA.
For UK/EEC/RoW enquiries and orders: loddonvalleypress@gmail.com or write: Loddon Valley Press, 16 Kibblewhite Crescent, Twyford, Berkshire, RG10 9AX, UK (note on paying by cheque: only sterling cheques drawn on UK bank, made payable to 'Lorne Clark' will be accepted).
Also available from BVWS stall and BVWS:
Mike Barker, Pound Cottage, Coate, Devizes, Wiltshire, SN10 3LG chairman@bvws.org.uk

BVWS Books



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Gerry Wells
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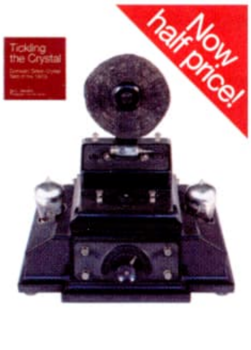

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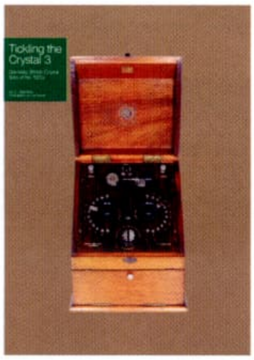

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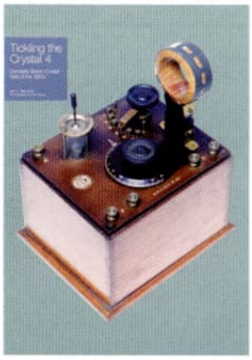

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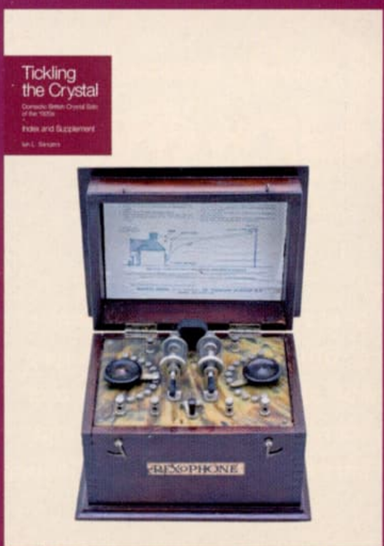

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7th December
Royal Wootton Bassett

The Memorial Hall, Station Rd. Wootton Bassett.
Nr. Swindon (J16/M4). Doors open 10:30.
Contact Mike Barker: 01380 860787

News and Meetings

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

2014 Meetings

September 14th Murphy Day, Mill Green Museum, Hatfield
September 28th Harpenden
October 5th Audiojumble
November 2nd Golborne
November 15th Afternoon of Music at The Vintage Wireless and Television Museum, West Dulwich
December 7th Royal Wootton Bassett

2015 Meetings

February 8th AudioJumble
March 1st Harpenden
April 12th Golborne
May 10th NVCF
June 6th Garden Party at The Vintage Wireless and Television Museum, West Dulwich
July 5th Royal Wootton Bassett
August 2nd Punnetts Town
September 13th Murphy Day
September 27th Harpenden
October 4th AudioJumble
November 1st Golborne (changed from 8th due to Remembrance Day)
December 6th Royal 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 9:30, tickets for sale from 09:00, Auction at 13:00. Contact Vic Williamson, 01582 593102
Audiojumble: The Angel Leisure Centre, Tonbridge, Kent. Enquiries, 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 10:00. Contact Mike Barker, 01380 860787
Golborne: Golborne: Golborne Parkside Sports & Community Club. Rivington Avenue, Golborne, Warrington. WA3 3HG contact Mark Ryding 07861 234364
Punnetts Town: Punnetts Town Village Hall, Heathfield, East Sussex TN21 9DS (opposite school) Contact John Howes 01435 830736
Mill Green Museum: Bush Hall Lane, Mill Green, Hatfield, AL95PD
For more details with maps to locations see the BVWS Website: www.bvws.org.uk/events/locations.htm

Giant rarity: Detector + Morse Receiver, c. 1910
Compact laboratory experimental unit for very early wireless data transfer! – (Euro 5.000 – 8.000)

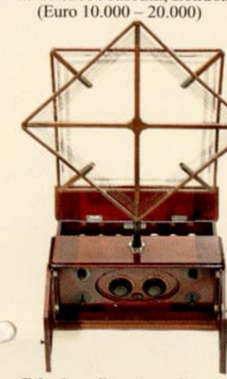
»MAC – Mechanical Analogue Computer«, 1958
First tape-operated computer in the world, for flight simulation, by Air Trainers Link Ltd., Aylesbury, UK. Size: 64 x 77 x 24 in. / 163 x 195 x 61 cm.
– **Only one other example is on exhibition at the Science Museum, London.** –
(Euro 10.000 – 20.000)

Early wireless telegraphy receiver after a design by Marconi, with coherers by Max Kohl, 1903
(Euro 2.500 – 4.000)

Rare French piano-form radio receiver by Ducretet, Paris, 1926
(Euro 4.000 – 5.000)

American »Candle Stick Telephone« by DeVeau Thelephone Mfg. Co., New York, 1905
(Euro 900 – 1.200 / US$ 1,200 – 1,600)

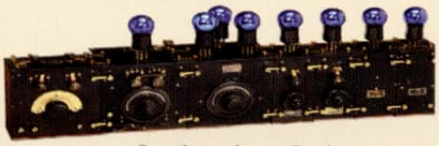
Giant Mercury Arc Rectifier »Signum«, c. 1930
Height: 70 cm / 27 ½ in. – Ø 22 cm / 8 ¾ in. –
(Euro 1.200 – 1.800)



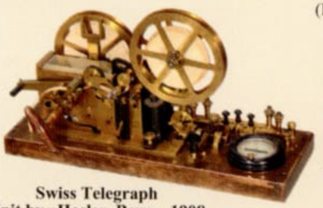
»Ethodyne Broadcast Receiver« by Burndept Ltd., London, 1926
(Euro 2.000 – 3.000)

WWII Shortwave Receiver »Anton Kw.E.a.«, 1944
Designed by Telefunken for mobile use. – (Euro 1.500 – 2.000 / US$ 2,000 – 2,600)

»Berrens Mod. AB4«, c. 1925
Rare French battery receiver. – (Euro 2.000 – 3.000)



»Superheterodynette Receiver« by Radio L.L., Paris, c. 1922
Extremely rare! – (Euro 8.000 – 12.000)



Swiss Telegraph Unit by »Hasler, Bern«, 1908
(Euro 2.000 – 3.000)

»Magnetic Detector« by Marconi's Wireless Telegraph Co., London, c. 1908
Early radio wave receiver for Morse code. A good example of the iconic "Maggie" made famous by its service upon the **R.M.S. Titanic**. –
(Euro 8.000 – 15.000)

WWII Longwave Receiver FuPE 40h by Telefunken, 1940

»Atwater Kent Breadboard Receiver Mod. 3955«, c. 1923
(Euro 1.800 – 2.500)

Pericaud Radio Secteur, c. 1925
French 4-valve battery receiver. Extremely rare!
(Euro 1.800 – 2.500)

Electric Driven Mercury Interrupter, 1881
(Euro 900 – 1.500 / US$ 1,200 – 2,000)

»MITS Altair 8800, 1975
Milestone: 1st P(ersonal) C(omputer) in the world. – (Euro 3.000 – 5.000 / US$ 4,000 – 6,500)

Early Battery Set with 6 Leyden Jars in Box, c. 1870
(Euro 1.000 – 1.500 / US$ 1,300 – 2,000)

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»Marconiphone V2«, c. 1924
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