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BULLETIN

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NVCF

National Vintage Communications Fair

Sunday 13th May 2018

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British Vintage Wireless Society

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An Ekco S.H.25 pictured from the front and rear

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From the Chair...

As I write one fine Sunday morning in February, I notice that the daffs are already pushing through, just a reminder of how fast we've sped away from winter and are already well into another year. And as I look around the workshop, I notice that there are a few projects that I'd intended to have a go at last year but are still collecting dust. I buy items at our auctions and swap meets with all the best intentions of working on them but other demands on my time mean that they remain pipe dreams. Every so often I get a bit ruthless, have a clear out and chuck things back into the auctions, it's probably better to let someone else have a go, or do they also buy on a whim and then end up doing the same? It's interesting being an auction porter, after a while you do see items re appear again and again…

Following the plea for a new membership secretary in the last Bulletin, Dave Church was very quick to respond. Many of you will know Dave, by face if not also by name, as a regular visitor to our RWB, Harpenden and Punnetts Town events. For a while now he has been working quietly in the background scanning the Bulletin back issues for the BVWS website. He has been co-opted on to the Committee and will take on the role of Membership Secretary at the AGM in March. I know that he will give much dedication to this role and with his enthusiasm for the hobby he'll be a great asset to the society. Thank you, Dave!

Thank you to the others who also enquired.

It is with great regret that I have received the resignation from our BVWS Archivist Lorne Clark. The society holds much historical material, some of great significance, be it text, letters or photographs and Lorne has been scanning, logging and storing it for the last seven years, this information will eventually be accessible on line for the benefit of all well into the future. Lorne is having to give up this role due to medical reasons, on behalf of the society I thank Lorne for all his many hours of hard work. We wish him well and look forward to seeing him at our events.

We are looking for someone to take over the role of BVWS Archivist, if you are able to help, please get in touch.

We understand that Harpenden Public Halls, a regular meeting place for the BVWS since 1978, is to close in 2020. The site is due to be redeveloped to support the provision of other leisure and sports facilities in the town. Cost has also become an issue, to hire the building for the day and pay for additional tables to be bought in now costs in excess of £900 per event.

So we need your help to find a new location to hold our March and September events for 2020 onwards. Mike, Jim and Vic did spend a weekend a few years back visiting other locations in the area. The problems faced were not only excessive cost but availability on a Sunday – many schools and leisure centres who have large halls run sporting activities at weekends. We need the exclusive use of a suitable room from 8am to 6pm.

We no longer need a hall quite the size of HPH, something the size of 'Bassett would suit, a larger village hall maybe? Although a stage isn't necessary to display the lots, the auctioneer and his extra eyes need to be elevated to see over the crowd. Somewhere northwards of the M25 along the M1/A5 corridor would be ideal. Other considerations are parking facilities, access by rail/public transport and catering facilities. If you know of anywhere that might worthy of consideration, please get in touch and we'll investigate.

Please note – we will continue to meet at Harpenden Public Halls until you read otherwise here!

It's been a busy start to the year with the extra auction at Royal Wootton Bassett and our usual presence at the Audiojumble in Tonbridge. And with Harpenden auction/ swap meet/AGM coming in March, Golborne swap meet in April and of course the NVCF at Warwickshire in May we've certainly plenty to do. I thank not only the committee but also the many other members who give so much of their time and travel long distances to help make these events successful for us all to enjoy. We simply couldn't do it without you...

Best regards

Greg

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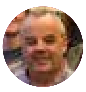
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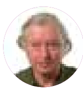
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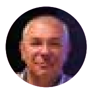
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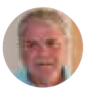
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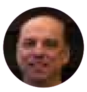
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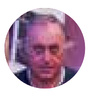
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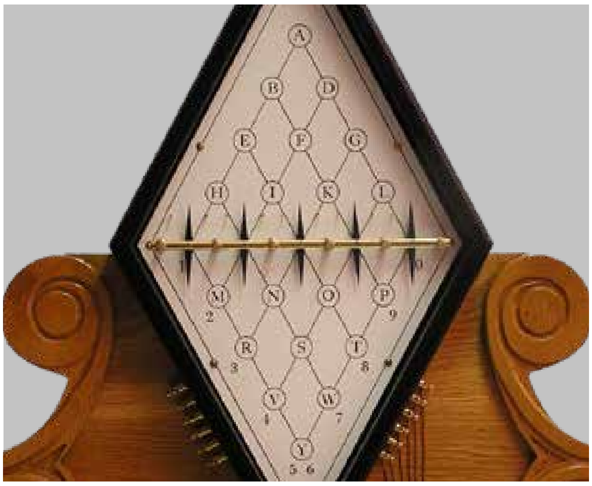

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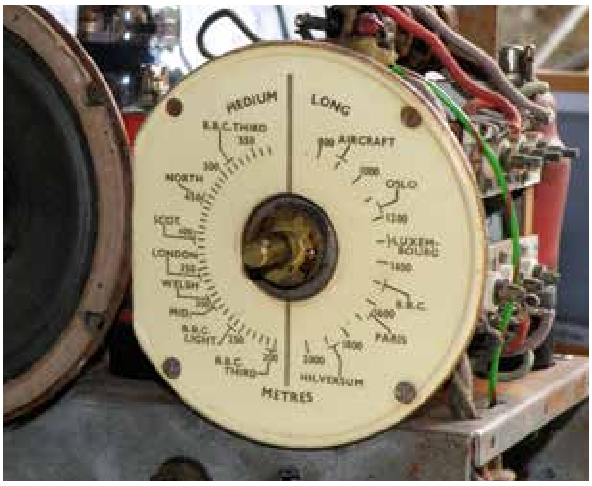

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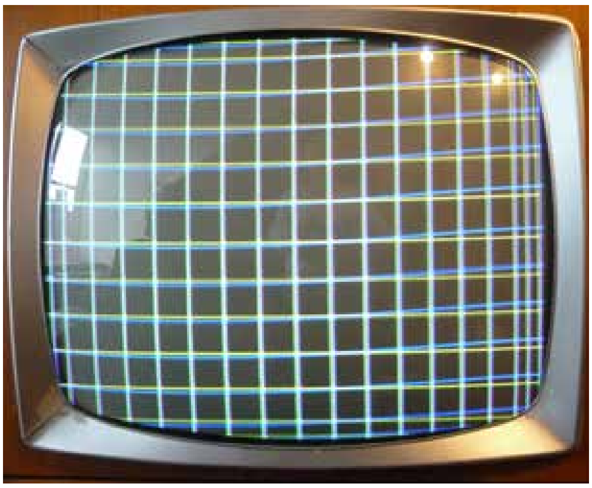


Colour TV Restoration Part 2 - Page 53

The Windsor 45B Valve Tester

Roger Grant

This interesting piece of test gear was rescued on its way to the skip along with a Windsor 20B Signal Tracer and a Windsor 110c component bridge, all made by the Taylor Company of Slough Bucks in the early 1950's, all three a bit scruffy with a touch of rust thrown in.

In all my years working in the electronics industry I don't ever remember seeing anyone actually using a component bridge, although most of the workshops that I worked in had one. The same with the signal tracer, a much rarer beast, basically an audio amp with a few extra functions, again I don't remember seeing anyone using one. The usefulness and condition of these three pieces renders the only one worth looking at the valve tester. Still a very useful and sought-after piece of test gear.

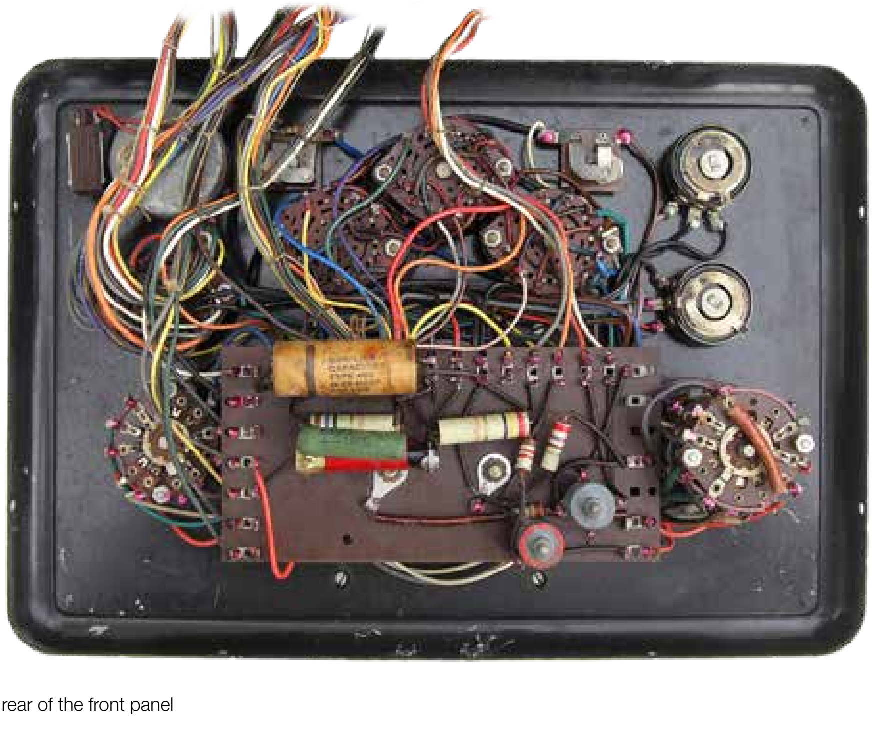
This one really looks the part. It's compact and looks very functional, and is a typical example of one of the many lesser valve testers in the early post war years trying to compete with the professional and well established AVO testers of this time. Working in West London in the 1960's not too far from the Taylor factory I came across their test gear frequently, especially the 127A multimeter a firm favourite. A lot of the smaller Radio and TV businesses I worked for used Taylor test gear as it was A lot more affordable than the AVO range.

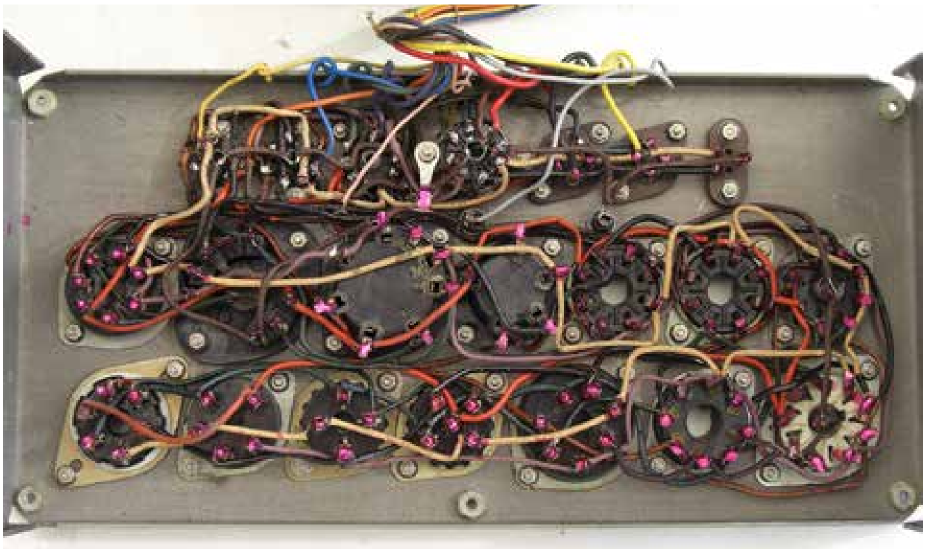
This valve tester came with all the instructions and paperwork, very handy as after a look at the front panel the valve pin selection method wasn't obvious. The set was very dirty, covered in a very sticky greasy dirt very difficult to clean especially the many valve sockets. Which took multiple attempts using both water/detergent based and solvent based cleaners. I eventually used an ammonia based foam cleaner which took a lot of rinsing with water as in the past I have found this can leave an electrically conductive residue so I only usually use it on the cabinets. Cleaning the valve holders was a real problem and required a very stiff, long bristled artists paintbrush to get to the bottom of the pin sockets and contacts. Four of the smaller valve sockets, the B9A, B8A, B7G/1 and B7G/2 (I did wonder why it had two B7G sockets) required replacement as the outer metal frame was very rusty and very unsightly but the rest eventually cleaned ok. I removed all of the knobs and meter for front panel cleaning. In order to remove the meter I had to remove the two meter lamps. These are well hidden and were stuck fast in their hardened rubber grommets and both broke during removal. They are 6v 0.2A tube type and the grommets were replaced with new ones.

Front view

The first checks were to test for any major problems. Fortunately the mains transformer checked out ok as did the meter, the rest of the components could easily be repaired or replaced so its all systems go. There are no smoothing capacitors in this testers power supplies as the valve being tested acts as the rectifier being tested on the positive half cycles of the AC supply, not unusual. I have found that most of the valve testers I have encountered work in this way.

On test all of the resistors were within spec and the rectifiers tested as expected for selenium pile types. RECT 1 only used to rectify the meter current on the filament continuity test and cathode bias on the mutual conductance test. RECT 2 for a negative grid bias voltage. There is only one capacitor used in this tester, C1 a 0.25uf 350v paper type. On test this proved to be ok in leakage and capacity, well above 20meg leakage and reading 0.26 mfd capacity. This capacitor is only used in the cathode leakage test circuit, where the capacitor is connected between the filament and cathode. The rest of the elements are connected together and an AC voltage applied and the valve acts as a rectifier and produces around 50 volts DC between the filament and cathode and the meter reads any leakage current read as megohms of leakage.


The rear of the front panel



Tester Valve socket deck underside

The rubber mains lead was showing signs of deterioration so I replaced it with a more modern type that looked very similar, the rest of the wiring is plastic and all ok.

I very cautiously powered up on a variac and all was well. The meter lit up and no evidence of any problems. A closer look at the front panel shows this tester has all the usual selector switches but how to set up the valve on test was still unclear. The test function selector, filament, anode, screen and grid voltage selectors were all self explanatory and can be set from the manufacturers data but there are three selector switches for selecting the valve pins marked A, B and C, and two pots marked A and B. This requires the Taylor instruction manual and valve chart to make any sense of it, unlike the AVO testers where the valve pin roller switches are in pin number order, and are also marked with their function.

The next step was a good read of the instruction manual, this is a very flimsy paper manual, fifteen pages in all, A5 size. The centre fold pages are the complete set of circuit diagrams of this tester, a bit small and difficult to read and they didn't shed any light on solving the pin number puzzle, although (with a magnifying glass) I did ascertain that the drawing is dated 4th April 1951.

Using my PC and a scanned-in copy of the manual, I re-drew all of the circuit diagrams and printed them in a more useable size. The main circuit diagram of the power supplies and switching, a diagram of the valve holder wiring and six separate explanatory drawings of the circuit used for each test function. Having one for each of the test functions of the valve under test made the situation a bit clearer.

It appears that the heater pins are permanently wired to the common pins of any particular valve base i.e. pins 4 and 5 on a B9A base, pins 3 and 4 on a B7G, pins 2 and 7 on an I.O. base and so on. This explains why there are two I.O. bases and two B7G bases. These cover the heater pin variations on these bases. There are three permanently wired wander sockets on the valve holder deck for the top cap connection, Black for Cathode/ground, Green for grid and Red for the anode, this accounts for five of the eleven wires connecting the main tester to the valve holder deck sockets leaving six for the switch selectable pins of the valve.

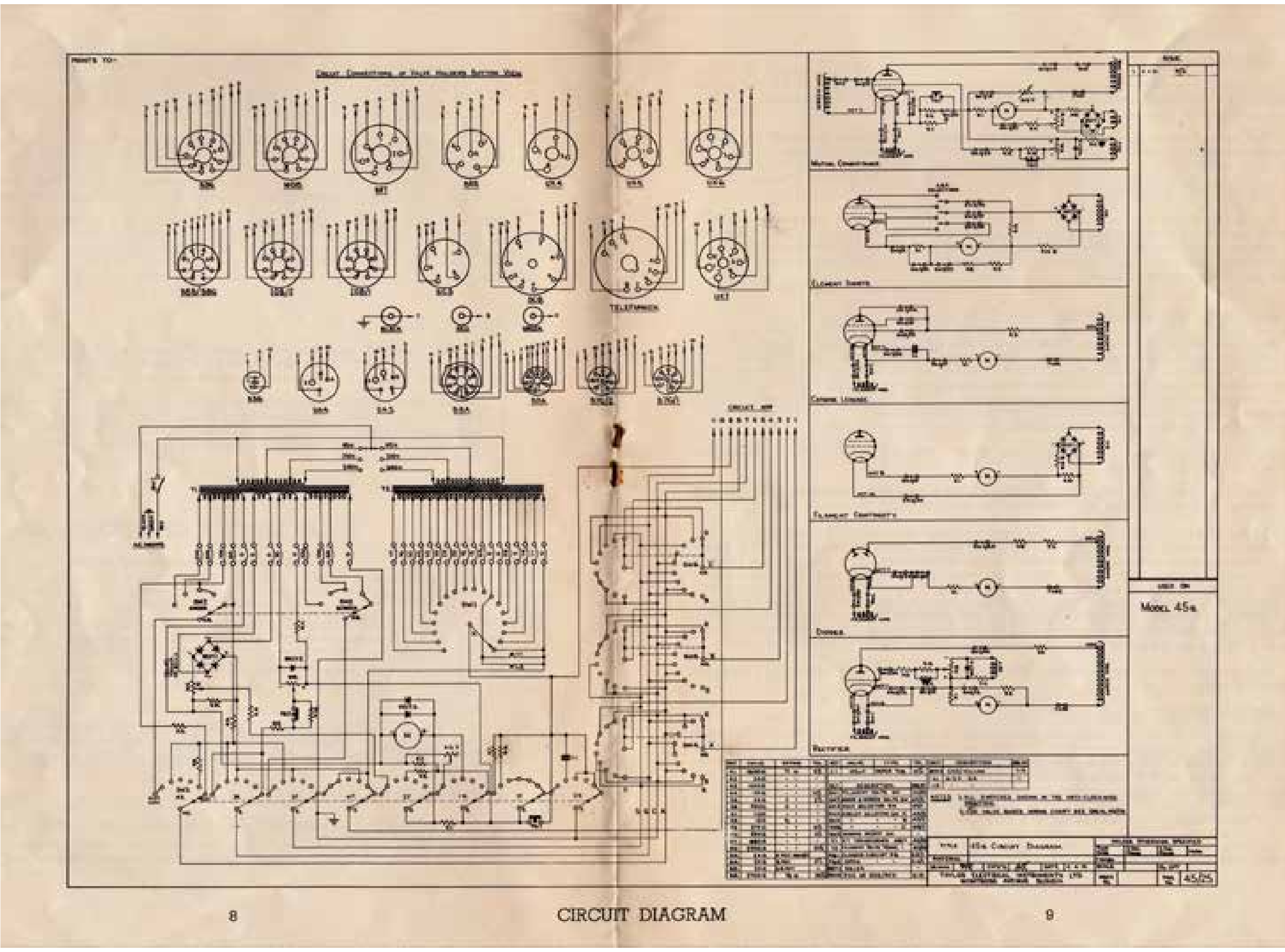
These eleven wires are referred to in the circuit diagram as "Circuits 1 to 11" abbreviated to CCT. CCT 11 is the Top cap Grid socket, CCT10 and CCT9 are the permanently wired filament connections, CCT8 is the Top cap Anode socket, CCT 7 is the Top cap Ground socket and CCT 1 thro 6 are the six switch selectable connections.

The selector switch "A" has two wafers switching circuits 1 and 2 to two of the four electrode connections to the valve base, Anode, Grid, Screen and Cathode.

Valve socket deck

Front page of manual

The PW Ad for the 45B



Original circuit diagram

The ten selectable positions for these switches cover all combinations for these two circuits, on position "0" the circuits are both grounded (cathode). Switch "B" is the same as switch "A" but connects circuits 3 and 4 and Switch "C" likewise connects circuits 5 and 6. The circuit numbers don't refer to pin numbers in any way so reference to the three digit coding in the Valve chart is absolutely necessary. The top cap lead is plugged into the appropriate wander socket on the valve holder deck.


Inside the tester, the works

Following the instructions very closely, (usually a good idea at this point) and using the Valve chart booklet I selected a handful of known good valves and ran through the test instructions, the easy ones first. Diodes and Rectifiers. The only anomaly is the inclusion of a grid input for controlled rectifiers, something I hadn't encountered before, these tests were easy enough, the first tests, electrode shorts, filament continuity, cathode leakage then diodes or rectifiers selected for "Go" or "No Go" emission on the meter, these were quite straightforward. Next a triode, after the initial tests for continuous filament, shorted electrodes and leakages, the set up for Mutual conductance. This now employs the rest of the controls, the pots "A" and "B" and the two push buttons marked "METER" and "GAS".

With a high regard for the safety of the meter as a mishap and its demise would render this tester useless and replacement very difficult (although this tester does have a 100m/A fuse in the anode circuit), I decided that it would be a good idea to switch off before making any switch setting changes as the instructions suggest that a clash of pin selections could easily damage the valve or the tester.

Before selecting mutual conductance and power on (Two ranges, 3m/A or 15m/A, selected according to expected result), I checked that the voltage selections were correct especially the filament voltage and that pots A and B are turned fully anticlockwise as per instructions. On power on, (wait for the valve to warm up) turn knob "A" clockwise

(Meter current shunt) until the meter pointer reaches the "X1" mark (about 3/5 up the scale). Then turn knob "B" (bucking bias voltage) until the pointer returns to zero, press the "METER" push button (this shorts out the cathode bias resistor) and read mA/V directly from the scale. On low emission valves where the pointer will not reach X1 then set it at X2 (about 2/5 up the scale) and on pressing "METER", multiply the scale reading by two.

After mutual conductance, the excessive grid current test is performed without changing any of the switch control settings, turn knob B to the fully clockwise position (meter 500uA f.s.d.), turn knob A so that the meter reads centre scale, then press the "GAS" push button (drops grid bias). If the meter goes off the scale in either direction the valve has excessive grid current, right positive grid current, left negative grid current, the latter may be due to grid emission.

So far, so good, my known good valves tested with expected results, and I now feel more at home with this tester, the valve chart lists around 3000 valves and in the manual there's a valve bases wiring look-up chart so you can work out the ABC switch settings for any valves not listed, you do have to work it out as there are two electrode connections per switch, not too difficult, just a little inconvenient.

The valves in the valve chart are listed by type, I found the choice of selection a bit strange. First Receiving valves, which seems to cover anything that amplifies, then Rectifiers, then followed by a miscellaneous section containing Thyratron's, Tuning Indicators, Gas Triodes and with a adaptor, Cathode Ray Tubes.

Any multiple valves have two or more sets of switch settings including the tuning indicators. These have three (or more) one on the triode amplifier, then the shadow target anode followed by the shadow test. The shadow test changes the triode anode voltage (connected to the screen voltage supply as the target is connected to the anode supply) closing the indicator shadow, this seemed to work reasonably well while giving a good indication of the state of the phosphor, the usual problem with magic eyes.

I wasn't keen on the ABC pin selector switch idea and much prefer the extra switches one for each pin, but this would require six extra switches and a bigger box to fit it all in and increase the cost considerably.

The very flimsy paper instruction leaflet was in very good condition considering one would probably need to refer to it every time if valve testing wasn't very frequent. This points to this tester not having had much use, probably as it's a lot easier to check a valve by substitution.

There's a lot of fiddling about using this valve tester, great if you like twiddling knobs and switches. While this can make it more fun to use it's very time consuming and easy to miss something out or get a wrong pin setting. There's also limited anode and screen voltages available. To compensate for this there's a formula to calculate the deviation from the

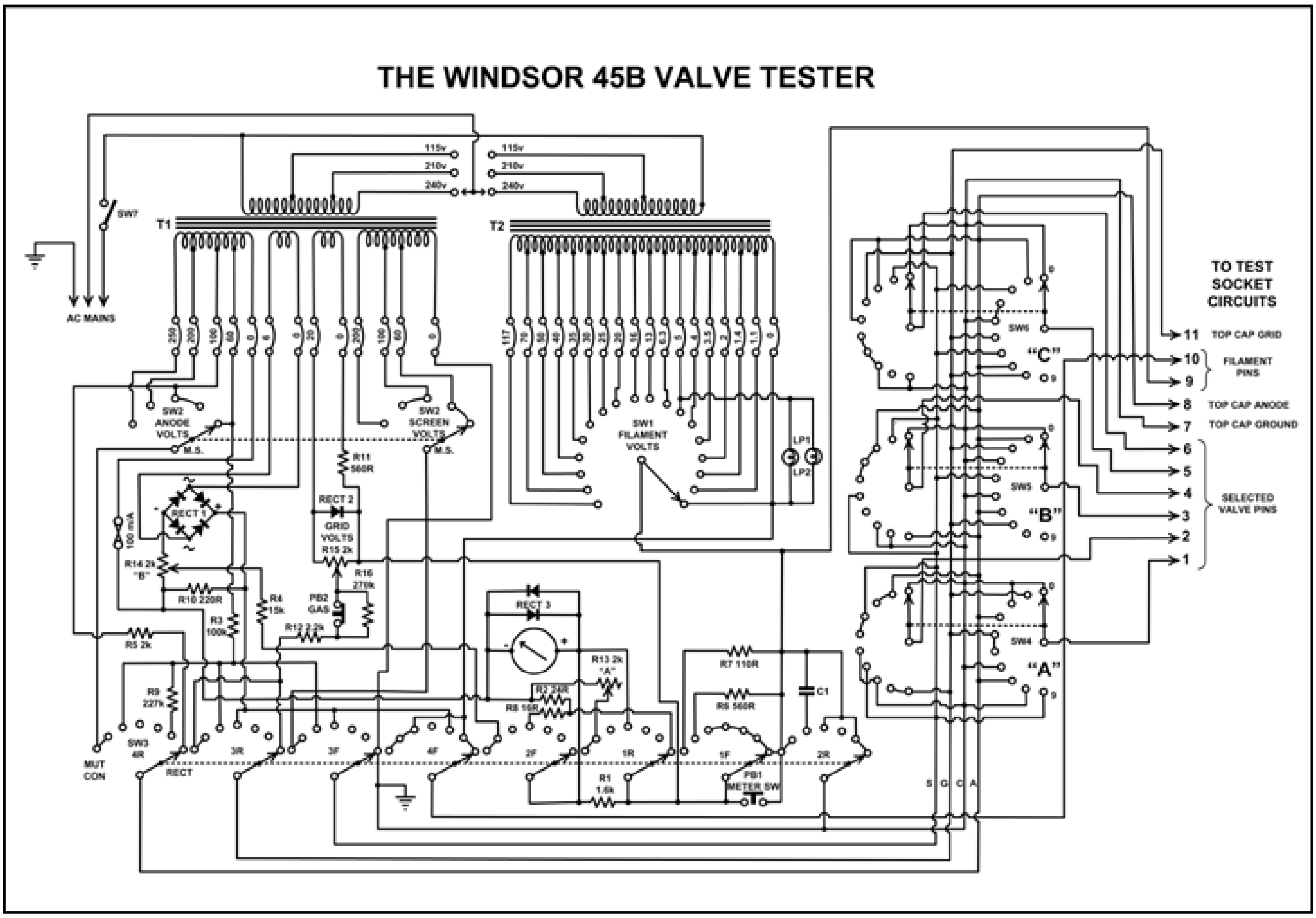
VALVE BASES

CIRCUIT	UX6 6 PIN AMERICAN	UX5 5 PIN AMERICAN	UX4 4 PIN AMERICAN	BR5 5 PIN ENGLISH	BR7 7 PIN ENGLISH	MO8 8 PIN MAZDA OCTAL	B9G 9 PIN ENGLISH GLASS	UX7 7 PIN AMERICAN	TEL TELEFUNKEN	SC8 8 PIN SIDE CONTACT	SC5 5 PIN SIDE CONTACT	I08/1 8 PIN AMERICAN OCTAL No1	I08/2 8 PIN AMERICAN OCTAL No2	B8B B8G LOKTAL	B7G/1 7 PIN MINIATURE	B7G/2 7 PIN MINIATURE	B9A 9 PIN MINIATURE GLASS	B8A 8 PIN LOCK-IN MINIATURE GLASS	DA5 5 PIN MIVAC MIDGET	DA4 4 PIN MIVAC MIDGET	B3G 3 PIN MINIATURE GLASS
1	4	—	—	—	2	5	2	5	7	6	1	5	3	6	6	1	2	3	—	—	—
2	2	2	2	1	3	3	7	3	8	8	—	4	4	3	—	2	6	5	1	1	—
3	5	—	3	2	1	6	8	6	2	1	4	1	1	4	4	6	9	4	2	2	—
4	—	4	—	—	7	7	3	2	4	5	—	3	6	2	—	5	1	2	—	—	—
5	3	3	—	5	—	—	6	4	1	7	5	6	2	5	3	—	8	—	5	—	—
6	—	—	—	—	6	4	4	—	—	—	—	8	5	7	5	7	7	6	—	—	—
7	—	—	—	—	—	2	5	—	3	4	—	—	—	—	—	—	3	7	—	—	2
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—
9	6	5	4	3	4	1	1	7	6	3	2	7	7	8	1	4	4	1	3	3	1
10	1	1	1	4	5	8	9	1	5	2	3	2	8	1	7	3	5	8	4	4	3

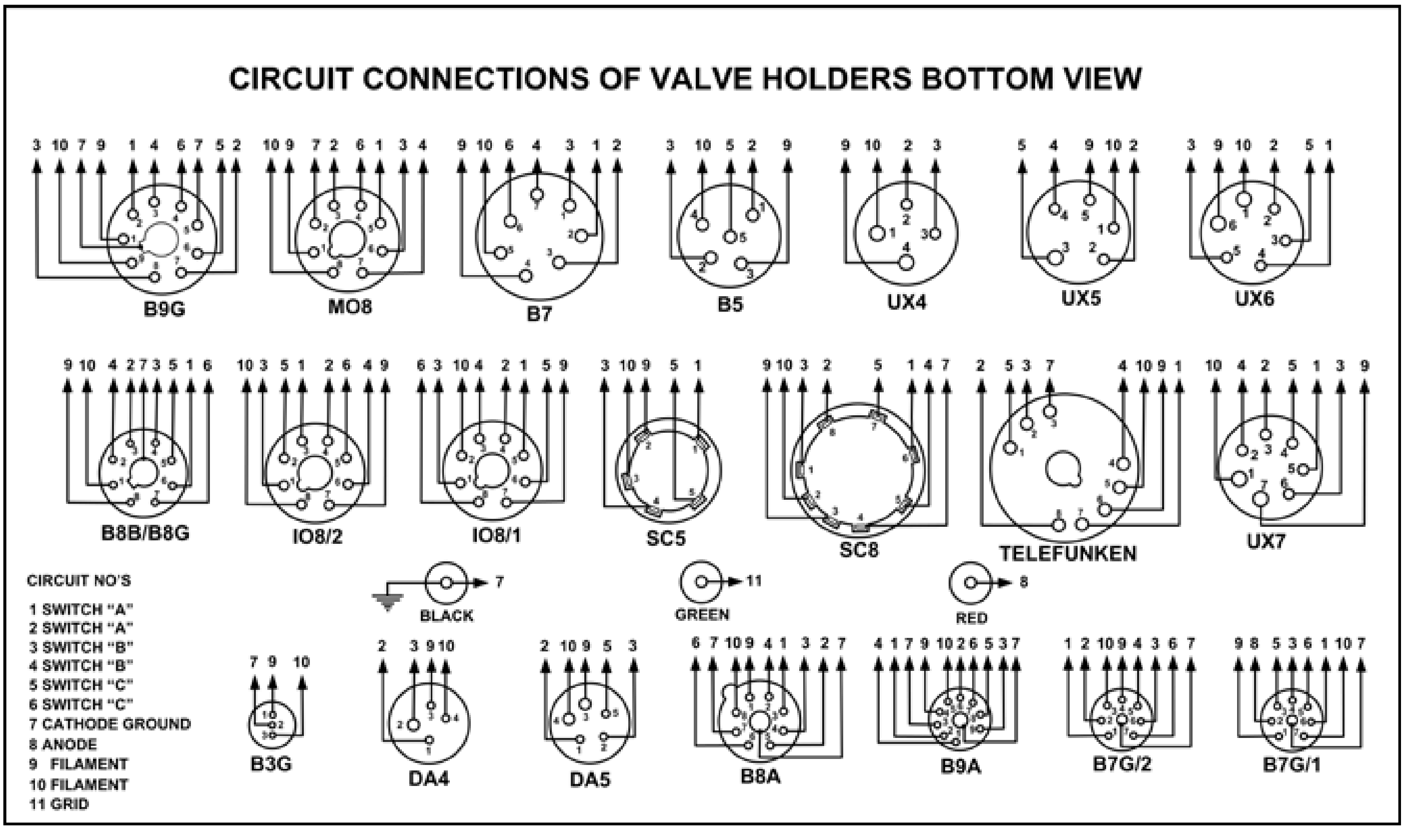
CIRCUIT SELECTOR SWITCH POSITIONS.

CIRCUIT	0	1	2	3	4	5	6	7	8	9	CIRCUIT SWITCH
1	C	G	C	A	G	G	C	A	C	S	A
2	C	A	A	S	S	C	S	C	G	G	
3	C	A	G	C	S	C	A	G	—	—	B
4	C	S	A	A	A	S	—	C	C	A	
5	C	A	S	C	C	G	S	A	G	—	C
6	C	S	A	G	A	C	C	C	—	C	
7	PERMANENTLY CONNECTED TO CATHODE										
8	" " " ANODE										
9	" " " F1(CATHODE SIDE)										
10	" " " F2										

Pin Selection calculating Chart (Scan)



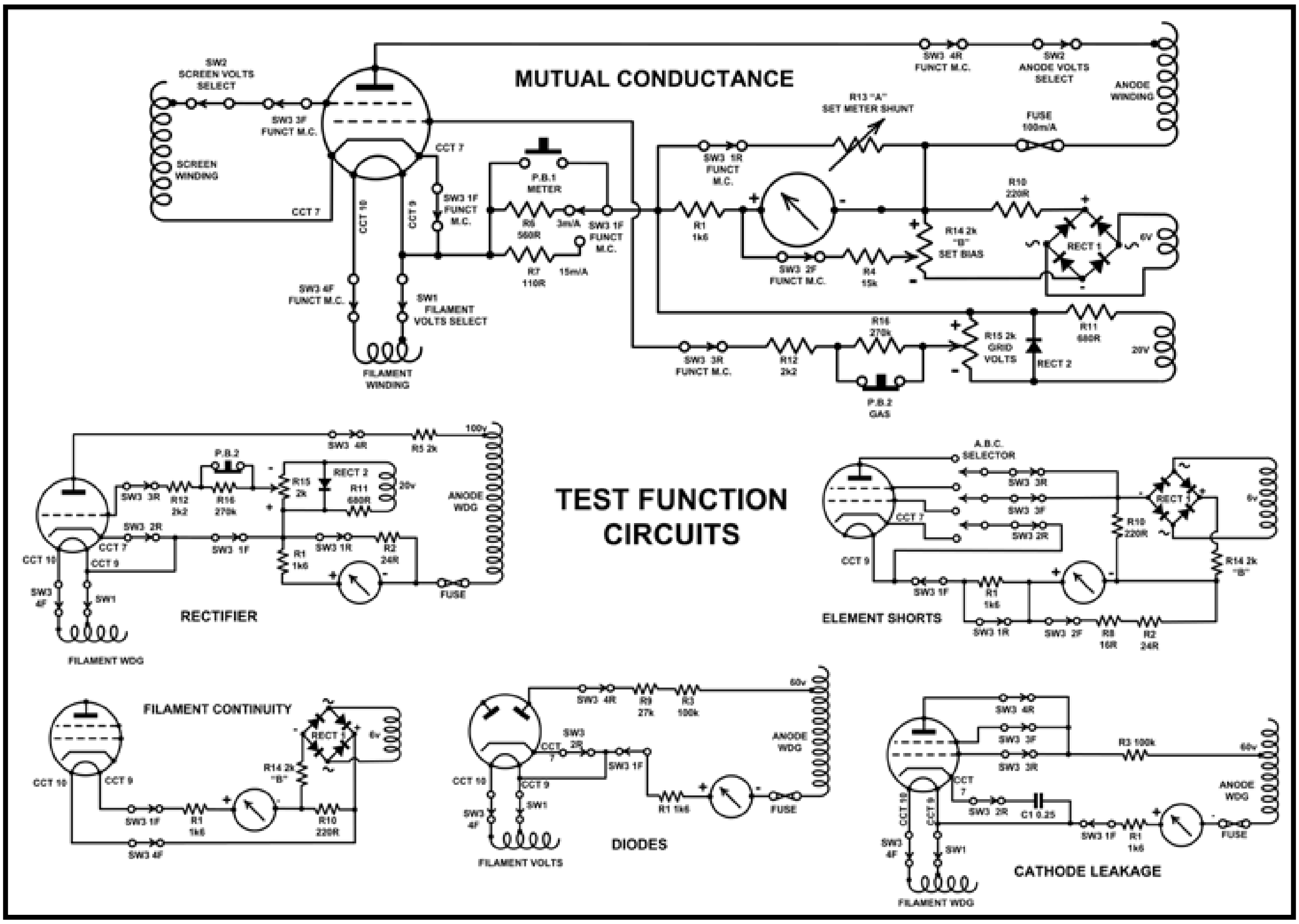
Main circuit (redraw)



Valve under test circuits (6) (redraw)

manufacturers specification in the instructions, even more fiddling, but if you don't have another valve to substitute for a suspected one, this like other testers is well worth its keep.

It also serves as a reasonably good gadget for one in one out batch testing several valves of the same type and it doesn't require a large space on the bench like the AVO valve testers and doesn't take up much space on the shelf.



The Valve holder wiring. (re-draw)

M A R C O N I P H O N E 9 1 1

Prof. Charles Wheatstone and his telegraphs Part 1

Fons Vanden Berghen

In the past I have written articles about Samuel Morse, Louis Breguet and Werner Siemens, their activities in the field of telegraphy, their instruments and their companies. So it is high time that I now devote one to Charles Wheatstone…. Let it be clear from the beginning: I did not do any research about the life and work of Prof. Ch. Wheatstone. First, I am not in the position to do that, and second, some talented people have already done this thoroughly and with success. That has resulted in splendid books and there are several of them in my library. See the bibliography at the end of this article.

Wheatstone began his lifelong involvement with electrical engineering in the days when it was still at the stage of "philosophical toys". Yet, after having done tests in order to measure the speed of electricity in cables, he had a vision of telecommunications that could deliver printed messages around the world. Working with William F. Cooke he developed the first practical electric telegraph; he also made contributions in the fields of optics and acoustics as well as electrical engineering. He had an encyclopaedic knowledge of the scientific literature in several languages, and made connections which benefited not only his own work but also that of others. His research aided the development of the new King's College in London into a centre of scientific excellence. Amongst his many inventions were the concertina and the stereoscope, both very popular in the nineteenth century. He is usually remembered by electricians and engineers for the 'Wheatstone bridge', which he did not invent but published the details of in the course of a lecture on measurements. He tried to measure the speed of electricity, made electric motors, laid the base for a linear motor, and so much more. Yes, Wheatstone was certainly a major figure in Victorian science.

Fig 1 Prof. Ch. Wheatstone

Some Precursors

I think it is worth describing in chronological order how technology lead to the invention of the telegraph. I will not go all the way back, but will only highlight briefly some interesting facts and people, starting at the beginning of the 19-th century.

Around the year 1800 Allessandro Volta (1745-1827) noticed that he could generate an electric current by bringing two different metals into contact with one another. Further research resulted in the 'voltaic pile' pictured in Fig 2, which comprised a stack of discs in the recurring sequence of copper, zinc and felt soaked in sulphuric acid. That was the start of the development of further research for continuous current sources: the batteries.

In 1816 Francis Ronalds (1788-1873) erected in his garden (just above Hammersmith Bridge in London) a complex wooden structure that carried nearly 8 miles of metallic wire. On applying an electric charge to one end of the long wire, a spark would jump from the other end. He thus showed that electricity would travel a long distance in an imperceptible interval of time and without any apparent diminution. Then he used the line to carry out some simple signalling experiments.

In 1820, the Danish physicist Hans Christian Œrsted (1777-1851) published a paper in which he showed that a magnetic needle could be deflected by a wire carrying an electric current, and that the direction of the deflection depended on the direction of the current and on whether the wire was above or below the needle. Less than two months later André-Marie Ampere (1775-1836) published his theoretical explanation of the effect and that was the start of electromagnetism. I can add here that Œrsted was in London in May 1823 where he became acquainted with Wheatstone's work.

At around the same time Johann Schweigger (1779-1857) of Halle (Germany, not my hometown here in Belgium…) announced the invention which became known as Schweigger's multiplier, an invention of great importance in the history of the telegraph. He had concluded from Œrsted's experiments that if a current was made to flow through a wire wound in a coil, a needle placed inside the coil and parallel to its turns, would experience a force multiplied in proportion to the numbers of turns of wire.

Schweigger's idea was successfully applied in 1832 by the scientists Karl F. Gauss (1777-1855) and Wilhelm E. Weber (1804-1891) of Göttingen (Germ.) to the private single line telegraph system (2.5 km) between the observatory and Weber's laboratory. Their system may be regarded as the world's first effective telegraph link. It was mainly used to transmit the results of their measurements related to Ohm's law and the earth's magnetic field. During the mid-eighteen thirties , they handed their system over to prof. Carl A. Steinheil (1801-1870) of Munich. He made improvements in the electromagnetic system for generating the current (by a magneto), and also devised a simple but ingenious receiver. He published a description in 1838 but did not develop it any further. Steinheil also discovered in the mid 1830's, during his experiments concerning the use of railway rails as conductors, that he could use the earth just as well as a wire.

Fig 2 Volta pile - photo coll. of the author

At about the same time there was a Russian diplomat in Germany, Baron Schilling von Canstatt (1786-1837), who was, with the help of professor Georg W.Muncke (1772-1847) of Heidelberg (Germ.), working on a telegraph based upon five electrical circuits controlling five needles. Each magnetic needle was suspended by a silk thread and hung horizontally within a coil of wire. Fixed on the suspended thread was a vertical disc of cardboard carrying a horizontal black line on one side and a vertical line on the other. Below the needle and the coil was a horizontal paddle which moved in a small bath of mercury in order to limit the fluctuation of the needle. As each disc could take two positions, depending on the sense of the electrical current sent by the transmitter, there were 32 possible positions. In the next few years Schilling simplified his telegraph to use only one needle. In 1837, at the order of the Russian Tsar, he installed the first line between Kronstadt and Peterhof. Sadly, he died before the project could be completed and it was discontinued. Pity, he could have been the father of the telegraph…

Professor Muncke showed such a single needle system in his lectures. It was in March 1836 when one of his audience, a young man called William Fothergill Cooke, was extremely captivated by the telegraph and immediately saw its money-making potential. He soon asked Wheatstone to help him.

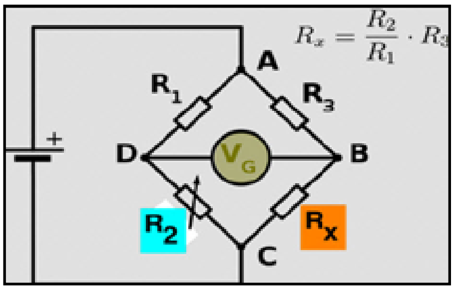
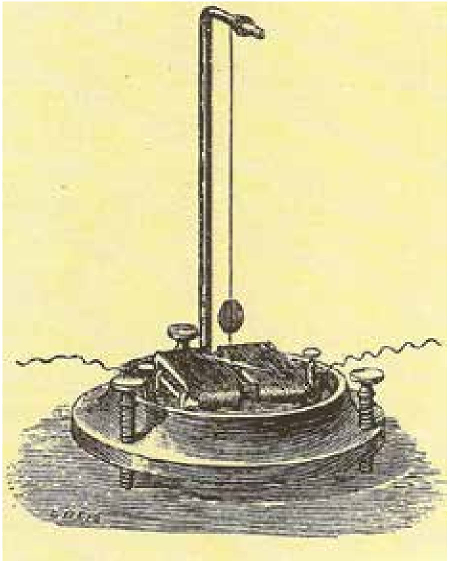


Fig 3 Wheatstone-Bridge



Muncke's apparatus

Professor Charles Wheatstone (1802-1875)

Charles Wheatstone was born on 6 February 1802 in Barnwood (Gloucester). His father was a musician, and in the early 1820's we find Charles engaged in the manufacture and sale of musical instruments in London. Quite how the young musical instrument maker turned to serious scientific enquiry is not clear. His work was directed towards the improvement of the instruments his firm made, but instead of trying one alteration after another he chose to conduct systematic experiments on the nature of sound. He read widely, particularly the published work of Continental scientists. Then he began his life-long involvement with electrical engineering. He obtained his first patent in 1829 for a special music instrument, the "symphonium". In 1833 he published two great papers. One was labelled 'On Acoustic Figures,' and the other 'An Account of some experiments to measure the velocity of electricity and the duration of electric light'. This latter paper on electricity marks a definite departure from the work he had previously done on acoustics. His experiment is known as the one with the rotating mirror. The result of his experiment was 288,000 miles a second, although more precise experiments in the 1860s showed that this was markedly higher than the actual speed of light. Even so, those two great papers so enhanced his scientific reputation that in 1834 he was appointed to the post of Professor of Experimental Philosophy at King's College, London. His early attempts to measure the speed of electrical current using long lines (1833-1834) were inconclusive, but these experiments gave him the idea to transmit signals over great distances. In other words, he was already thinking of how he could convert his apparatus into a telegraph! His later studies of signals in submarine cables contributed to the understanding of the effects of capacitance and inductance in undersea conductors. As a consequence, he devoted himself in the following years (especially during 1836 and 1837) to the making of a telegraph. By early 1837 he had invented several versions. Important to note are relationships with two men who had a considerable influence on him and who helped a lot in that period. These were his friend Joseph Daniell (1790-1845), who was also a Professor at King's College, and Professor Joseph Henry (1797-1878), Professor of Mathematics and Natural Philosophy at the Albany Academy, New York, an authority on electromagnetism. The fact that Wheatstone alone had the necessary understanding of electric circuit theory to design a telegraph system which would work through several miles of wire put him in a strong position for what followed. Together with William F. Cooke, who knocked on his door on 27 February 1837, he developed in that year the first practical electric telegraph. Both men were interested in it, but their approaches were quite different: Wheatstone was pursuing scientific research while Cooke was embarking on a business venture. Cooke told Wheatstone that his intention was to take out a patent; Wheatstone told Cooke that his own intention was the advancement of scientific theory and that he had no plans to exploit the telegraph commercially. More on this in the next pages. For Belgian readers I can add here that the Belgian scientist (and director of the Royal Observatory) Adolphe Quetelet and Wheatstone were very good friends. In 1840 Quetelet wrote about Wheatstone's telegraph in the Bulletin of the Royal Academy of Brussels, and Belgium was the only European country (outside the UK) to have installed Cooke & Wheatstone needle telegraphs (1845/1846). This was certainly highly influenced by their friendship. Amongst others, Quetelet helped Wheatstone to gain a patent in Belgium.

A few more words about the Wheatstone Bridge - Fig 3

Prof. Wheatstone is usually remembered by electricians and engineers for the 'Wheatstone bridge'. He did not invent this instrument, but published details of it in the course of a lecture in 1843 on electrical measurements. It was actually a device first put forward by one of his assistants, Mr. S.H. Christie. But despite all that, the arrangement of resistors (in the form of a bridge?) has been known ever since as 'Wheatstone's Bridge'. He himself called it 'the differential resistance measurer'. And now for the technicians among us…Why is it called a 'bridge'. I think that Brian Bowers is right when he presented this idea in his book on Wheatstone [1] "This term relates not to the whole circuit, but to the detector, which 'bridges' points of equal potential". A last and sad comment here: Charles Wheatstone died almost a hundred and fifty years ago, and while he made a number of significant inventions, he is only remembered, if at all, for this 'Bridge', which he did not invent…

The aim is to calculate the resistance value (Rx) of un unknown conductor (e.g. the resistance of a long wire). The equation in the figure becomes valid when no current flows through the galvanometer (R2 is a variable resistor).

Fig 4 W. Cooke

William Fothergill Cooke (1806-1879)

William Cooke was born at Ealing in 1806. His father was a surgeon who was later appointed to the post of Professor of Anatomy at Durham University. William was educated at Edinburgh University, but that education was not continued beyond the age of nineteen, when he joined the Army. He resigned in 1833 on grounds of ill health. During that year he started to model anatomical sections in wax, and in 1834 he accompanied his parents on a tour of Switzerland and Germany. At Heidelberg he met the director of the Anatomical Institute, and there he returned, in November 1834, to study anatomy. One day early in 1836 he went to a lecture by Professor Muncke at which the professor demonstrated his copy of Schilling's single needle telegraph (see section 1). The demonstration was so simple that it appealed to Cooke's untutored imagination. The wires ran across the room and the needle moved at the other side. Later on, William said that he was thinking at that moment: 'if it could work across a room, why not across a continent'. While still in Germany he made his first instrument during the month of March 1836, corresponding in most ways to Muncke's. In April 1836 he travelled back to London, where he applied himself with his accustomed energy to the development of a telegraph. An important question came up: 'will the telegraph work at the end of a long line?'. He was able to pose this question, through the agency of a friend, to the great scientist Michael Faraday. Faraday, however, who was well known for his discoveries in electromagnetic induction (made in 1831), did not have a definite answer at that time, although he spoke positively as to the general aspects of his plans. That was in November 1836. Then Cooke was directed by Peter Mark Roget, Secretary of the Royal Society, to Prof Wheatstone. He called on Wheatstone on 27 February 1837, and Wheatstone, to Cooke's great satisfaction, told him that he had four miles of wire in readiness. But then Cooke learned that Wheatstone had been employed for months in the construction of a telegraph, and had actually invented several with a view to bring them to a practical use. A positive result of the meeting was that Cooke was invited to come back the next day to discuss a proposal to unite their plans and carry them out together.

Fig 5 Five-needle telegraph - photo coll. of the author

Via a partnership towards a practical electric telegraph

In March 1837 the partnership was agreed in principle between the scientist and the entrepreneur, and the current ideas of both inventors could be united; Cooke was more 'the businessman' and Wheatstone on the other hand the 'scientific man'. The full title of the patent is 'Improvements in Giving Signals and Sounding Alarms in Distant Place by means of Electric Current transmitted through metallic Circuits'. It received the 'Great Seal' on 12 June 1837. By December, the 'Specification', for which they were allowed six months under the existing patent law to submit, had a different tale to tell through its eighteen pages of text and its three sheets of drawings; it focused on a five needle telegraph. This patent reflected mostly ideas from Wheatstone and only a few from Cooke. It was a point in time at which Cooke turned from experiments to practical affairs. Subsequent to the grant of the patent in 1837, the first of many that Cooke and Wheatstone obtained together and separately, the partnership constructed lines of telegraph in its own name and granted licences to others to use its instruments and materials. The business had a very slow start, not least because the seed capital used to build the lines had to be borrowed from individuals and banks, as the partners had only limited means. The first 'public' trial was held on 25 July 1837 over a distance of 2.4 km. between Euston Square and Camden Town (North London) for the London & Birmingham Railway. For this trial Wheatstone had made telegraph instruments with four needles suspended vertically (arranged in such a way that twelve characters could be transmitted), and the line was required to be laid at the expense of Cooke and Wheatstone. In September two other demonstrations were given, now with five-needle instruments (twenty characters). Alas, it did not lead to a contract. The first permanent line of electric telegraph in England was completed on 9 July 1839 between the Paddington and West Drayton stations of the Great Western Railway (part of the London to Bristol line), a distance of thirteen miles, having taken a year to make. It used another model of the four-needle instrument which allowed the transmission of twenty characters. On 6 July 1840 a telegraph system was opened on the London and Blackwall Railway. One can say that this was

Fig 6 ABC telegraph - photo coll. of the author

the first successful commercial application of the electric telegraph in the world.

In 1838 Morse was in England seeking an English patent, but the application was opposed by Cooke and Wheatstone, among others, on the grounds that he was seeking to patent ideas which were already published. In 1840 Cooke and Wheatstone wrote to Morse suggesting that they join forces but after consulting friends Morse rejected the proposal.[2]

The purchase and installation of the wires for all the upcoming projects was very expensive. The only way to raise the necessary capital for further expansion was to form a company, and so "The Electric Telegraph Company" was founded in 1846. Soon after, Wheatstone was bought out by Cooke. He kept rather loose contacts as 'scientific adviser' and as 'assistant'. The establishment of the ET Co was the final parting of the ways for Cooke and Wheatstone. Cooke was a director of the company for most of the rest of his life, although he made no more inventions in connection with the telegraph. Belgium was the only foreign customer (as from 1845). The contract was signed between the Belgian government and the "Compagnie du Télégraphe Électrique"; the English name translated in French. In 1850 the Belgian government took over the operations. Wheatstone was very successful with his ABC telegraph, patented in 1858. In order to enforce the success he established the "Universal Private Telegraph Company" in June 1861. The company proved profitable, and when the telegraphs where taken over by the General Post Office (GPO) in 1870 the shareholders, and Wheatstone additionally for his patents, got a huge compensation. In that year the company had over 2,500 miles (4.000 km) of wire and 1,700 instruments in use. Wheatstone also had his own manufacturing establishment, "the British Telegraph Manufactory". It was first established in about

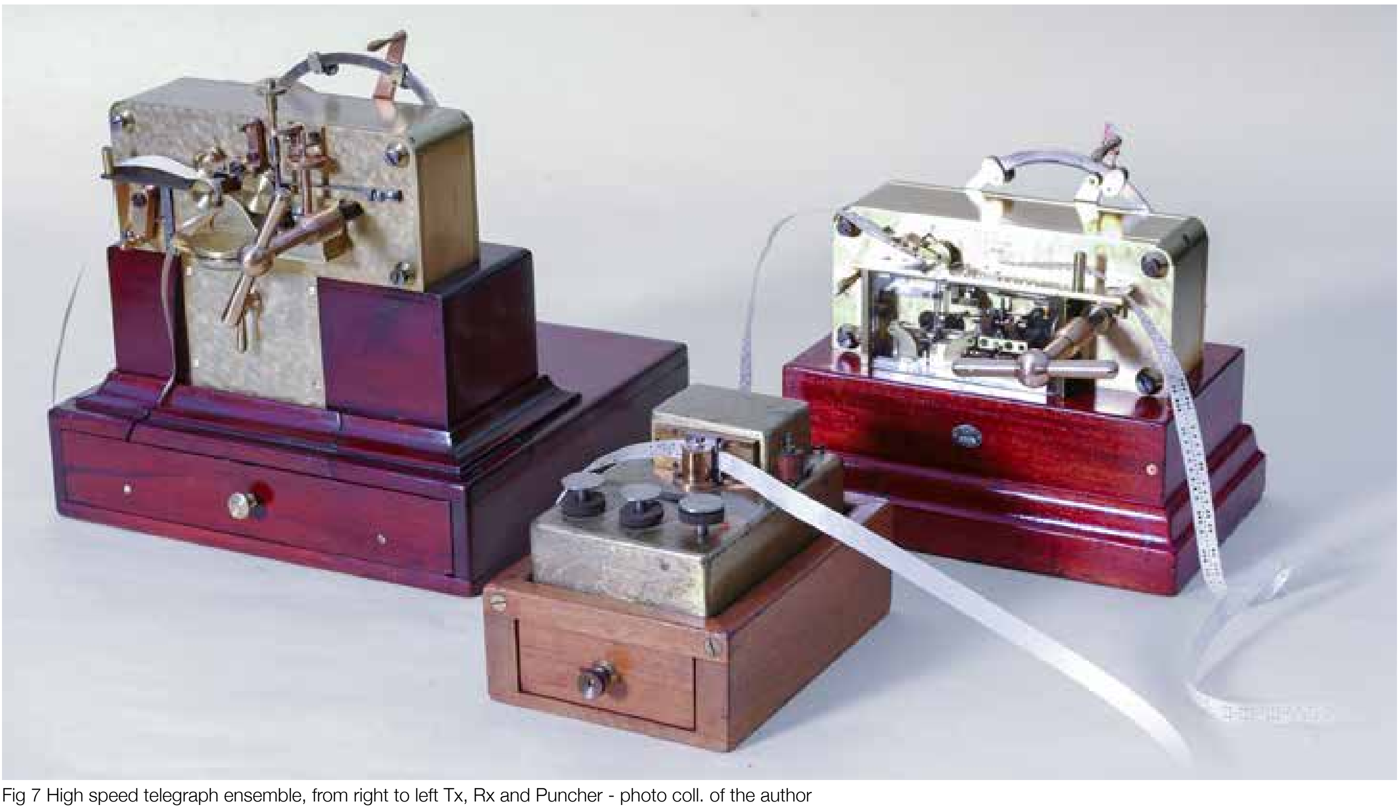


Fig 7 High speed telegraph ensemble, from right to left Tx, Rx and Puncher - photo coll. of the author

1858, became a limited company in January 1874, and was wound up voluntarily in 1882.

Without going into the tangled complications of the story of Samuel Morse and Alfred Vail in America, it can be fairly claimed that Wheatstone and Cooke were first in the field, with a margin of several years in their favour (sorry, American friends!). And from this point on, slowly but inexorably, the telegraph went ahead.

Towards a discord

Towards the end of 1840 there was one prospect which disquieted Cooke: the state of his relationship with Wheatstone, which had never been an easy partnership. The cause of the difficulty was their fundamental difference of approach. Wheatstone wanted scientific glory, with, if possible, monetary rewards as well. Cooke wanted commercial success with, naturally, a fair proportion of the scientific glory. It would have been so much easier if Wheatstone had been less astute about money and/or Cooke less hungry for reputation. The tension became more acute the longer they worked together. (Didn't we see later exactly the same happen between Samuel Morse and Alfred Vail…). The divergence continued. Cooke was engaging in building short lines for signalling purposes and therefore in developing and using simple needle instruments, whereas Wheatstone was developing new ideas of less immediate application. In 1841 he made a printing telegraph based on his 'alphabetic' (ABC) telegraph of the previous year. However, it was very slow, and the whole idea of telegraphy was too new for there to be any demand for a printer. His main activity in pure science during the next year or so was to establish a sound basis for the measurement of electrical properties such as voltage, current and resistance. Later on, Wheatstone continued with his scientific work, and this resulted in many inventions, papers, instruments, theories and technologies. But an important part of that was still in the field of telegraphy. In Part 2 I will give some details of his ABC telegraph (patented in 1858) and his 'high speed' telegraphic system (for which he received, also in 1858, a first patent) He was knighted in 1868. He never retired, but continued working to within a few days of his death at the age of 73. It was while attending meetings of the Academy of Science in Paris that he became ill with bronchitis and he died there on 19 October 1875.

Cooke made a great deal of money from the telegraph, though he ended his days in poverty. He invested his money in a quarry in North Wales, and in 1865 he obtained a patent for slate-cutting machinery. But the business failed and he lost all his money. He received his Knighthood in 1869 (the year that the telegraph companies were nationalized), and died in 1879.

End of Part 1

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* Bill Burns, for revising and correcting my 'Flemish English'. Bill is the leading world authority regarding submarine cables and everything related to it > see his http://atlantic-cable.com/

The de la Warr Radionic Diagnostic Instrument

Bob Clarke

Radionics is the art of diagnosing and treating illness by detecting and harmonising the natural energy waves emitted by the patient, many devices are available which purport to do this. When examined they often appear to be random collections of electronic components that ignore the laws of physics and electronics, the device described in this article is one such instrument.

A brief history of Radionics

Dr. Albert Abrams (1863 - 1924) pioneered the use of resistance in the diagnosis of disease in the early part of the 20th century. Abrams needed two subjects for his experiments one healthy and one unwell, the healthy subject being used as an indicator. When his equipment was in use a positive reflex would be obtained in the abdomen of the healthy subject if the instrument was set to the correct resistance for the disease suffered by the patient.[1] For example, if the resistance of the subjects condition was found to be say 50 ohms, a table of resistances would point the practitioner to the correct diagnosis. As this technique needed two subjects Abrams experimented with the “Stick Pad Detector”, this replaced the healthy subject with a latex pad across which the index finger was gently drawn. At the correct settings a “stick effect” was obtained and the instrument was then adjusted to maximise the effect. These effects were explained by Abrams as “measurements of an electronically measurable radiation” variations of which were caused by disease or other imbalances in the body. Radionics was coined by students of Abrams as a term to describe this process. Abrams also experimented with samples of medicine and found that he could follow the effectiveness of a drug by using two samples in his apparatus, one of the medicine, the other taken from the patient (blood or tissue). Abrams explained his results by espousing a theory he called “ERA” (electronic reactions of Abrams), the theory proposed that all parts of the body emit an electrical force at certain frequencies and when the patient is ill these emissions are altered.[2]

Dr. Ruth Drown (1881 – 1965) a student of Abrams defined a Radionic instrument as a “modulator of the life force”, she adopted the concept of harmonising a detuned life force (i.e. one suffering with a disease) by using the instrument as a transmitter of the correct form of the radiation. Drown abandoned resistance as the measure and adopted the term Rate to better describe the radiation, so a condition which had a resistance of 50 ohms now had a Rate of 50.

Drown and Abrams continued their experiments and eventually claimed to be able to diagnose any medical condition, including some that weren't known to conventional medicine. Drown went one stage further and claimed to be able to diagnose and cure conditions with a sample of dried blood at a distance, something Abrams had tried with limited success. This apparently works because Radionic theory states that a sample from a person, for example a drop of blood, will radiate in the same manner as the body and so remote diagnosis and treatment is possible. Her explanation of this phenomena was that the Rates exert a background pressure in the atmosphere and were able to be received by the patient, the setting of the correct rate on the instrument, she asserted, set up a resonance that increased the receptivity of the patient, this she termed broadcasting. The terminology used in Radionics tends to be drawn from the newly emerging science of radio communication during the 1920s, hence a device for treatment is a transmitter and the diagnosis equipment is a receiver, this is where the similarity sadly ends.

In 1942 George de la Warr (1904 – 1969) began to develop his theories that would become influential in the development of Radionics in the UK.[3] At that time equipment was generally manufactured in America and was hard to obtain in the British Isles and he was heavily influenced by the work of Abrams and Drown. de la Warr instruments are similar to those used by Drown but modified and improved. He eventually published around 8000 Rates for his instruments and set up de la Warr Laboratories in Oxford to manufacture and market them, they closed in 1987.

Both Drown and de la Warr were the subjects of legal proceedings regarding the efficacy of their devices. In 1963 Drown and her business partner a Dr. Chatfield were investigated by the American F.D.A.[4] when an undercover agent commissioned them to diagnose her children's illness by the use of dried blood samples. The three samples were actually from a turkey, a sheep and a pig, her children were not physically ill. Drown and Chatfield's diagnosis was that they were coming down with mumps and chicken pox. Drown died in 1965 whilst awaiting trial, Chatfield and an assistant were convicted of grand theft and sentenced. To this day the F.D.A. does not recognise any Radionic equipment as fit for use.

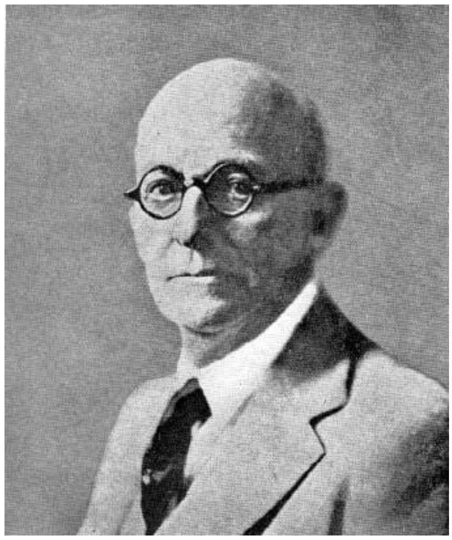

Figure 1 - Dr. Albert Abrams

De la Warr was sued in the high court during 1960 by Catherine Phillips[5] a disgruntled customer who claimed her health had been ruined by the apparatus and also maintained that the equipment could not possibly have the powers de la Warr claimed, the court found for de la Warr although the judge stated that the claims may be fraudulent. The court was swayed by de la Warr's argument that he truly believed in the equipment and that no one would invest large amounts

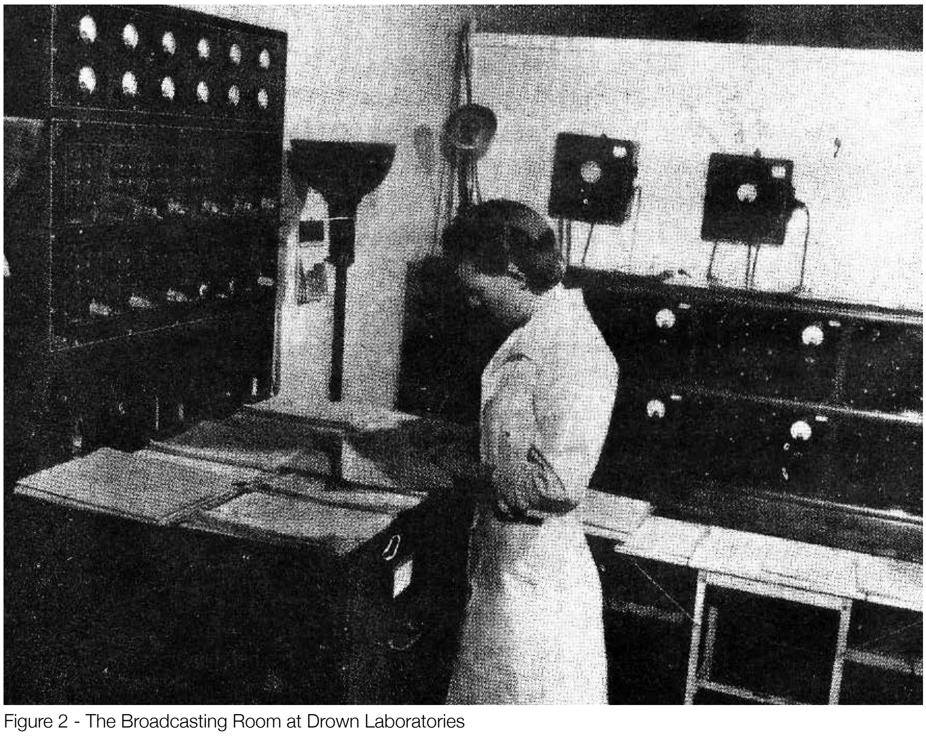

Figure 2 - The Broadcasting Room at Drown Laboratories

Figure 3 - The de la Warr radionic instrument

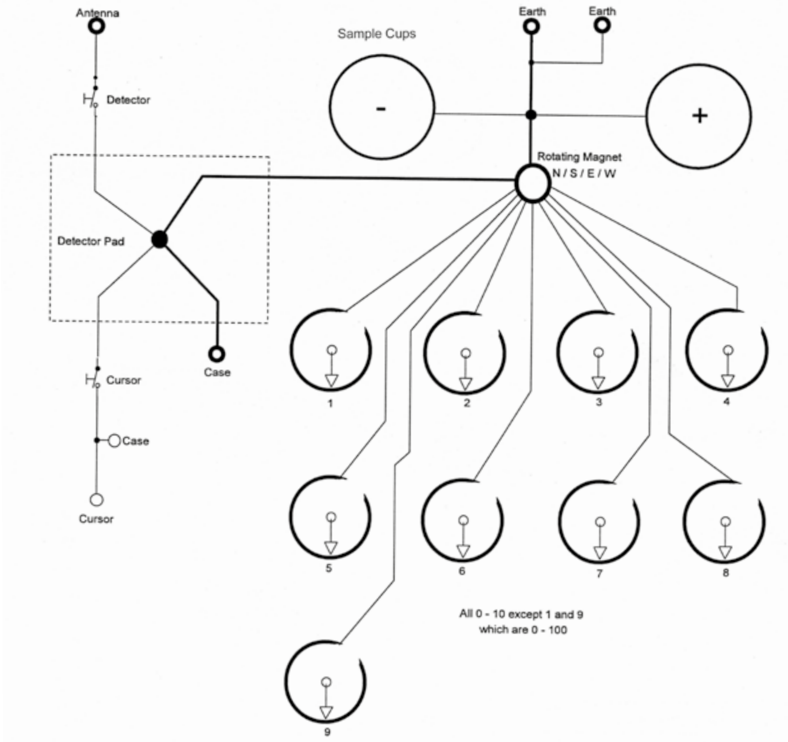

Figure 4 - Schematic of the instrument

Figure 5 - Rear of the right hand panel

of money, as he had, in a hoax. He also argued that as the equipment worked on the metaphysical plane and was a channel for thoughts, it was not operable by everyone. Although after ten days of argument the court found for de la Warr the case almost ruined him as Phillips was awarded costs. George de la Warr died nine years later

In the UK Dr. Bruce Copen (1923 - 1998)[6] followed on from de la Warr and founded Copen Laboratories to manufacture and sell his Radionic instruments. Copen was a renowned dowser and was called in when the Coronation Stone was stolen from Westminster Abbey on Christmas day 1950, he failed to locate it and it turned up in Scotland a year later. Dr Copen died suddenly in 1998, Copen Labs is still trading and sells Radionic instruments to the largely American market.

It is interesting to note that all the players in this tale have little or no background in electronics or physics. Abrams was awarded a medical degree at Heidelburg in November 1882 and pursued a medical career until 1923. Dr. Drown was a chiropractor as was her business partner Dr. Chatfield, de la Warr was a civil engineer working for Oxford C.C before embarking on his experiments and Dr. Copen was a doctor of philosophy and literature. Radionics has always been a subject which has caused debate and its earliest pioneers were in no way immune to this, all of the figures in this story with the exception of Copen, were at some point mired in controversy regarding the efficacy of the systems they were using.

The de la Warr Diagnostic Instrument

To operate the instrument; where the nature of the illness is unknown you must decide on the patients most troublesome symptom, to do this you make a list of all the patients symptoms on a piece of paper that will fit over the glass panel. Set the ninth dial at 10 and all the others to 0, this will enable you to detect the symptom of primary importance, slide the cursor over the list with the left hand until a reaction is felt on the detector with the right. The symptom may then be found in the table of rates and entered on the instruments' dials. So for say Cough the Rate is 20244 and this should be set on the first four dials. The procedure is then repeated with the locations sheet which is situated under the glass plate to refine the diagnosis, the Rate being entered on the subsequent dials.[7]

Housed in a neat rexine covered box the "de la Warr Diagnostic Instrument" to give it its full name consists of two panels. The left hand section houses a movable cursor which slides over a glass bed, the right hand section houses the controls for setting Rates, the detector pad and two cups into which samples may be placed. In addition a control is provided for tuning the instrument and connectors for earth and an antenna (Figure 3). The instrument is very well constructed, the box is solid and the fittings are all bright chrome plated, the dial scales are engraved into the panel and the overall finish exudes quality. When obtained the rexine

Figure 6 - One of the control mechanisms

covering had more or less disintegrated and has been replaced, a new rubber membrane has also been fitted to the detector as the original had perished. The remainder of the instrument has simply been cleaned, which shows the quality of the fittings as it had been stored in a damp cellar.

The functional circuit of the instrument is shown in Figure 4. The detector pad is a piece of 18 B.G. sheet steel cut and fixed down so that when the chrome trim is screwed down the rubber membrane is held flush with the surface of the chrome. It is connected by a threaded stud to a similar piece of steel on the reverse of the front panel (Figure 5), the brass strips are the fixings for the chromium trim around the pad. The interior of the box is painted with silver paint and a number of the connections on the circuit connect to it, if this was intended to screen the device it is a failure as it appears to be normal non conductive paint.

The controls consist of a chromium plated track that is sprung to contact a brass wiper, there is only one connection to each control as the wiper has no connection other than to the shaft which is insulated from the remaining circuit (Figure 6). The tuning control to which every other control is connected consists of a rotatable magnet, this appears to be a cylindrical bar magnet with the poles at the ends of the cylinder. As it is rotated along its polar axis the magnetic field will not vary within the instrument and one doubts its functionality.

The cursor is connected by a wire link from the main circuit that passes though the case and connects to the hinge, this is duplicated on the left hand panel and connects to the top of the cursor slide rod, again there is only one connection to the cursor.

Although the build quality of the instrument is of a very high quality throughout, in common with many other pieces of Radionic equipment it would appear to be incapable of doing anything. Although I like to keep an open mind about things such as Holistic medicine I seriously doubt that this machine can perform any useful function. Proponents of the technique describe the instrument as a channel for energy and in 1963 de la Warr proposed that the energy is exchanged across what he described as a nodal point lattice[8] of which the patient and practitioner form a part. The belief that remote diagnosis and healing is possible is very similar to the ancient belief held by many cultures that it is possible to influence or control a person if you can obtain a part of their being, but practitioners of radionic technique would refute this. If the techniques work at all it is likely to be due to a form of the Placebo Effect which has been shown at times to have a beneficial psychological effect on patients.

Although not in any way related to radio, vintage or otherwise, this article shows that sometimes our hobby throws up the most unusual items. I was given this device as I have an interest in vintage measuring instruments having worked in instrumentation for most of my career, I have to admit that it has to be the most curious thing in my collection.

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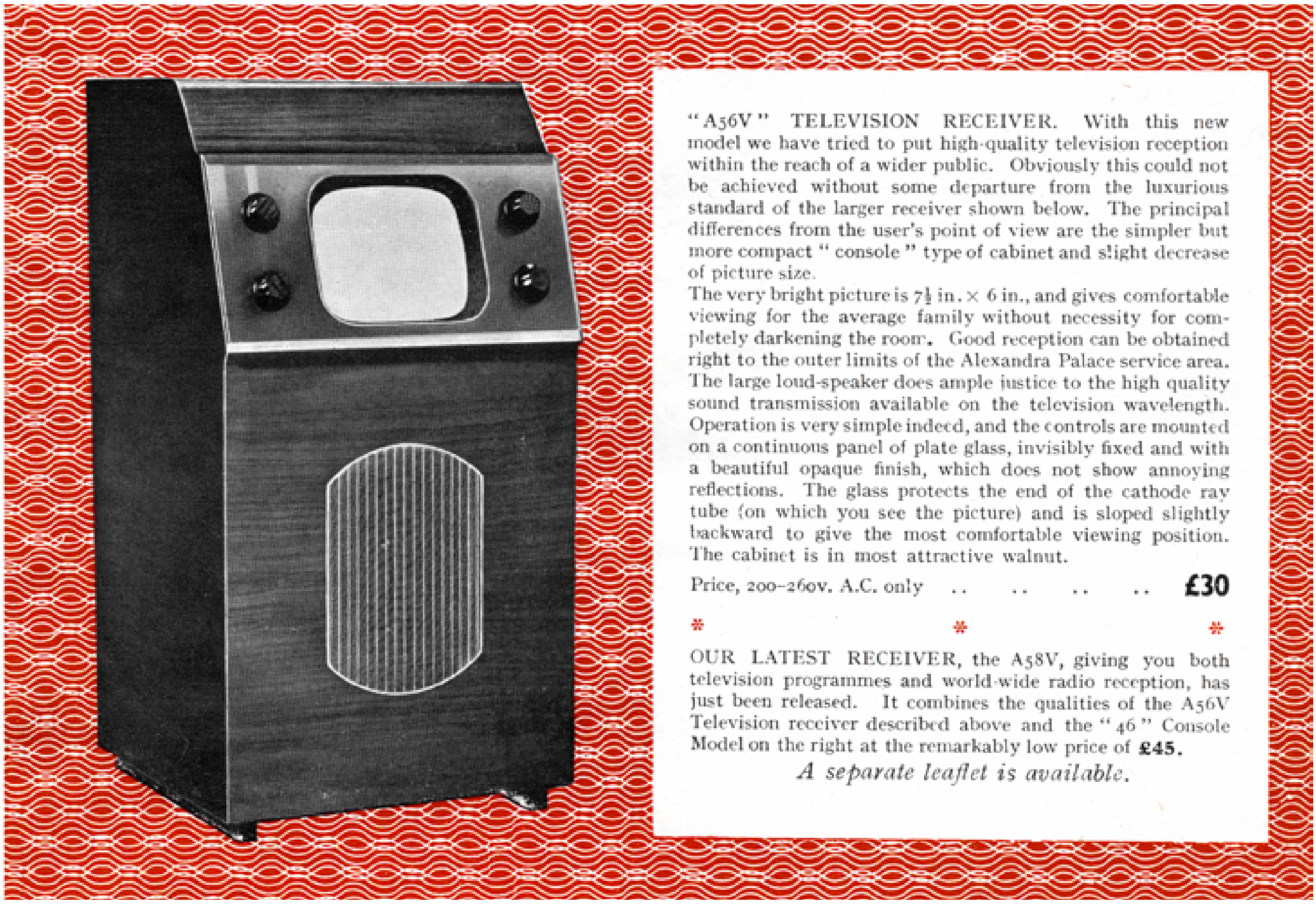


A short history of the Chakophone *wireless days*

Andrew Humphriss

In the early 1980's I was working in Royal Leamington Spa, Warwickshire, my work brought me into contact with many people who had diverse professions, and the contacts they have.

Around that time, I was given a home-made crystal set by a member of the family in exchange for a small display cabinet I had picked up on my travels.

I made friends with a cabinet maker in the old part of Leamington Spa town and thought due to his profession he might know where I could get a box to house my crystal set in, which is still in need of a suitable box some 30 years on.

I asked the cabinet maker one day about the cabinet I seek for the crystal set and he told me he had been approached by a gentleman in Kenilworth who had a box of old wireless parts to go to a good home.

On arranging a meeting, I called on an elderly gentleman who had a box full of odds and ends and amongst the items was an ebonite panel with some components attached but were very corroded having been stored in a damp environment for many years.

On further investigation and after placing adverts in magazines at the time, the Ebonite panel was marked Chakophone No.1B three valve, but nothing to indicate where it was made.

I was in luck a member of The British Vintage Wireless Society responded to my request for help, and brought my attention to the book Early Wireless by Anthony Constable which described the Chakophone No.1B and identified the manufacturer as The Eagle Engineering Co. Ltd, and at that time the company was Hestair Eagle, and the factory still in The Saltisford, Warwick.

I was living in Hampton Magna near Warwick at that time and passed the factory every day to my place of work in Leamington Spa, on making contact with the personnel manager one day while walking our Yorkshire terrier dog, he told me he remembered the wireless days and some of the workers who put the Chakophone wireless sets together.

Since finding out about the Local connection I started to research the Eagle Engineering Company Ltd and the wireless sets they made and the people involved.

Having spent the last 30 years plus searching for certain missing parts from what I have of the Chakophone No.1B to enable it to get working, it is only in the last two years or so I have attempted to restore the wireless having obtained the cabinet dimensions and a source of well-seasoned old English oak wood, and a BVWS member who could re nickel some of the original parts, this is an ongoing project and may be a subject for a future article in QRV magazine.

Here is a summary account on how The Eagle Engineering Co. Ltd started manufacturing wireless sets, as they were specialist in the manufacture of a wide range of vehicle bodies at that time; and today still operating on The Heathcote Industrial Estate, Warwick, under Dennis Eagle manufacturing specialised refuse vehicle which can be

Eagle Engineering works - 1921

seen today, used by local authorities.

The Chakophone wireless manufacturing journey, I believe started at the end of the First World War, when in 1919- 1920, Guy Henry Champ and his partner George Ernest Osborne Kay operated as Champ, Kay and Company and operated from the wharf and shedding next to the canal in The Saltisford, Warwick, Warwickshire, England.

They offered repairs and overhauls to motorcar lighting and starting sets and re-charging batteries (having the Exide battery agency).

They both offered their services as electrical engineers, and were engineers of small hand tools.

In 1922 Champ and Kay started operating wireless installations and offered the supply of parts and as reported in the local press operated a receiving wireless station, for customers to see and hear the wonder of wireless.

I have never seen any pre January 1923 wireless set manufactured by Champ and Kay but I do believe they did manufacture wireless sets.

In January 1923 it was announced that Messrs Champ Kay & Co. had decided to throw in their lot with The Eagle Engineering Company Ltd, Eagle Works, The Saltisford, Warwick, just up the road from where Champ and Kay had been operating.

Mr Guy Henry Champ was absorbed into an Electrical and Wireless department in Eagle Works, supplying any electrical requirements, lighting sets, and maintenance of the Exide battery service and the Champ and Kay company with their Chakophone wireless sets manufacturing.

The Eagle Engineering Company Ltd., of The Saltisford, Warwick were an all-round manufacturer of vehicle bodies and every type of tradesman was employed, so manufacturing wireless sets in wooden cabinets was easy for them.

During the period January 1923 to around 1936, a wide range of Chakophone wireless sets were manufactured in Eagle Works, The Saltisford, Warwick, and later in the former brewery building at the rear of the factory up to the winding up of the wireless manufacturing around 1936.

During the years 1923 to around the early 1930's The Eagle Engineering Company attended the wireless shows in London displaying their produce, as did so many other similar companies of the day.

Mr Kay moved on in the early 1920's and lived in Birmingham and died in the 1970's, little is known of what he finished up doing.

Mr Guy Champ in 1936 opened a retail shop The Eagle Wireless Supply Company Ltd., in Smith Street, Warwick, where he sold Murphy radios having the Murphy radio agencies.

He manufactured primary batteries reported in Murphy News and also sold photographic equipment.

Mr Champ was well known in Warwick, he served as a conservative councillor and was a Special Constable, sadly the journey ends with the death of Mr Guy Henry Champ in Warwick Hospital on the 31st March 1951.

Article originally featured in Practical Wireless - http://www.radioenthusiast.co.uk

Restoring a Ferguson 203U radio

Stef Niewiadomski

The Ferguson 203U was the company's first post-war compact AC/DC table radio with a plastic cabinet, released in June 1947. I'd been on the lookout for an example of this radio for a while, and saw one at the 2017 NVCF being sold at a reasonable price. The two-piece cabinet was dull but in good condition, the dial was unmarked, and the three knobs were present and seemed to rotate normally, so I snapped it up. Figure 1 shows the radio in its restored condition.

Figure 1: The restored state of my Ferguson 203U.

Variations on the 203

Three versions of the 203 seem to have been produced. The 203U had two incarnations: an American octal valve line-up (12K8GT, 12K7GT, 12Q7GT, 35L6GT and 35Z4GT, all with 150mA heaters) as described in Trader service sheet 820 (published in July 1947); a European valve line-up – as in my radio - as described in an Electrical and Radio Trading service sheet (in April 1948); and a model designated 203ULL (presumably with American valves, since it is mentioned in Trader sheet 820) which was designed to run from 100/110V AC or DC mains.

Contemporary adverts (see Figure 2) for the 203U referred to the model as the 'Mains Minor' which was a brand used previously in a couple of models, and show a purchase price of £15 plus £3 4s 6d purchase tax.

The 203ULL was obtained 'by special order' and its price is unknown. The HT smoothing resistor was replaced by a 5H 50Ω choke and the HT smoothing capacitors were increased to 32µF. The resistive line cord was replaced by a conventional mains cable: the American valve heaters voltages add up to about 109V, so on 100V they were a little underdriven. No sightings of this model have been reported, and it's unclear how many (if any) of this model were made.

Restorations of both versions of the 203U are described in the UK Vintage Radio Repair and Restoration Forum, and a European valved model was tackled in The Radiophile issue 101, and so it seems that both versions of the 203U were manufactured. At the release date of the radio, supplies of valves could still be unreliable, and so the manufacturer was giving itself the option of two valve sets, presumably confident that it could source at least one of them. Why only the American valve version is described in Trader 820 is unknown, but perhaps that was the version that entered production first, and production switched to the European valved version later. From the outside, there seems to be no way of telling the valve line-up of any particular 203U. All the versions were housed in the same compact cabinet, size 11⅜-inches by 6⅞-inches by 5¾-inches.

Another version of the European-valved 203U chassis was used in the 213RG radiogram (using a Garrard deck), released in 1948.

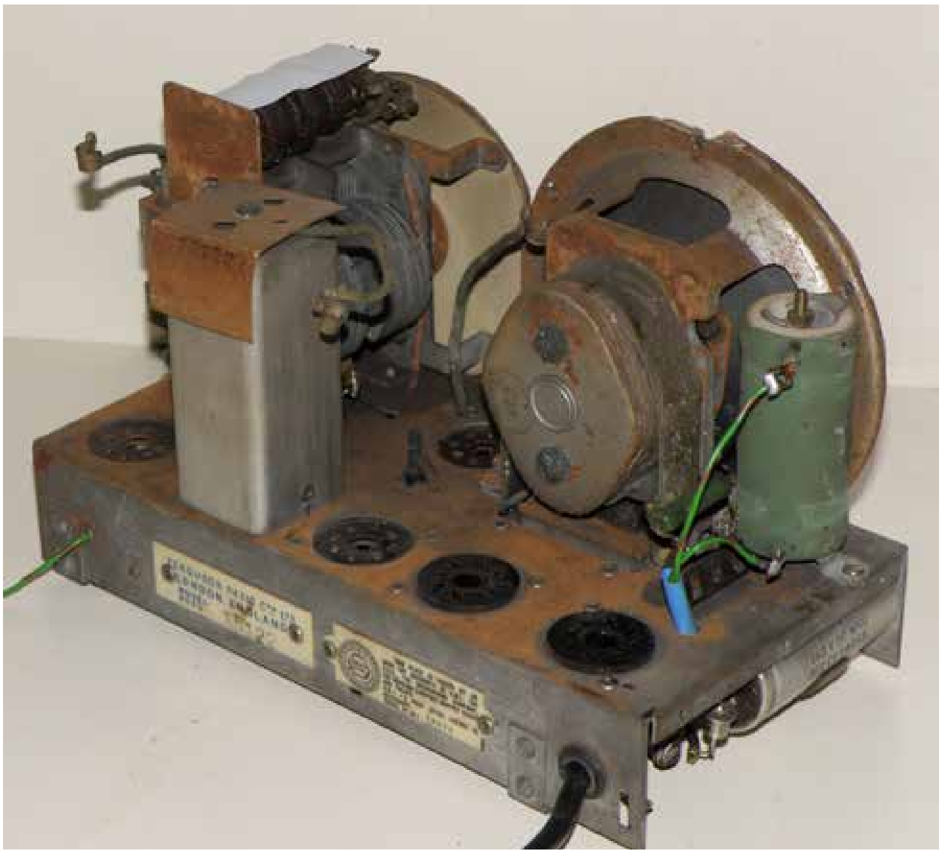


Figure 3: Rear view of the chassis before restoration, with the valves removed.

Restoring the chassis

My radio was fitted with a modern-looking two core mains cable, so clearly the original mains heater dropper cord had been replaced. Some restorers would take the first opportunity to fit a plug and switch the radio on. I'm more cautious and I always like to take a good look at the power supply area of any radio before connecting it to the mains, as in my experience, this is where most faults develop which can cause damage to the rest of the radio if powered up indiscriminately.

To remove the chassis, it's first necessary to separate the two halves of the cabinet. Two long screws (about 4-inches long, only one of which was present in my radio) unscrew from the rear and two 4BA screws were removed from the bottom, allowing

Figure 2: A 1947 advert for the 203U and the 203ULL. Note the use of the 'Mains Minor' branding which had been used previously by Ferguson for a couple of models.

the rear half to be removed backwards, with the mains and aerial leads slipping out through holes in the rear panel. I could now see the chassis: all the valves were present, along with a heater dropper resistor – which was not part of the original design – standing on a rather rusty steel surface.

I removed the volume and bandswitch knobs and two recessed nuts from the bottom, and the front section of the cabinet slid forwards to reveal the front of the chassis. The dial, tuning knob and the 4½-inch speaker were still attached to the chassis, and made a very neat self-contained unit – see Figure 3. I removed the valves to give better access to de-rust the chassis. There was an obvious piece of asbestos sheet lodged between the cabinet side and the dropper resistor, not boding well for the amount of heat it was dissipating.

Under the chassis things were mainly untouched (see Figures 4 and 5) with what looked like the original paper capacitors. However, although the rectifier valve was present, under its socket there was a semiconductor diode which was clearly not original. I've seen this before, where a faulty rectifier valve is left in place to maintain the continuity and overall voltage of the series heater chain, but its anode and cathode are no longer connected in circuit and the rectifier function is performed by the new diode.

The schematic of the European valve version of the radio, taken from the Electrical and Radio Trading service sheet, is shown in Figure 6. The radio is a conventional two band (medium and long wave) superhet with a CCH35 (see Figure 7) triode hexode forming the frequency changer stage, followed by a variable-μ EF39 IF amplifier at 470kHz (according to the Trader service sheet, the American valved version has an IF of 455kHz). An EBC33 forms the audio and AGC detector / audio amplifier stages; a CL33 is the audio output stage; and finally a CY31 forms the half-wave mains rectifier. My radio contained all Mullard-branded valves apart from a Tungsram EF39. All the valve heaters are rated at 200mA and are connected in series: the valves fitted to my radio all showed good heater continuity.

The CCH35 runs with 7V across its heater; the CL33 needs 35V; and the CY31 needs 20V. Along with the two valves with 6.3V heaters, this adds up to about 75V. If we string the dial lamp into the heater chain, we need to produce say 80V from the 230V mains, and so 150V needs to be dropped at 200mA. Ohm's Law gives us 750Ω, with a dissipation of I2R = 30W. This is not unreasonable for a resistive mains line cord, but is rather excessive for inside a compact cabinet. My radio was fitted with such a dropper, and presumably it was dissipating this power inside the cabinet, and generating a considerable amount of heat. I could have converted the radio to operate from 115V, which would have saved on heat dissipation, but I wanted to maintain its operation from the UK mains voltage.

Chassis restoration

Before making a long-term fix to the power supply, I wanted to power up the radio to check its RF and AF performance. I gave the top of the chassis a good brush down and rubbed in a thin layer of WD40 to restore its finish. I removed the two front-to-back metal stretchers from the bottom of the chassis to give me better access.

I measured the resistance of the audio transformer's primary at 450Ω, and a crackle from the speaker indicated that it was probably still in good condition. All the resistors measured close enough to their nominal values to be left alone. I removed C16, connected between the rectifier's anode and chassis, so that I could see the rectifier's socket more clearly and intended to fit a modern replacement. The small brown Hunts capacitor from the output valve's anode to chassis was cracked and so I changed it for a modern 22nF 630V capacitor. One end of the audio coupling capacitor, C13, had come adrift and so I soldered it back into place.

I fitted a mains plug, inserted the original valves, connected an aerial, and slowly ramped up the mains supply to the radio from my Variac. There was no glow from the power-on bulb, but the valves lit up and after a short while I could hear broadcasts

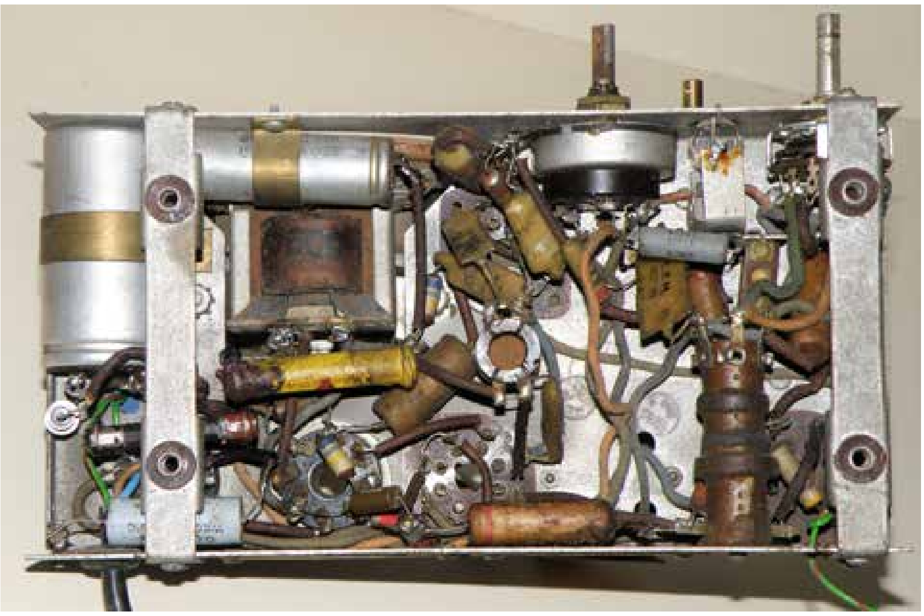


Figure 4: Bottom view of the chassis before restoration, with the front-to-back chassis runners still in place.

Figure 5: Close up of the power supply area of the chassis, showing the silicon power diode.

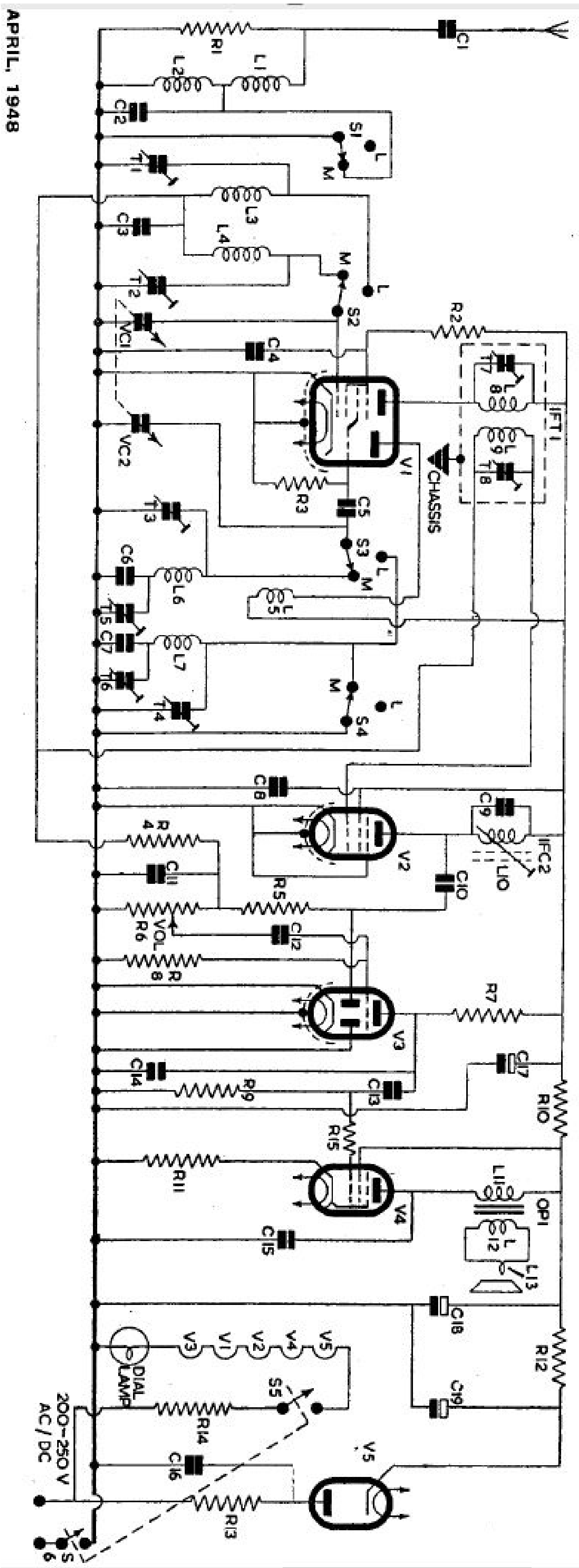


Figure 6 (pictured to the left): Schematic of the 203U, taken from the Electrical and Radio Trading service sheet. V1 is a CCH35; V2 an EF39; V3 an EBC33; V4 a CL33; and V5 a CY31. Note that the radio is factory-fitted with a double pole mains on/off switch, ensuring that the chassis is safe – assuming that the mains lead is connected the right way round - whether the radio is switched on or off.

on the long and medium waves as I tuned around. The wavechange switch was rather stiff, and so I lubricated the mechanism with some 3-in-1 oil. The audio wasn't very loud, and hum and distortion were audible. The HT smoothing capacitors C18 and C19 both measured very close to their nominal 16µF values and so were left in situ, but to reduce any residual HT ripple I soldered a new high voltage 10µF electrolytic across C19.

I checked the voltage at the output valve end of C13, and this was +4.5V, indicating a leaky capacitor that wasn't doing the output valve and transformer any good. I changed it for a new 47nF 630V component, and remeasured the voltage at 0.0V. One end of the HT decoupling electrolytic C17 (dated September 1947, a good indicator of when the radio was built) was bulging and was changed for a new 10µF capacitor. Distortion was a little better, but still audible. I thought the lack of sensitivity could be because of a leaky AGC capacitor – C3 on the schematic – and after changing it, the radio was much more sensitive.

Speech was still distorted, but a new EBC33

Figure 7: Mullard's advert for the CCH35, published in the November 2, 1946 issue of The Wireless and Electrical Trader. The valve was introduced by Mullard in 1940, at the same time as its 6.3V equivalent, the ECH35. Both these valves proved to be very successful and were used in many radio designs.

Figure 8: Top view of the chassis after restoration. The white cylindrical object is the 2.5μF motor capacitor, now acting as the heater voltage dropper.

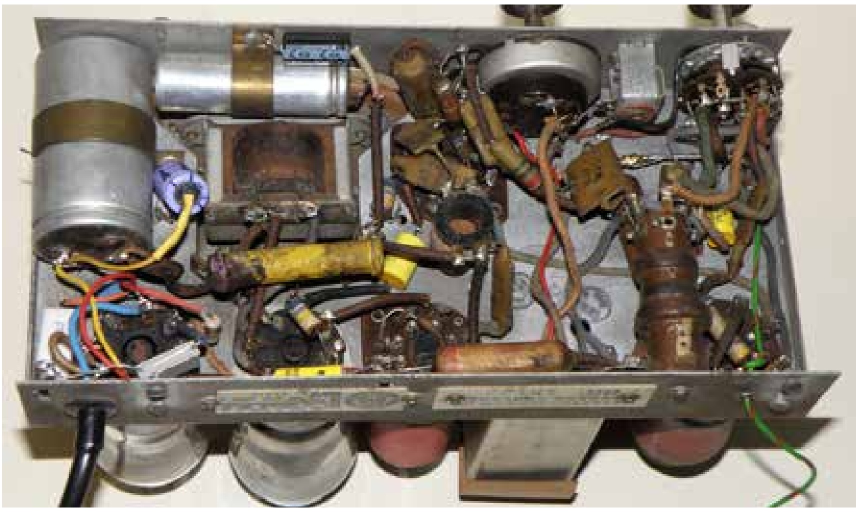


Figure 9: Post-restoration view under the chassis, with the power supply section at the left hand side. The two front-to-back runners need to be attached before the chassis is re-installed into the cabinet.

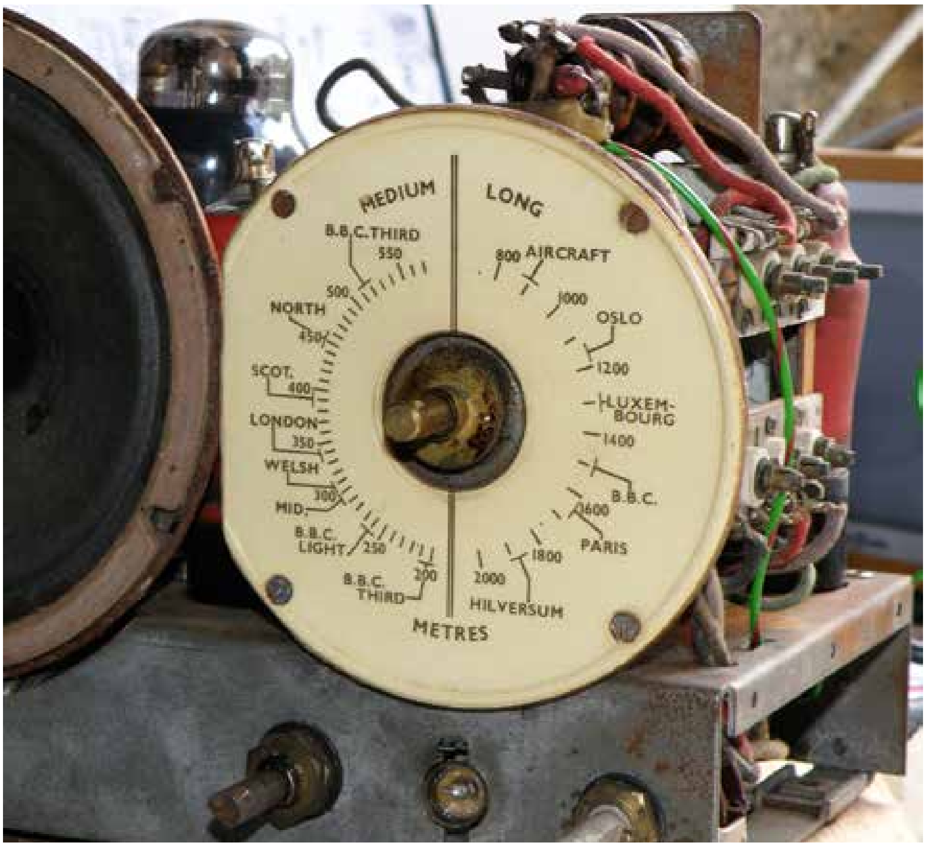


Figure 10: Close-up of the dial of the radio. Note the epicyclic drive and the Aircraft segment at about 900m on the long wave.

cured this problem. I was now satisfied that the radio was ready to have its valve rectifier re-instated, the still non-working power-on bulb fixed, and a fix made to the excessive heat dissipation inside the cabinet.

Capacitor heater dropper

I had been looking for a while for a radio where I could try a heater dropper consisting of a mains-rated capacitor, which has the advantage that it dissipates no power and therefore generates no heat inside the cabinet. Suitable mains-rated capacitors are not small, and are generally too big to fit into many radios, especially compact ones, which is exactly where these wattless droppers are potentially the most useful. However, my 203U looked like an ideal candidate, and my aim was to fit the capacitor into the space where the dropper resistor was currently mounted.

I found an on-line calculator (see Reference 1) on how to determine the capacitor's value, which came out close to 2.5μF. The one I used was advertised on eBay as a 2.5μF 450V 50/60Hz AC start and run motor capacitor. The capacitor had two tab terminals, which proved to be very easy to solder to. The capacitor was 32mm in diameter and stood 80mm high above the chassis, so it neatly replaced the 'old' dropper resistor, see Figure 8. A surge-limiting series resistor is also needed, and this came out at 47Ω, accommodated under the chassis.

Tracing the wiring for the power-on bulb, rather strangely it was connected between mains neutral and the chassis of the radio – which was itself connected to neutral of course – so this was never going to work. I re-wired the bulb so that it sat between the bottom of the valve heater chain and the chassis, and added a 39Ω resistor across the bulb. Now it worked when the radio was switched on.

The silicon diode was removed from across the rectifier's socket and the original wiring re-instated. A new CY31 was fitted, and the radio switched on again. After a rather long warm-up time – 50 seconds or so – the radio came to life. The power-on bulb was very well behaved, with no switch-on overbrightness and settled down to a good brightness. Figure 9 shows the underneath of the chassis after restoration.

The dial

The dial was in very good condition, see Figure 10. The radio has no dial glass, just a simple protective transparent covering to the markings, and an epicyclic slow motion drive – giving a reduction ratio of about 5:1 - behind the tuning knob, so no dial cord is needed. Note the marking of an Aircraft section around 900m (333kHz) on the long wave band. I think this refers to the NDBs (Non-Directional Beacons) at the higher frequency end of the long wave. These are low power transmitters, generally broadcasting between about 300kHz and 400kHz, used by aircraft for navigation, and it's unusual to find them highlighted on a domestic radio. They are amplitude modulated with a tone which carries that particular NDB's callsign in slow Morse. I've seen photos of some 203Us where this Aircraft section is not marked on the dial, so maybe this was removed in later production runs.

The cabinet

As mentioned earlier, the plastic cabinet comes in two parts in a clam-shell arrangement. The rear brown section of my radio was in very good condition, and simply needed a good clean and polish to remove a few scuffs and shallow scratches. At first sight, the front white section also looked to be in good condition. A closer examination revealed that this section had been repaired and repainted at some point: the paint finish had a few chips, and I fixed these with discrete dabs of white gloss paint and a polish. There was a slight crack in the base and I stabilised this with a little Superglue. The red plastic insert for the power-on bulb was clear and undamaged, and just needed a quick polish.

After a long soak test, I reassembled the chassis into the cabinet and repeated the test. When the cabinet had stabilised to its working temperature: the side enclosing the rectifier and output valves was reasonably warm, but much cooler than when the radio was fitted with the resistive heater dropper.

Summary

The Ferguson 203U is a good looking compact radio, introduced in 1947, and was manufactured with a choice of either American-coded (presumably manufactured by Brimar) or European valves. My example was in good condition and turned out to be the European valve version. The power supply had been modified to bypass a faulty rectifier valve – although its heater was still in circuit – and its resistive line cord had been removed. I re-instated the valve rectifier wiring and fitted a new rectifier valve, and swapped its resistive heater dropper for a capacitor / resistor combination This reduced considerably the power dissipated and hence the amount of heat generated inside the cabinet, and hopefully will extend the working life of the radio.

I'm still on the lookout for a US-valved version of the radio, so if you have one you'd be willing to part with, please contact me.

References

Reference 1: Details of various heater dropper configurations and how to calculate component values can be found at: http://www.vintage-radio.com/repair-restore-information/valve_dropper-calcs.html

Royal Wootton Bassett Auction, February 2018

Photos by Greg Hewitt

Decca DMR88

Candlestick telephone with bell set No 41

Bush TR130

Picnic gramophone, the iPod of it's day!

Marconi T37DA

Magnetic Loop Aerials Part 2

Gary Tempest

Previous article featured in the Bulletin Autumn 2016 Issue - As of now, three more of the GNT design have been made in both the original construction, and on a PCB, designed by David Taylor, all with successful results. These were by members of the VRF (Vintage Radio Forum) but of course there maybe others who don't use this site. On it there has been a lot of discussion and about Loops in general (170 replies and 13,480 views at this time). I have followed the thread with interest and learnt a lot from it. Some interesting links were found including one to the reverse engineering of a commercial product, the Wellbrook (WellB), after its amplifier was accidently destroyed.

Pic.1. Wellbrook loop used for testing

WellB and Wellgood (WellG) Loop Amplifiers

WellB is a company who have been making and selling amplified, un-tuned, loop aerials for some years Ref. 1 and Pic.1. Note in the picture, the rotator covered by a bucket, with a hole in it and a cut funnel secured to the rotating pole for rain water to run clear. The rotator is rarely used now and will be dispensed with when the weather gets warmer.

I can vouch for the performance although a few amplifiers have been found to go faulty including mine, which was replaced under warranty. It was that failure that inspired me to have a go at building something myself as described in the first article. In that I didn't mention that I already had a WellB as I wasn't trying to upstage that in anyway. But it 'popped out' on the VRF Thread and so I may as well refer to it here.

The WellG amplifier is fully described in Ref. 2. The author, George Smart (GS), with the help of a friend with access to an X-Ray machine, reverse engineered a WellB amplifier that was destroyed by inadvertently connecting it to a transmitter. After copying the design he made a printed circuit board as an improvement to the original strip board construction.

There is a theoretical article Ref. 3, published in 1999, quoted by GS, which is said to describe the workings of these aerial amplifiers for those that are interested Possibly it is the basis used for the feedback windings that null out the effect of emitter resistance giving increased gain and linearity. It actually describes a grounded base configuration whereas the WellB works in grounded emitter.

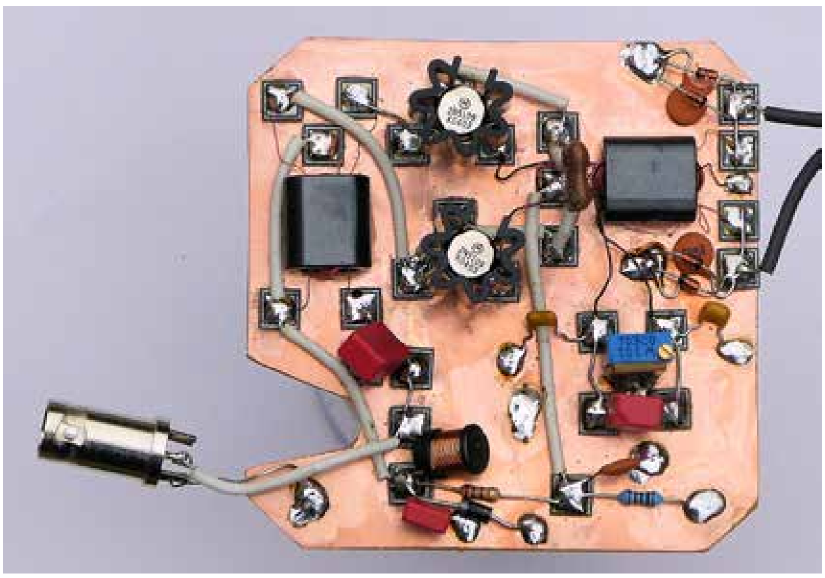
In my opinion GS is remiss in not giving any praise to the WellB design which is clever and elegant to achieve its performance with just two active devices. Much of its success must be in the design of the input transformer T1 which possibly took a lot of development effort.

Building a WellG amplifier myself

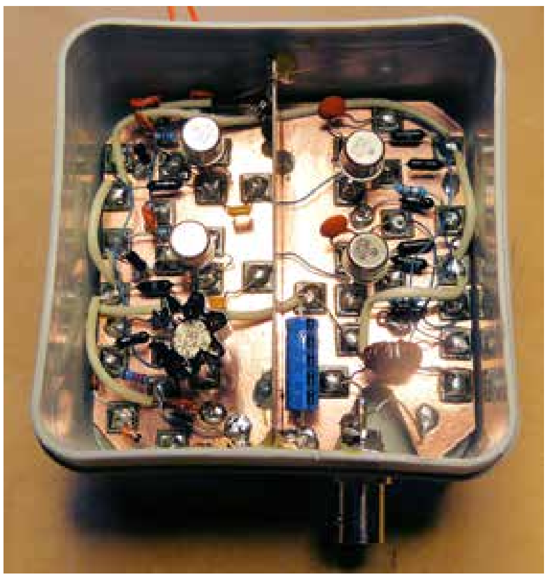
There were things I didn't understand about it and so building one would give me a chance to do some detective work. It was built, Pic. 2 using the Manhattan method again but this time using bought in 'tiles' Ref. 4 found by a VRF member. These just snap off and are a joy to use and a layout can be put down very quickly. They are larger than the ones made by me being a quarter of an inch square against my roughly 3mm. It does make compact designs trickier to fit the components and on one intended for my NZ friend Peter a few components were put in a little vertical Pic. 3.

There is a picture (Pic. 4) of my PCB design that has been outside for three months and it can be seen that I have dispensed with encapsulation and used Zinsser Spray shellac instead. This was applied heavily and I believe it to be adequate especially if the Amp is powered 24/7. When I opened the box to take this picture there was no moisture in the box and I hadn't drilled a 'dribble' drain hole.

One constructor of my amplifier thought that the Manhattan method was difficult and messy using Super Glue. But there are ways of going about it that make it easier. Firstly the copper clad board needs scrubbing with #0000 wire wool and the use of a bottle of fresh glue is recommended. Never take the bottle



Pic. 2. WellG circuit board



Pic. 3. Peters Loop Box

Pic 4. GNT circuit board PCB version

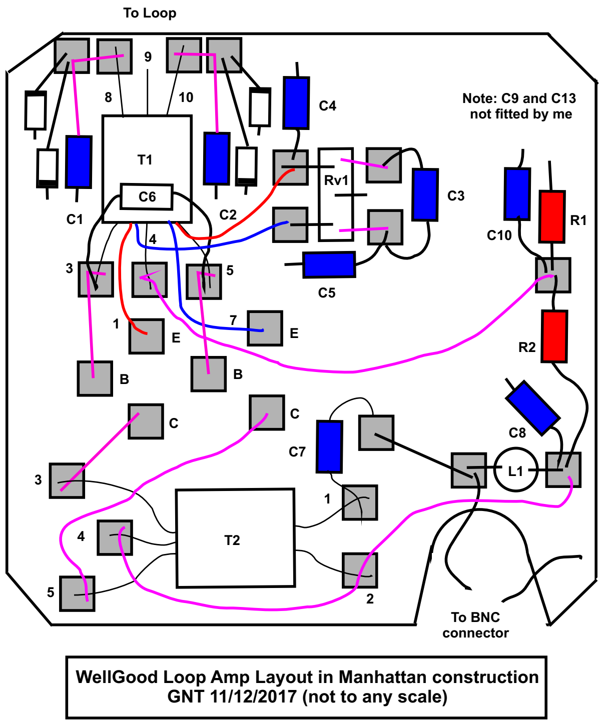


Fig. 1. WellG Loop Amp layout.

to the tile: squirt a little on a piece of scrap card and apply it using the stem of a cotton bud cut off at an angle. I find that holding the tile in a pair of bent metal tweezers, the glue can be applied, it placed down and the other end of the cotton bud used to hold it in place whist the other hand is picking up the next tile. Some glue is wasted, but left in the bottle it doesn't keep that long anyway; you need to be quick to put down more than five tiles before fresh is needed. Once all the tiles are down, and I do this simply by eye from a layout diagram, then it needs to be placed somewhere warm overnight before soldering. Doing this I had few tiles lift which is not the case if time isn't allowed.

As to being difficult to mount components then that depends upon previous experience. At one time I used to make prototype circuit boards, for dual in line packages, and wire them using fine insulated wire and compared to that I find this pretty easy and enjoyable. To me it's a good development method but not as easy or reliable as a printed circuit board. Pushing items, including fine wires, through a hole gives them some mechanical support. I have included a layout Fig. 1 if anyone wants to make a WellG and note that it includes extra pads that, where possible, allow a single component wire, or a 24 SWG tinned copper wire, to be used to trap the fine coil wires to make soldering easier and more reliable. This is also good as the outer secondary wires (3 and 5), of the input transformer, may need reversing as my build went into oscillation on first switch on, as did that of GS. Alternatively the 1t feedback windings can be reversed but the former is easier.

It's quick to mount the components

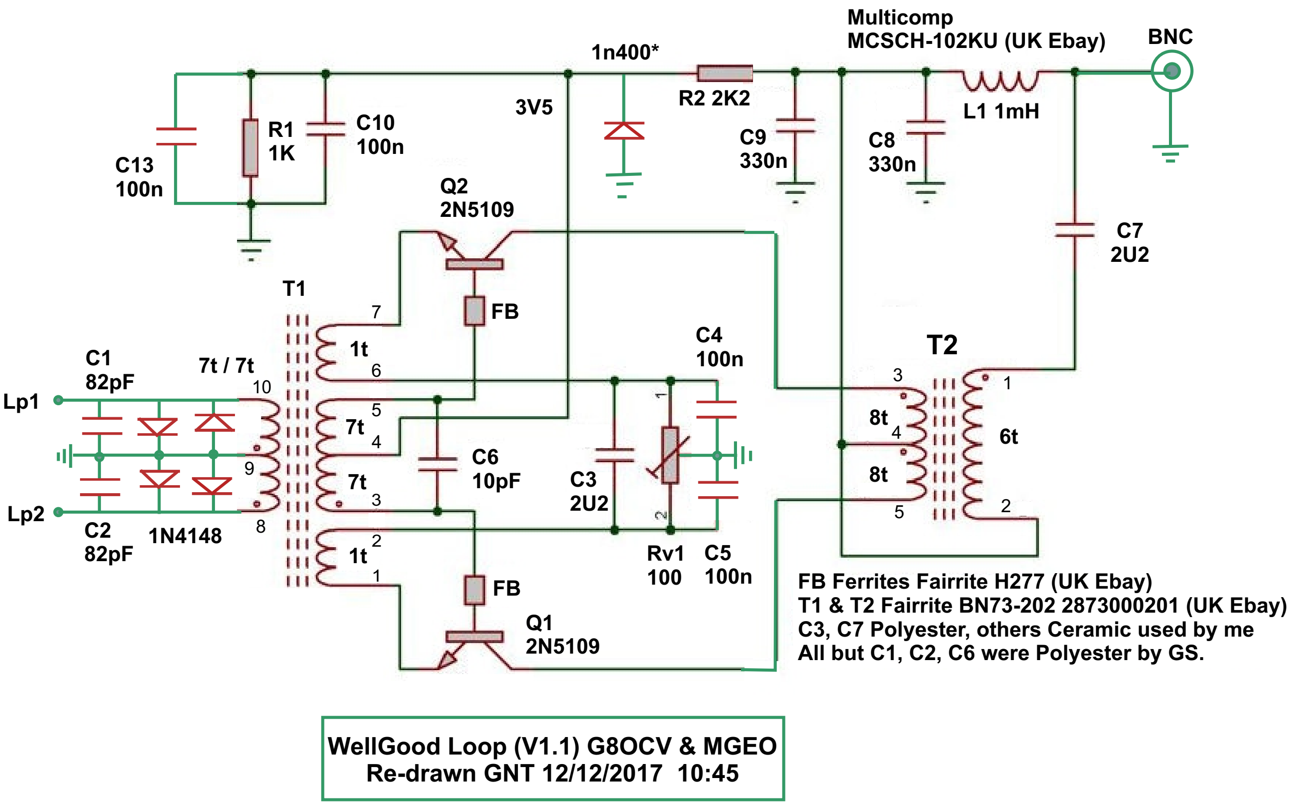
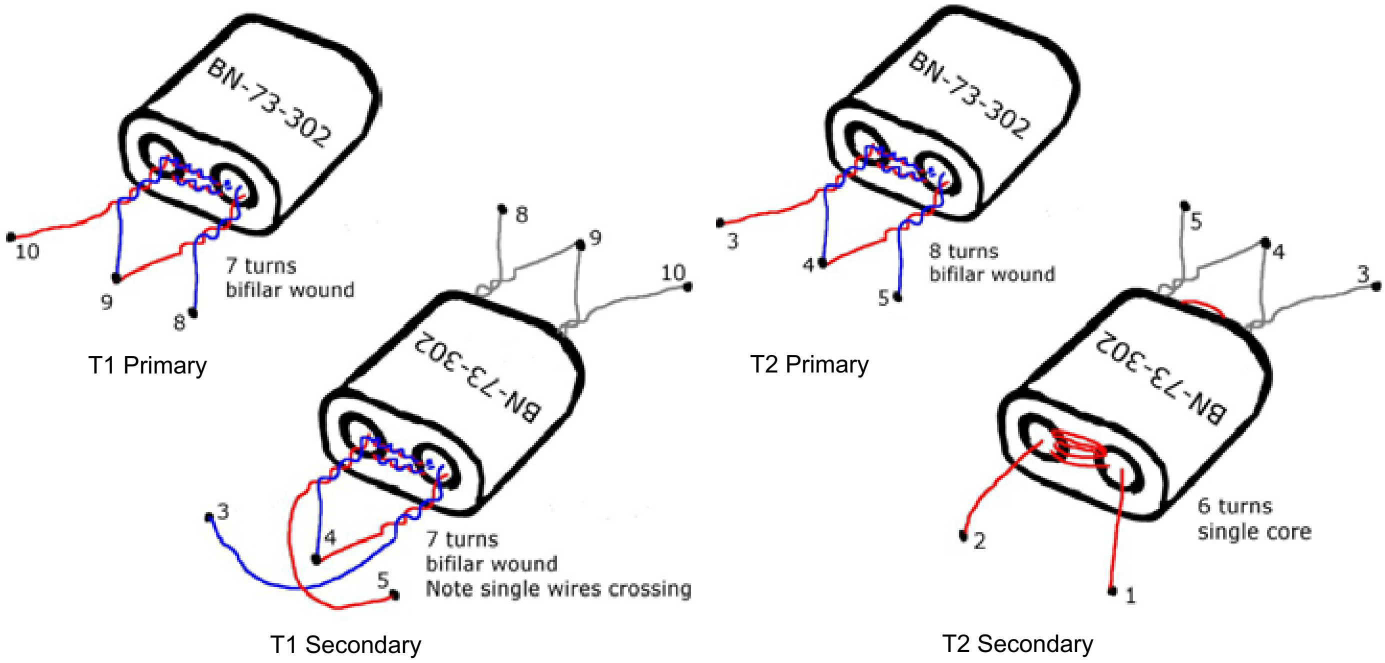


Fig. 2. WellG circuit redrawn



Wind T1 primary as shown, then turn the core around and wind the secondary. The 1t (27 SWG) coils are best fitted once the transformer is mounted. I turn is up through a hole and down through the other.

All wire, for both transformers, other than the single turns on T1, is 37 SWG although up to 32 should be possible.

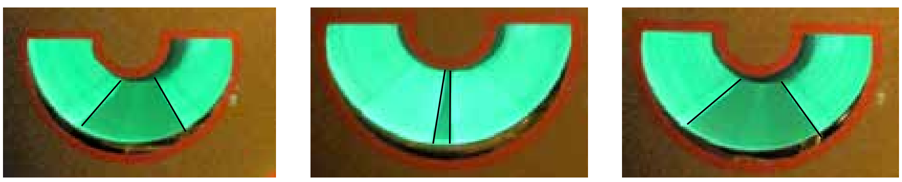
Wind T2 primary as shown, then turn the core around and wind the secondary.

WellGood Loop Coils (V1.1) G8OCV & MGED
Redrawn GNT 12/12/2017

Fig. 3. WellG coils

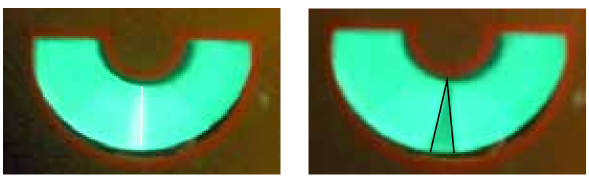
No 1t feedback wdgs. Pantry Xmitter MW | With 1t feedback wdgs. Pantry Xmitter MW 2m of coax from Amp | With 1t feedback wdgs. Pantry Xmitter MW 30m of coax from Amp

Pic. 5. WellG with and without 1T



GNT circuit with Tr3 | GNT circuit NO Tr3 | WellG

The same station around 19.2m (15 mHz) , on the dial (daytime)



GNT circuit NO Tr3 | WellB

Another station, another day, around 17m, on the dial (daytime)

Pic. 6. Performance on SW

for this design as there aren't so many of them but making the coils takes time and patience. I used 37 SWG, which is a little finer than the 0.2mm quoted. This was with the exception of the feedback windings, for T1, where I used 27 SWG as being stouter it made soldering in the single turn easier.

Detective work on the WellG

I have condensed the circuit diagram Fig. 2 and indicated a few minor changes I made. One of these was to add my customary diode to protect against reverse voltage; unlikely but it has happened, usually when bench testing.

For testing (see below for Tips on this) I was just using a high performance radio with an eye valve, an indoor loop, and using a mixture of strong and weak stations, including my 20 feet away MW rebroadcasting transmitter (usually called a "pantry transmitter" on the VRF).

During testing I removed from circuit the 1t emitter feedback windings and the effect can be seen in Pic.5. Also shown here is the attenuation when 30m of coax is used between the Amp and the radio.

I was intrigued as to why C3 and C7 were such a large value for the RF signals involved. In use I found no difference if they were just 100nF ceramics but I left them as they were. The impedances are low and the aim to get as much signal current as possible seems likely be the explanation given. But why are the de-coupling capacitors doubled up? I expect using the WellB strip board construction, which is very compact,

Pic. 7. Easy fit coaxila plug

Pic. 8. Inside the plug

Pic.9. Inner wire screw fixing

that ceramic types would have been used. Perhaps these are suspect once encapsulated, from the stresses that can induce, and both are unlikely to fail. For C3 and C7 it may have just been easier to use one poly component as these are a much more critical item.

Capacitor C6 was another I couldn't find a reason for. With and without it, on MW and SW (a station at 16.7m) performance seemed the same; possibly it is there for an unseen stability issue.

Simplified GNT design (see the previous article Autumn 2016)

There seems little point in using a current tail transistor Tr3 for the Tr1/ Tr2 pair, for better immunity to the common mode signal (signal common to both bases) from the 'vertical antenna' effect. The WellB has a very short tail and works satisfactorily and in tests done by me, with the GNT, I could find no difference with or without it on MW and LW (but see results on SW later).

So all the items associated with Tr3 can be left out, if building another, and simply replaced with a couple of 220 Ohm resistors in parallel. I found no improvement in putting a capacitor across the resistors as in the WellG but didn't test for this on SW.

Tips on building either design

Construction

From the layout diagram, for the GNT, I always start by putting down the tiles for the transistors. I do this by running strips of masking tape across the copper clad board that are in the right place to butt the emitter and collector tiles to. By allowing it to run across a piece of board or a clean smooth bench it also stops the circuit board moving around. Once these and the base tiles are in place all the others are easy as they more or less flow from them. For making the simplified version then the tiles for Tr1 and Tr2, and those associated with them, can be spaced out a little for making easier component placement.

For the WellB, its best to concentrate on those tiles used for the transformers T1 and T2 starting with the input for T1. With these in place a bare ferrite core, laid down as a guide, is a help for positioning the tiles for the secondary connections. Then do the same for T2. Really, as the board has plenty of room, it's easy to lay out for the rest of the components. Have to hand the poly caps and the choke to get the spacing right.

Either hot melt plastic can be used to secure the ferrites or super glue. The former is not so strong. I found it best to mount these first before adding the 1T coils to T1 and then continuing with the remaining components. It's a good idea to put in C6 after initial testing as it will have to be taken off if T1 secondary wires need reversing. For building both designs I always mount the transistors last.

Testing

Of course it's best to test the board before mounting it in the plastic boxes. Nothing more needs to be said for the GNT as it was covered in the previous article. For the WellB, before switch on, check that RV1 is approximately central. On power up monitor the supply current. This is easy if using a bench supply and the Power Feed box isn't needed at this stage anyway. If the current is approximately 100mA then that's good but if it's around 25mA then the circuit is certainly in oscillation which can be confirmed with an oscilloscope. T1 secondary wires (3 and 5) will need swapping around remembering to mount C6 afterwards.

With the circuit stable RV1 needs adjusting so that both transistors pass approximately the same current. An initial way is with a digital current meter in one of the power feed wires. At balance the circuit will draw the least current. Final tweaking, as suggested by GS, is to measure the mV across RV1. It's best to allow the transistors time to heat up and note that I fitted heat sinks as I had them and it can do no harm.

If the connection between L1 and C7 tiles is broken, then power can be applied to L1 and C7 wired to a loose BNC socket and connected to a local radio. Of course a temporary wire loop will need to be strung to see if performance is present and reasonably good; not as good as a remote location obviously.

If so, I would now hook up the Amp to its remote Loop, on 50m of cable for me, and check out its performance before the Zinsser treatment and 'boxing up'.

The Zinsser treatment is just a couple of heavy coats, which are applied somewhere warm, after removing any large flux deposits with IPA (Isopropyl Alcohol) and cotton buds. But do solder on the final input and output wires before spraying.

Mounting the circuit board in the boxes

I have found hot melt glue is simple to use for this. For the GNT then a couple of blobs between the screen and the box work fine. For the WellG then it has to be to the board in a clear space. It is easy to prise the glue away from the plastic of the box if it needs removing.

Use of 2N3866 transistors.

This was suggested on VRF and why not? I bought five but didn't get around to trying them. They do have a wider Hfe (DC current gain) spread and about half of the Ft (frequency where the gain has fallen to unity) of the 2N5109 and so may not be so good for SW especially in the WellG circuit where they are run at twice the collector current to the GNT circuit and Ft may be even slightly higher. For Hfe though they are about half the price, from Ebay traders I have had some dealings with, so buying a few more and matching them with a tester, if you have one, or a simple circuit if not, is possibly more acceptable.

For the five transistors, on my repaired multi-meter that has this facility, I had Hfe of: 66, 83, 141, 158, 190.

For nine 2N5109, the Hfe readings were: 98, 99, 106, 115, 117, 128, 141, 153, 159.

For the GNT circuit, as it is all AC coupled, transistor 'matching' possibly makes little difference and for the WellG adjustment of RV1 takes care of it. However, if they are similar, and I always do match pairs, it may help with rejection of common mode signals.

All of these transistors were marked Motorola but I did have some RCA 2N5109 that had Hfe of: 40, 45, 62, 63 that performed poorly in one GNT circuit particularly as Tr1 / Tr2. From this I would be looking for

Pic. 10. Cable stripper

transistors that had gains above 100.

Where do these transistors come from? I expect the traders are buying in bulk from China, giving them a quick test, as some of the leads are bent as they have to be to do this, and shipping them out in packs of five at a mark up.

There was some discussion on VRF that there might be fakes, re-stamped from types with less performance and cheaper. It is better to have moved away from encapsulation as it makes changing them possible if performance is disappointing. It would be nice to buy some from Mouser, in the USA; they even have MIL spec devices so all might be the genuine item but they do add £12 postage. If I was starting from scratch I would go that way as on a quantity of 10 it still only makes them £3 each.

Performance on a remote loop

I had a selection of boards and circuits to try on the 1m diameter WellB loop with the same GNT design Power Feed box shown on the schematic in the previous article. The WellB loop was used as it was convenient to detach the spade terminals from its amplifier mounted below. Testing was confined to performance with an HMV 650 and listening and seeing how much the eye valve closed. Obviously a communications receiver indicating signal strength and S/N ratio would have been preferable but I don't have one.

Designs were the WellB, the WellG and the GNT with and without TR3 the current source tail (the simplified GNT design).

On MW and LW all have similar and satisfactory performance but the WellG was slightly lower gain than the WellB on SW. Then for a surprise the GNT with no TR3 was considerably better in performance on SW for stations I could find at around 17 to 19m, see Pic. 6.

Was this because the gain of the two circuits was different anyway? So for the one without TR3 this was soldered back into place but as before there was less gain with it. At this time I also removed the 10 Ohm gain reducing resistors from the emitters of Tr1 / Tr2 but at these frequencies it made no difference but did boost the gain slightly on LW R4.

Coaxial leads

From all the plugging and un-plugging I have been doing, I had problems with the low cost coaxial leads bought from CPC Farnell. Basically the inner pin of the plug was not well enough secured and slowly moved back in the connector. I tried fitting new ones, using solder and crimp versions but this is very tricky in the 'field', well the bottom of the garden. It's also a nightmare of diameters and stranded or solid inner wire to find the right connector. Eventually I found the screw type shown in the pictures (Pic. 7-9) and these are very easy to fit and supplied by CPC Farnell PSG03208. Some will say but they are only good for a temporary fit but not so I think if you fill up the space inside with silicon filler or even quick set epoxy. Wear disposable gloves of course when doing this. So far two, with a solidly fixed inner pin, have been fine and if they give problems I would just cut them off and fit new ones. The aluminium foil wrapped around the braid in some cable is only metallised on one side so it's best to remove this completely.

The cable stripper shown in Pic. 10 is recommended.

Conclusions

I certainly achieved what I set out to do which was to make an untuned loop and amplifier that would give clear, listenable stations on MW and LW.

For SW there may be unfinished business in achieving the optimum circuit, as the pictures show in "Performance on a remote loop". However, it really needs a communications receiver to go further and someone with the interest to do so. For me, SW is a frustrating business in that signal strength varies so much, and stations seem to go off air, even during swapping designs.

References:

Ref 1. http://www.wellbrook.uk.com/

Ref 2. https://www.george-smart.co.uk/projects/wellgood_loop/

Ref 3. http://home.earthlink.net/~christrask/MWSCAS99.pdf

Ref 4. http://www.qrpme.com/?p=product&id=MES

Audiojumble, February 2018

Photos by Carl Glover


Velleman kit valve amp


Echoplex EP4 tape delay effect unit

On reflection, this is actually a Pye Mozart tuner unit!

An elevated view of the AudioJumble,
February 2018,
Photographed by Carl Glover

Tannoy Cheviots

AVO CT160 valve tester

Local rumours suggest it's a Philips Laservision!

A pair of Leak TL12 Plus mono amps

Bringing valve manufacturing back to the UK

Bob Manekshaw

Great Britain was once at the heart of thermionic valve development and production, proudly creating high-quality and consistent products for a worldwide audience. With a shift to solid state technology, demand diminished and the industry moved abroad.

Bring it back

Brimar's primary aim is to rebuild the valve manufacturing base in the UK. Valves used for audio amplifiers are still highly desired by professional users, because of their warm and natural sound. Companies in Asia and Eastern Europe have catered for this market, but there are concerns of a decrease in quality and durability as testing standards have noticeably decreased. The primary aspiration of Brimar was to bring the high standard of valve development and production back to the UK, using existing knowledge and equipment combined with some 21st century advancement. Since then, Brimar has begun to purchase and restore machinery to further the production of their valves, at their base in Stoke Prior, near Redditch.

The story so far

Brimar's story starts with Roy and his business partner Bob, who acquired the name 'Brimar' when the trademark became free upon the demise of Rank Brimar. Brimar was a highly respected brand, well known for valve production, before moving on to manufacturing complex thermal imaging systems for military vehicles. The company ran into hard times and unfortunately closed in 2012.

Bob and Roy began Brimar's new lease of life by buying new and old stock valves. However, they quickly found that new "foreign production" valves have a reputation for being unreliable. Brimar are now implementing high quality control procedures to ensure each valve is fit for purpose; their overall aim of the company is to bring valve production back to the United Kingdom. Since then they have joined up with John, a keen valve enthusiast from the age of 12, who assumed the technology was long gone. From looking online and visiting a BVWS show, this confirmed this was far from the case and there is still a passionate movement to keep valve technology alive. John's involvement with Brimar started by locating the machines originally used in the U.K. for valve production, then bringing them back into the country for repair.

Recent breakthroughs

Most recently, Brimar has brought on board several individuals who are striving to help with the management and realisation of the organisation. They have had a two significant of breakthroughs in the project, getting them closer to their dream.

The first came from an acquisition of some equipment allowing them to start a small scale manufacturing operation, enabling production of a limited range of valves.

The second breakthrough came from tracking down three pantechnicon loads of equipment. Originally from the Mullard works in Blackburn, the machines were shipped to Europe for valve production, before being put into storage indefinitely. Thanks to John they've now been brought back home. Brimar is now setting up a permanent home for the company in Stoke Prior, and hopefully by the time this goes to press they will have moved in the majority of the machines.

Brimar needs YOUR help

What can you do to help see this project to fruition? Brimar needs extra help with getting the machines working again. They are aiming to restore automatic grid machines, sealers, evacuators and huge bulbing machines used for valve production and this is your chance to make a real difference. You can get involved to learn about valve production, help Brimar to refurbish their machines, or contribute advice and support to help bring this magnificent industry back into the country. Brimar welcomes all volunteers, so please get in touch right away! To find out more about Brimar visit their website at www.brimaruk.com.

Gecophone Smoker's Cabinet receiving set

Evan Murfett

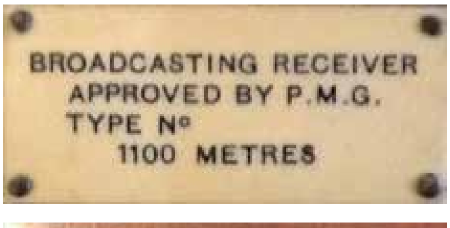
I purchased this Gecophone two valve smoker's cabinet receiver from Fin Stewart in 2013 along with a Gecophone BC 2580 two valve amplifier and a Gecophone BC 2600 horn speaker. At that time, I didn't fully understand the rarity and historical importance of this receiver.

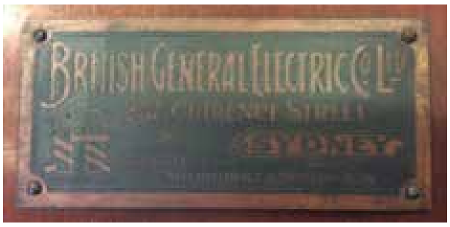
Based on the 1923 Gecophone BC2001, this receiver would probably have been supplied with two DER valves: HF amplification and detector left to right as you look at the control panel. It differs from the BC2001 in that it has capacitance and reaction tuning both before the HF amplifier and also between the HF amp and the detector. It does not bear a 'BC No' and the 'BBC-Type Approved by Postmaster General' transfer is covered by a small ivorine plate which is inscribed with 1100 metres (wavelength).

The receiver, which still bears its original retailers plate, is an example of the much maligned and short-lived Australian Sealed Set scheme, about which much has already been written. Farmer and Company were granted a Broadcast Licence in November 1923 with call-sign 2FC on 1100 metres wavelength. 2FC commenced test broadcasts in December 1923 and officially commenced regular broadcast services in January 1924. By May 1924, the Sealed Set scheme was doomed as a result of continued pressure from manufacturers and the general public and by July 1924, the scheme was defunct with new Broadcast Regulations signed by the Governor General. 2FC changed to a medium wavelength in about 1928 and went on to become ABC Radio National.

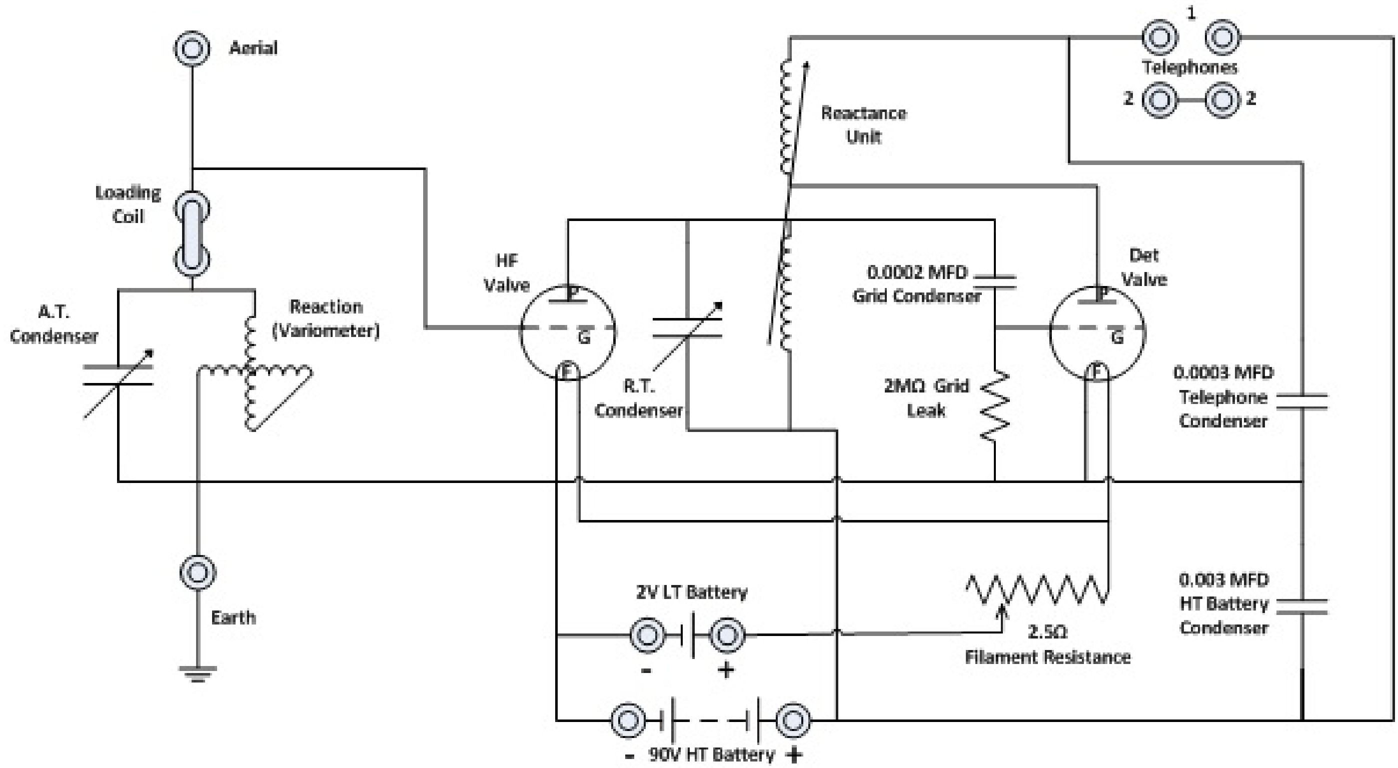
This background places my Gecophone receiver in the first six (probably less) months of radio broadcast in Australia and suggests that it was likely to have been modified from very early in its life to be tuneable to other, medium wave frequencies. The control panel has a hole centred amongst the four control dials and a corresponding hole in the rear of the cabinet not found on the British versions. In a 'eureka' moment shared with a friend and fellow HRSA member, we realised that this would be for a draw bar which may have incorporated a lead seal as the means of achieving the 'Sealed Set' status.

Fin Stewart purchased the Gecophone receiver from Lou Albert in the early 1990's. Lou had acquired it from a friend who was a nightwatchman in Maitland NSW in the late 1970's. The receiver was in the warehouse of a radio repairer due for demolition.





GECOPHONE 1100M SEALED SET RECEIVER



Lou thought that it was likely to have been a trade- in, as it had a price chalked to the side of it (now long gone). The smoker's cabinet was missing a door which Fin had made and I have now reinstated the correct moulding on the doors.

Other than replacing the missing door, neither Lou nor Fin had attempted to restore the receiver to working condition. The wiring, which consists of uninsulated 18G tinned copper wire, typical of this era, bore all the hallmarks of 90 years of repair, modification and tinkering. I very fortunately came upon an article from the New Zealand Vintage Radio Society written by John Stokes in 1989. It included a description of an almost identical 1100m wavelength Gecophone receiver and a circuit diagram. Using this circuit diagram as a basis, and allowing for the few minor differences, I untangled the bird's nest of original wiring. I reconnected what I could of the original rigid wiring, replaced what was missing with new 18G TCW and crossed my fingers. Using a couple of Mullard PM2 valves with a 90V HT supply and a little extra capacitance in the aerial circuit (the receiver was designed for 1100 m wavelength), I cautiously breathed life into it for the first time in at least 40 years and probably much, much longer.

After much adjusting of the tuning dials and the reactance damper plate, the first crackly sounds finally gave way to the unmistakable musical prelude to the 10 PM ABC Radio National news, shortly followed by Philip Adams' Late Night Live wherein he interviewed author Marc Raboy about his newly published book 'Marconi: The Man Who Networked the World'. August nights are cold in Woodend and my workshop has no heating, so try as I might, I couldn't prise my wife from her warm bed to come and share in this exciting, historic and fortuitous wireless broadcast event.

The two valve amplifier is next on the list.

Early use of wireless in Antarctica, 1912 -1937

Gwyn Griffiths

In the early years of the twentieth century pioneers of wireless for scientific purposes had to overcome problems with technology, limited understanding of wireless propagation, and, at times, incapable operators in their quest to establish wireless links between home, their ships and bases in Antarctica.

Australasian Antarctic Expedition

Sir Douglas Mawson's 1911-14 Australasian Antarctic Expedition was the first to use wireless in the Antarctic. Obtaining meteorological observations was Mawson's prime reason for establishing a wireless link between Australia and Antarctica in order to improve weather forecasts for ships sailing off the southern coasts of Australia and New Zealand[1]. Using the technology of the time a reliable wireless link could not be established without an intermediate relay station. Mawson chose Macquarie Island at a distance of 963 miles from Hobart, Tasmania and 1005 miles from his eventual base at Cape Denison, Antarctica, Figure 1. The site chosen was, "the summit of the isolated precipitous hill – Wireless Hill. We had then to face the serious difficulty of transportation of the heavy masts and engine parts from the beach to the summit – a vertical height of over three hundred and fifty feet"[2], Figure 2a. The technical advantages of the site included an unobstructed outlook and a peaty, sodden ground that provided an excellent earth.

The transmitters at both sites were Telefunken 1.5kW spark sets supplied by the Australasian Wireless Company, operating on "long wave". The Macquarie station first made contact with ships operating south of Australia on 13 February 1912, closely followed by contact with stations at Sydney and Hobart. Erecting the wireless masts at the Antarctic base at Cape Denison began in earnest on 4 April 1912, Figure 2b. Unfortunately, Mawson soon discovered that Cape Denison suffered severely from katabatic winds with an annual average speed of 80km/hr. Despite the best efforts of the telegraphist Walter Hannam, Figure 2c, and Frank Bickerton the engineer for the wireless installation, these winds, and technical difficulties, delayed bringing the wireless station into full service. Hannam managed to make contact with Macquarie on 25 September 1912 , considered the first successful message from Antarctica to the outside world. By early October the aerial was at 90 feet, but a hurricane on 13 October wrecked one of the masts, "the timber smashed and split in fifteen places as if struck by lightning"[3]. Repairs took four months and on 15 February 1913, Hannam's replacement, Sidney Jeffryes, heard weather report transmissions from Macquarie to Hobart. Two-way communications began on 21 February when the first incoming news was of the loss of Captain Scott and his polar party. Once up and running, in keeping with Mawson's aims for the expedition, a coded weather report that had priority over all other messages was sent out each night. By late March wireless communication was routine such that it was common for them to, "wake up in the morning and find that quite a budget of wireless messages had been received" and, "the wireless did us splendid service". Mawson charged his men to send messages to keep the volume down.

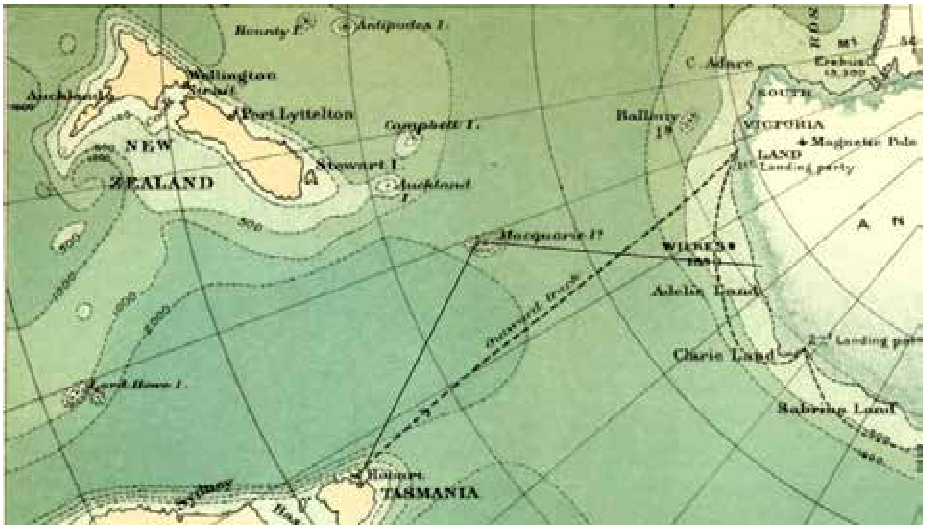


Figure 1 Map of Mawson's intentions with the wireless paths from Hobart to Macquarie and Macquarie to Cape Denison[1].The dotted line shows his intended, rather than actual, outward track.

Unfortunately, by early July 1913, as Mawson recounts in his book 'Home of the Blizzard'[2], Jeffryes had become ill, "His work on the wireless had been assiduous at all times, and there is no doubt that the continual and acute strain of sending and receiving messages under unprecedented conditions was such that he eventually had a mental breakdown". From then until November, when 24-hour daylight put an end to their operations, the engineer Bickerton and Mawson himself operated the wireless equipment after Bickerton had learnt sufficient Morse code. On return to Australia Jeffryes was diagnosed with paranoid schizophrenia; a 2014 chamber opera 'Call of Aurora' by Joe Bugden was inspired by Jeffryes' experiences on the expedition[4].

The operators made a number of observations on radio wave propagation, some, such as on intensity and interference, were of general interest, but others were specific to the Polar Regions. A correlation between occurrences of aurora and "dampened" incoming radio signals was observed, and, on 17 October 1913, it was found that reception suddenly improved as the sea ice in the Bay and out to the horizon was driven out to sea, suggesting that, "wireless waves are for some reason more readily transmitted across a surface of water than across ice". This is indeed the case arising from improved propagation directly over a

Figure 2a From the collections of the State Library of New South Wales. The wireless masts and aerials erected on Wireless Hill, Macquarie Island 1912 (IE1553248).

Figure 2b Cape Denison, Antarctica, 1912 (IE1553463).

conducting medium – in this case seawater.

The expedition also consisted of a Western Base party under the leadership of Frank Wild 1500 miles to the west on the Shackleton Ice Shelf. The party had a wireless receiver but on 11 March 1912, “Our amateur ‘wireless man’ [geologist Charles Hoadley] got the box containing wireless receiver, found it full of snow, cleaned her & gazed in despair at all the points & ends of wire fastened thereto. ‘Those are all connected with something’, said our leader, sagely. ‘Yes, but what the ****** are they connected with’ retorted the unfortunate wireless man! [5]”. Between them, they did manage to connect up the components present, but even by 25 April they had not found parts that were missing.

Imperial Transantarctic Expedition

Sir Ernest Shackleton’s Imperial Transantarctic Expedition had two parts, the well-known voyage of the Endurance in the Weddell Sea and the lesser-known voyage of the Aurora to the Ross Sea to set up food depots for Shackleton’s polar party. The term ‘Wireless’ is not present in the index of Shackleton’s book of the voyage of the Endurance. However, they did have a wireless receiver - type unknown, reputedly donated by a South American supporter - but no transmitter, and no wireless specialist. Biographers have suggested Shackleton was not impressed with the fickleness and cost of the wireless apparatus used by Mawson, and was wary of wireless communications compromising his complete control over the expedition[6]. It is not surprising that the receiver they did have was of little use. With Endurance stranded in the ice of the southern Weddell Sea, on 31 January 1915 Shackleton wrote, “James and Hudson rigged the wireless in hope of receiving the monthly transmission from the Falkland Islands due at 0320 the following day. James was doubtful about hearing anything with our small apparatus at a distance of 1630 miles ... We heard nothing and later efforts were similarly unsuccessful”.

In contrast the Aurora was better equipped; the Telefunken apparatus as used by Mawson had been bought for the expedition following a public subscription publicised by the Sydney Morning Herald. Aurora’s

Figure 2c Walter Hannam, telegraphist at Cape Denison (IE1562479).

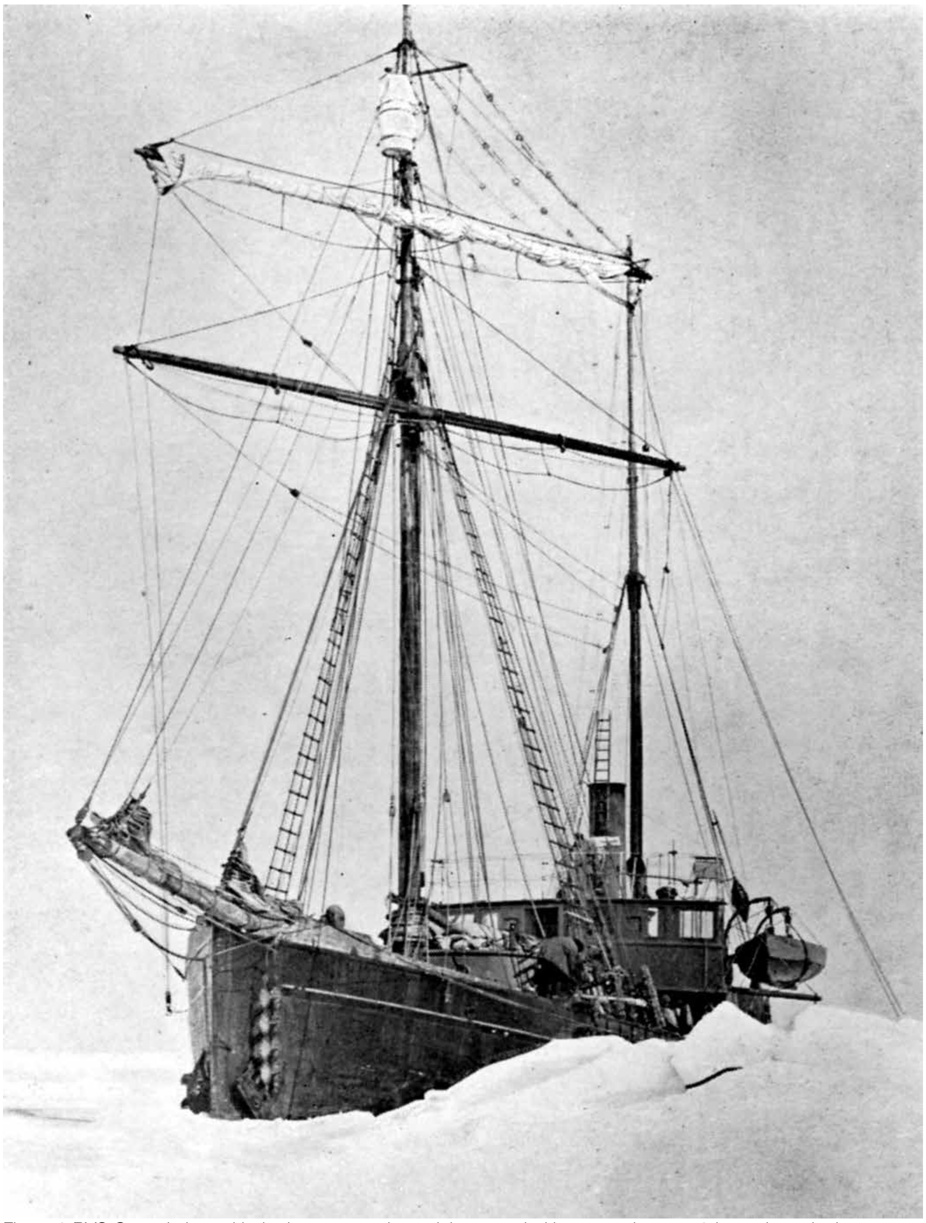


Figure 3 RYS Quest in ice, with the long wave wire aerial suspended between the top of the main and mizzen masts[10].

pantry was adapted as the wireless room. The wireless operator was the 19-year old Lionel (later Sir Lionel) Hooke an employee of Amalgamated Wireless (Australasia) Ltd. on his third voyage as wireless operator. In January 1915 communications were soon established between the ship and shore stations in Australia for the first part of her voyage. Hooke, with Aubrey Ninnis, a motor expert, fixed a faulty generator for the wireless HT supply before the ship got beyond range, the last messages being as the ship crossed 60°S, some 1100 miles south of Hobart - the base hut was to be the same distance further south.

With Aurora frozen in to the ice off Ross Island twenty-foot extensions were added to her fore and mizzen masts to raise the aerial in an attempt to contact Macquarie Island. A receiving aerial was rigged between the ship and the hut ashore. Hooke went ashore on 4 May and listened for Macquarie for four hours to no avail. He had brought with him a "small set of gear ... capable of being rigged for sending and receiving at the hut ... for use in emergencies"[7].

Hooke was on the Aurora when moving ice took the embedded ship away from the base hut two days later. With aerials rigged between the drifting Aurora's masts and the sea ice and an earth using copper wire through the ice into the sea Hooke made regular attempts to contact those stranded on Ross Island, but there is no known record of the shore party trying to listen or transmit[7]. On one occasion the Aurora's aerials shorted to earth, and as Hooke leant over a transformer he received, according to the ship's Captain, a shock of 9,000 volts that made him sick, but he was not seriously injured.

Towards the end of June Hooke had concluded that the insulators and aerials were inadequate to handle the power of the transmitter, with sparks and hisses being the tell-tale signs of breakdown. His attempts to coat the insulators with shellac, bitumen and wax brought no relief[7]. But in August 1915, by now drifting some 450 miles north of Ross Island, Hooke heard the Macquarie Island station in contact with Hobart and Awarua, New Zealand, although Aurora's transmissions were still not heard. It was on 23 March 1916 that Hooke finally managed to make contact with operator Alfred Goodwin at Awarua, a range of 590 miles (Awarua used a Telefunken 30kW transmitter and an umbrella aerial from a 394 foot tower that sat on glass insulators[8]) and with Hobart at about 1200 miles. As a consequence, the world learnt of the fate of the Aurora and the story was front-page news.

Progress after WWI

Wireless undoubtedly became more useful to scientific research in the Antarctic and Southern Ocean in the decade after the First World War, but the progress was at times faltering. The 1921–1922 Shackleton-Rowett expedition on the RYS Quest provides an example of shortcomings with equipment. Perhaps in part a reaction to his experience on the Endurance, Sir Ernest Shackleton ensured that the Quest was fitted with two wireless transmitting and receiving sets. However, only the smaller of the two transmitters worked properly, and at best it had a range of only 250 miles, making it effective only for contacts when close to the coast of South America or when in the vicinity of whalers with wireless[9]. More encouragingly, time signals were received on long wave consistently from 3000 miles, and "in certain incidences" from a range of 8000–9000 miles, suggesting they were receiving signals from Northern Europe or North America while sailing the Southern Ocean. The wireless aerial (Figure 3) was an inverted 'L' of three parallel sets of wire cages[10].

In 1904 the Argentine Government Meteorological Office took over the operation of a meteorological station on Laurie Island in the South Orkney Islands from the staff of W.S. Bruce's Scottish National Antarctic Expedition. The station operates to this day. Given the island's isolation and the commitment of the Argentine Government to the meteorological station it is surprising that wireless was not established at Laurie Island before 1925. In this case, technical factors were less likely to have been the reason. The South Orkney Islands were claimed formally by Britain in 1908 and, under the provisions of the International Wireless Telegraph Convention (1906) Argentina would need permission from Britain to establish a wireless station. Permission was not sought; but in 1925 wireless operation

Figure 4 MV Alert, equipped with a Marconi RP11 long-wave receiver for time signals[13].

started from the meteorological station on Laurie Island without a licence from Britain[11].

Commercial rather than scientific reasons provided the main motivation for a wireless station beginning operation on South Georgia in 1925. Working initially through the station at Port Stanley reports could be sent to Montevideo, Uruguay and beyond. A direct short-wave service between Grytviken, South Georgia and Norway was established in 1927 to serve the needs of Norwegian whalers.

Wireless on the RRS Discovery

From 1925 to 1951 the UK Discovery Committee undertook a series of scientific expeditions to the maritime Antarctic on Scott's RRS Discovery and from 1929 on RRS Discovery II. Much of the equipment on the Discovery was tested on her voyage south from September 1925 to February 1926. She made oceanographic, meteorological and biological observations in the South Orkney Islands, South Shetland Islands, the Palmer Archipelago, Bismark and Gerlache Straits and across Drake Passage before returning to England in September 1927. A short review on the performance of the Discovery's wireless sets was prepared for the 89th meeting of the Committee on 7 March 1930: "September 1926: Reception satisfactory but not always readable owing to atmospheric conditions. … Transmission, 1.5kW Spark Transmitter, very good results occasionally but constant extreme range remains in vicinity of 400 miles. Walvis Bay reported signals clear and strong at 887 miles. Cape Town could not be reached at 600 miles. Stanley gave good strength at 700 miles. 1.5kW CW Transmitter. Longest distance reached 1550 miles; this was during daylight. July 1927: Reception exceptionally good generally. Around South Orkneys and South Shetlands fading frequently experienced on 600 metres but on long wave Time Signals and Press News very clear and strong. Transmission. Q.G. [Quench Gap] transmitter range of 500–600 miles fairly constant. CW Transmitter. Messages transmitted to Simonstown up to a total distance of 2680 miles"[12].

The Discovery Committee recognised that the coastlines and inshore hydrography of many of the islands in the Falkland Island Dependencies were poorly known. As a consequence, much inshore survey work was done between 1926 and 1930 from a 25-foot motorboat, the MV Alert, Figure 4. The survey party of five to six men carried a Marconi 4-valve P.P. 11 long wave wireless telegraphy receiving set[13].

This set, "worked very well and enabled us to receive time signals from Nauen [a suburb of Berlin] or Rugby practically when required. This set should be replaced nowadays by a short wave set, because the receiver with its low- and high-tension batteries took up a lot of space and was also very heavy for a small boat".

On the RRS Discovery II in 1930 the main transmitter for long and medium wave interrupted continuous wave telegraphy was a Marconi International Marine Communications Company (hereafter 'Marconi') type MC13 of 1.5kW rating (Figure 5a), and a Marconi type MR4B for reception (Figure 5b). Despite the multitude of dials, both these sets were of simple design. The MC13 transmitter used

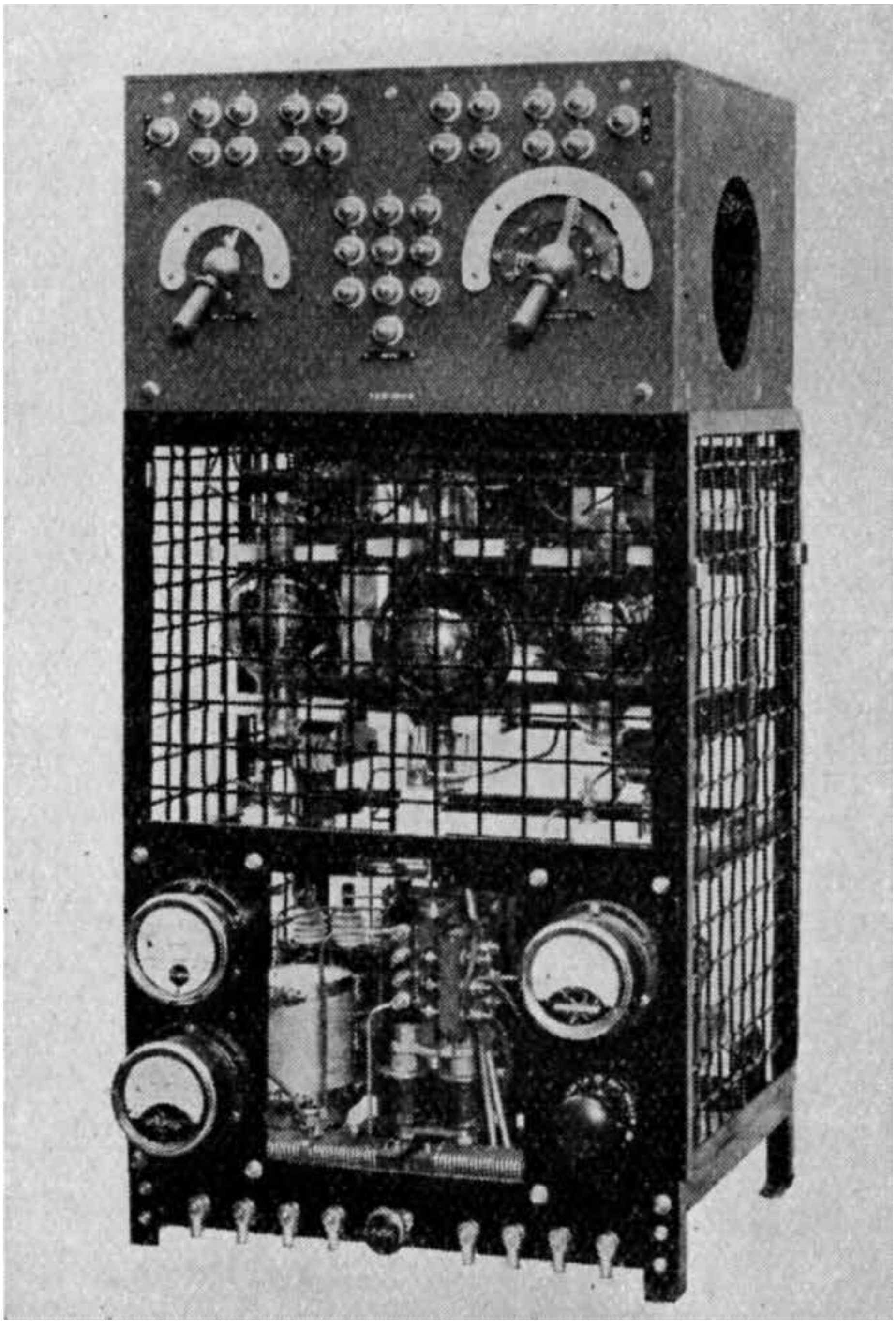


Figure 5a Wireless sets of the same types as those on Discovery II in 1930. Marconi 1.5 kW Interrupted Continuous Wave transmitter type MC13 for long and medium waves.

a single oscillating valve and two rectifying valves to provide a high voltage direct current from the alternating current supply. The MR4B receiver used a single triode valve as the radio frequency amplifier and detector with variable inductive coupling for regeneration followed by a transformer-coupled single triode audio amplifier to drive a pair of headphones. A separate emergency set (Marconi type 355) covered the 600 metre maritime emergency channel. A short wave transmitter (Marconi type 295) and receiver (Marconi type AD20) were also fitted. Technical details of these sets can be found in Dowsett's Handbook[14].

Wireless communication with RRS Discovery II was problematic on her first voyage south in 1929-30. The Master, Captain Cary, summarized the difficulties in a letter to the Secretary of the Discovery Committee on 19 January 1930, "On our passage from Greenock to London the set was found to be unsatisfactory in operation even over very short distances and upon this being reported Marconis' sent an expert with instructions to put the set in complete working order. Between London and St Vincent results were moderate, under good conditions we could reach Portishead. One day out from St Vincent transmitting communication with Portishead was lost and later we could not get Monte Video at 300 miles, or the S.S. "Avelonia Star" at a distance of 10 miles"[15].

While at Montevideo the Uruguayan Government sent wireless engineers to the ship to assist with fault finding and repairs. However, further technical problems emerged on the passage to Stanley, Falkland Islands. These technical problems were compounded by human error, Captain Carey writing, "The Wireless Operator would appear to have been unfortunate: he was apparently listening in to Rugby when Portishead was broadcasting and vice versa and I have informed him that, if he continues to be so, I shall send him home in the R.R.S. "William Scoresby" and let the Able Seaman who was also a wireless rating in the Navy take his place"[15]. There was also the opinion of the Hydrographer

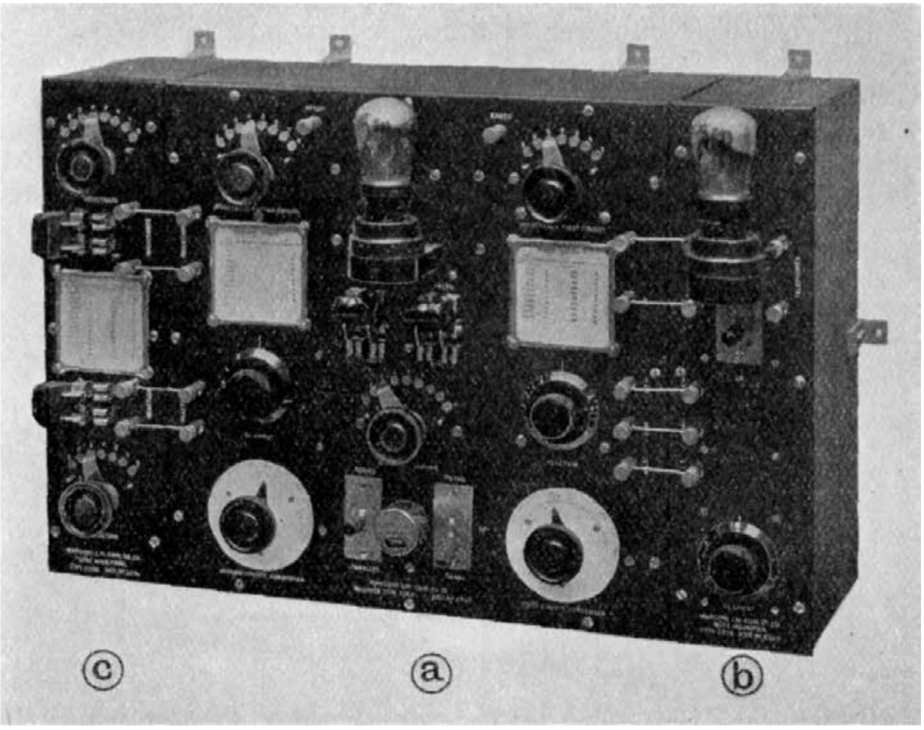


Figure 5b Marconi receiver type MR4B[14]

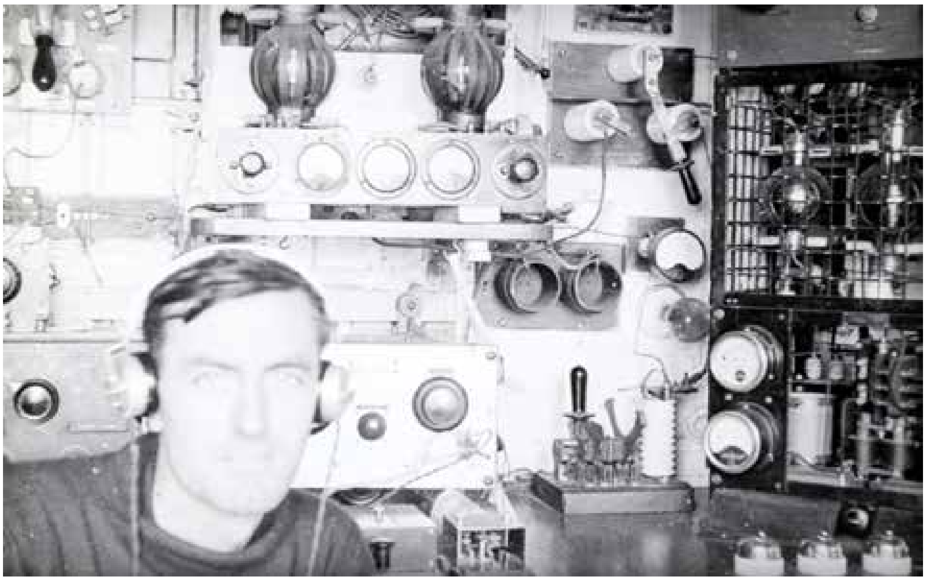


Figure 6 Discovery II radio room during the Ellsworth Relief Expedition, 1935-1936. From Museums Victoria at https://collections.museumvictoria.com.au/items/1735642.

Figure 7 A field party radio set with a hand-cranked generator[19].

of the Navy, "It is considered that the failure of the Apparatus is largely attributable to the inefficiency of the operator"[16].

In the meantime the Committee commissioned a report from Marconi into the wireless installation. As part of this investigation, the Officer in Charge of Burnham (Portishead Radio) wrote to the Discovery Committee, that communication with Discovery II, "does not compare with that of the whaling vessels operating around South Georgia"[17].

These letters, written in March 1930, reflected the situation before mid-January 1930, for on 18 January 1930 a wireless telegraphist had been transferred from the Committee's smaller ship, the William Scoresby, to Discovery II. It seems as if Carey dismissed his previous wireless operator immediately after writing his letter to the Committee. The incoming operator appears to have been able to operate the wireless apparatus with a higher degree of success. An anonymous undated memorandum observed, "Great difficulty was experienced in getting messages to the ship during her outward voyage, both Portishead and Rugby being unsuccessful on numerous instances until 23 January 1930"[16]. However, the incoming operator's time on Discovery II was cut short; it came to light that he had misappropriated £988-16-4 from the accounts of the William Scoresby. He was tried in Cape Town and sentenced to six months imprisonment in June 1930.

By mid 1931 the condition of the wireless sets on Discovery II had again deteriorated, "the station generally appears to have been neglected. The emergency battery has twice been flooded by sea water … All items of gear, with the exception of the D.F. [Direction Finder] are in a workable condition, but many repairs will be necessary to bring the station up to a satisfactory state"[17]. The cost for the work itemized in the letter was £187-0-4. And with that estimate for repairs the file on the wireless installation on Discovery II in the National Oceanographic Library archives ends.

In all likelihood the equipment was brought into a satisfactory state, and there is evidence that until at least January 1936 the ship was still operating with the Marconi MC13 transmitter. A photograph by Eric Douglas, an RAAF flight mechanic, taken during Discovery II's expedition to the Bay of Whales, Ross Sea, to rescue the polar aviators Lincoln Ellsworth and Herbert Hollick Kenyon shows the operator, Petty Officer A.E. Morris by the transmitter, compare the apparatus on the right of Figure 6 to the MC13 in Figure 5a.

British Graham Land Expedition

Led by the Australian John Rymill the British Graham Land Expedition (1934-37) was a frugal undertaking by sixteen individuals, nine of whom spent the winters ashore to complete a remarkable programme of geographical discovery and scientific investigations along the west coast of the Antarctic Peninsula[18]. The budget of under £20,000 was sufficient for a second-hand ship, the Penola, and a de Havilland Fox Moth single-engine aeroplane that could be fitted with floats or skis. Wireless, under the charge of Lieutenant I.F. Meiklejohn of the Royal Corps of Signals, was to play three important roles in the work of the expedition: for receiving time signals to correct their chronometers, for safe operations with the aeroplane, and for maintaining contact with the outside world through the station at Port Stanley.

It was not unusual for the battery-powered time signals receiver to be used at -30°C when out on surveys for it was kept outside their tent to avoid condensation. The usual aerial was 60 feet of wire some four feet off the ground suspended between two skis. Their normal procedure was to try and receive a time signal each morning and evening when surveying. Rymill was usually able to hear the short-wave signal from WWV, Maryland, USA at 5, 8 and 11 p.m. local time [21.30, 00.30 and 03.30 UTC] and the morning signal at 10 a.m. [14.30 UTC] from LOL, Buenos Aires.

One example of their use of wireless with air operations was of finding a site for a new base as their mapping surveys took them further south in their second year. The exploration was done from Penola, with the Fox Moth remaining on Winter Island in the Argentine Islands. Through twice-daily schedules Meiklejohn on the Penola kept the pilot, Hampton, informed of the ship's location, the weather, and the sea ice conditions, as the aeroplane would land on the sea. The wireless receiver was not fitted to the Fox Moth, rather the set and the aerial were at their camp and once the go-ahead to fly down had been given the set was packed into the aeroplane. Hence, no in-flight reception was possible. Such are the vagaries of wireless propagation that Hampton flew down to the new southern base using the previous day's wireless report of good weather, noting that, "I couldn't hear Meiklejohn at 9.30, and Port Stanley, instead of repeating Meiklejohn's weather report to me, repeated a personal message".

Byrd's Antarctic Expeditions

Richard Byrd's first Antarctic expedition 1928–30, with its base camp at Little America on the Ross Ice Shelf, made extensive and spectacular use of radio communication. This was to such an extent that Byrd wrote, "I suppose this single department received more attention than any other, for our program called for the most elaborate system of communications ever proposed in a Continent where radio conditions are notoriously bad"[19]. To provide the essential communications the shore party included five radio engineers, and between the two expedition ships, the main base, the three aircraft and three dog teams (Figure 7) there were 24 transmitters and 31 receivers. An extensive aerial array was constructed at Little America (Figure 8). Byrd's contract with the New York Times meant that a short wave radio link to the USA was essential, in return the newspaper assisted with the choice of equipment. Earlier, the Radio Corporation of America had declared that direct transmission from the Antarctic to New York was impossible[20].

The chief radio engineer, Malcolm Hanson, provided on loan from the US Navy, had polar experience having built and used radio sets in the Arctic. On 25 January 1929, one month after landing, he made contact on 34 metres with the "chief of the radio staff" of the New York Times and a radio station near San Francisco. Hanson also made studies of the Kennelly-Heaviside layer of the ionosphere (the E layer), which entailed a 48-hour trip ten miles out from Little America in temperatures of -40°C.

William Haines, the chief meteorologist, made full use of the weather information returned by radio from field parties together with his surface observations and those from pilot balloons to advise Byrd on conditions for flying, no more so than when deciding on the timing for the flight to the South Pole. On 28 November 1929 after the Geological Party had radioed from 300 miles inland that there was perfect visibility and clouds were lifting over the mountains, the Ford Tri-Motor Floyd Bennett took off. After flying up onto the plateau via the Liv Glacier they reached the Pole at 0114 GMT the following day, sending observations by radio to base throughout.

Byrd's second expedition (1933-35) made even more extensive use of radio. Base

Figure 8 Climbing one of the radio masts at Little America[19].

facilities now included a radio programme production facility with Charles Murphy as announcer and producer for a weekly series broadcast by CBS and a biweekly programme for NBC[21]. The shortwave equipment included two 100W transmitters and a 1.5kW amplifier, with the operating frequency between 6650 and 21625kHz depending on conditions. At times they would use two frequencies simultaneously to try and ensure reception of their programmes, one frequency using a 100W transmitter alone, and the other with the 1.5kW amplifier. The aerials included three rhombics at heights of 40-60 feet directed to Buenos Aires, New York and San Francisco. If direct contact could not be made with the USA programmes from Little America were relayed via Buenos Aires. At least one of the aerial masts was fitted with a wind power generator to charge a bank of batteries, described by H.R. Young as weighing four hundredweight, developing 140V with a 1kW output at 120-260 rpm. John Dyer, a physicist and one of the radiomen, shot a number of 8mm silent cine films that touch on several aspects of the expedition's use of radio. In 1986 he added a rather poignant narration[22].

This expedition is notable for the time Byrd spent alone at the Bolling Advance Weather Station at 80° 8'S, 123 miles inland from Little America. The station was intended to provide information on the meteorological conditions on the ice shelf through the winter night. John Dyer had built a "very simple"[23] short wave radio receiver capable of receiving telephony signals and a CW Morse code transmitter with a 5W output for Byrd's use (Figure 9). Byrd was no wireless operator; he wrote down the Morse code for messages he intended to transmit, and when he needed to provide answers, he wrote, "Dyer manages to follow me - he must have learnt mind-reading along with his engineering"[24]. The radio sets were powered

Figure 9 Admiral Byrd at the radio set at Bolling Advance Base[24].

by a petrol generator, the fumes of which caused Byrd to suffer several bouts of carbon monoxide poisoning. Plans were made over the radio for his early recovery in mid August 1934 during the darkness of the austral winter.

In their use of radio, Byrd's two expeditions were thoroughly modern, and demonstrated the full breadth of uses from science through logistics to entertainment and serving the needs of sponsors. There had certainly been great progress over the 25 years since Mawson's pioneering wireless installations in one of the earth's most challenging environments.

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[22] These are available to view as three videos at https://www.antarctican.org/byrd

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MARCONIPHONE 572 & 575

The Ferranti "Nova" 3 valve superhet of 1935

Graham Dawson

I recently acquired a 1935 Ferranti Nova 3 valve superhet from an old friend, BVWS member, and work acquaintance John Savage of Guildford. John is thinning out his sizeable collection of vintage radios and communication sets and asked me if I would like this model. Except for a new mains lead, the set looked in fairly original condition and had been running a few years ago, so we ran it up on a Variac to find out if it was still working. As I like 1930s sets I thanked him and brought it home for a closer look to see what work might have been done on the set during its lifetime.

The bakelite cabinet was free from cracks and the back was undamaged. However what at first glance appeared to be in "original condition" proved not to be the case when the chassis was removed from the cabinet. I had the Trader service sheet 106 from 1936 on the BVWS CD and printed a copy off to work on the set on the bench.

The first obvious change was that the mains transformer was not the original and the rectifier valve which was on a sub board mounted above it, had been re-wired and re-fitted on new pillars above this substitute transformer. This could have been done at anytime, but the pattern was of a 1950s unit as 4 volt heaters and centre tapped HT transformers were not so common much after this period and it did not look like a specially wound component.

Underneath it had all the paper capacitors replaced by a variety of makes and sizes, also of late 1950s or early 1960s vintage. The 8 + 8 uF main electrolytic smoothing capacitor had been changed for separate 10 and 22 uF caps and placed in the same general area. It did not look as though many, if any, resistors had been changed, but with extensive soldering for the capacitors change it was not easy to tell what might be original and what were replacements.

The general condition of the chassis would indicate no major disturbance of coils or IF transformers and the mica capacitors were certainly original as was the dial cord drive and 3 gang tuning condenser.

Really all this was what one would expect for a set of its age which at some time had been refurbished to continue working reliably for a few more years, though a mains transformer replacement is not normally needed. Probably the original was damaged in some way making a replacement necessary.

The valves were all of the type originally fitted, though the PT4 output valve was the only Ferranti made valve in the set, the others being of different makes. I only tested the R4 rectifier valve as the set seemed lively and I guessed the other valves to have satisfactory emission. Fortunately the speaker energising coil was still OK as was the speaker output transformer. In fact the set performed quite well on medium wave, although the AVC left something to be desired in keeping signal levels constant. The IF frequency of this set is 125 KHz and the medium wave tunes down to 190 meters. While the capacitor changes had left this set far from original inside, this was not visibly evident externally and the performance made it a worthwhile survivor to enjoy in the future.

Eddystone S680X: An orphan of the storm

Andy Palmer

Sometimes the way in which we acquire vintage radios involves some tenuous links in a long chain. The main subject of this article, an Eddystone S680X 'communications' receiver, ended up with me as the indirect result of a heavy rain storm one Friday night! (but I'm sorry to disappoint film 'buffs' as it is absolutely nothing to do with the 1921 D. W. Griffith classic silent film set in 18th century Revolutionary France, 'Orphans of the Storm', and starring Lillian and Dorothy Gish!).

How it came my way

One Saturday morning in the summer of 2017 the door bell rang. A rather distressed elderly lady from a house almost opposite had struggled across two roads and a wide grass verge supported by her 'walker'. She was seeking assistance because she was without electricity. Her son was away for the weekend and none of her phones worked to call for help as they were all 'cordless' and so required power for the base units (I always keep one 'wired' phone in the house for emergencies!).

I followed her over to her house and set about finding out why the two earth leakage trips in her fuse box had tripped. After a fruitless search involving disconnecting just about every plug and socket, isolating several outside lights, the shed supply, the pond pump etc, I eventually traced the earth leakage to the gas boiler in the kitchen. It was hidden inside a kitchen unit. The flue and ceiling above the kitchen unit was wet and water had entered the boiler due to the storm on Friday night. I isolated the boiler supply and was then able to reset the trips so power was at least restored to the rest of the house.

A week or so later the elderly lady's daughter came over to thank me. We got chatting and my job in radio engineering and interest in vintage radio came up in the conversation. Another couple of weeks passed before I received a call to say a friend of the elderly lady's daughter, a widow, had some radios that she wished to dispose of and was I interested? There was absolutely no clue as to what the radios were and I'm careful nowadays not to collect too much junk but temptation got the better of me so I said 'yes'!

About a month later the radios turned up. One was a nicotine encrusted early 1970s Grundig Satellit 2000. The other was a dusty, rusty and cobwebby 1950s Eddystone S680X communications receiver. They had belonged to the elderly lady's daughter's friend's husband (are you following this?!). Apparently a doctor by profession, it seems he had also been a keen short wave listener but sadly he had passed away a couple of years ago.

A short detour: the Grundig Satellit 2000

I suppose 1973 doesn't quite count as proper 'vintage' yet but the Satellit 2000 is a top quality all-transistor radio with a mix of germanium and silicon devices and I feel it's worthy of a mention. After cleaning off the nicotine I found that the case was actually black plastic with grey aluminium trim, so not entirely brown as it first appeared! Apart from one strip of aluminium trim that was missing the radio appeared to be unmolested, but it had a couple of mechanical problems that were immediately apparent. I'll briefly describe the repairs that were needed:

Figure 1: Grundig Satellit 2000.

1) The FM tuning control was seized solid due to the grease on the tuning gang reduction gears having turned into a glue-like substance over the years. Once the chassis had been removed from the case, cleaning and re-lubricating the drive sorted out that problem.

2) Six of the band selection push button switches would not operate and some were stuck down. The coil springs which 'un-latch' the switches are supposed to bear against plastic flanges on the switch shafts but these thin plastic parts had broken off leaving the return springs with nothing to push against. Some careful 0.7mm hole drilling of the shafts and insertion of stiff steel wires to act as spring retainers solved this problem. A dab of Araldite on each one should ensure that they stay put.

3) The 'S Meter' had three faults. Sometimes it would not move at all and when it did move there was a continuous deflection of around ¾ scale. Also the small bulb that illuminates the meter was blown.

3a. The moving coil meter has a ring magnet at its centre that once upon a time was glued to two plastic supports. Sometime between 1973 and 2017 the glue had let go of the magnet so it was free to jam the meter's moving coil as it rattled around. I carefully moved the magnet into the correct position and applied a couple of very small drops of Super Glue to hold it.

3b. The continuous ¾ scale deflection was eventually traced to leakage in a small disc ceramic capacitor associated with the S Meter's diode detector circuit. Grundig had taken the trouble to fit an additional IF amplifier and transformer stage whose sole purpose is to drive the AM S Meter – no expense spared!

3c. The bulb pokes into a recess in the back of the meter and it has a special base. There was no way that I'd find a direct or even close replacement, so I cheated. I fitted a 3mm amber LED and a current limiting resistor. The effect is indistinguishable from the real thing, honest!

With its 5-foot(!) long telescopic whip antenna, LW, MW, VHF FM and no less than 10 short wave bands, this is about as good as it gets in the way of 'portable' receivers in 1973. Actually it's probably more accurate to refer to it as 'transportable' as you really wouldn't want carry it very far, especially if it was full of batteries. Short wave bands 3 to 10 have a switch which either allows each SW broadcast band to be 'band spread' across the whole length of the scale, or each frequency range to be expanded to provide continuous coverage all the way up to 30MHz. The AM IF band width has switchable wide and narrow options. The output stage employs a complementary pair of beefy AD161 and AD162 power transistors as were often used in car radios of that era, so it has plenty of audio 'oomph' for the hard of hearing (and their neighbours). It's sensitive on all bands and is a delight to operate. Well done Mr. Grundig!

Figure 2: Front ¾ view with case removed.

Brief history of the Eddystone brand and the Stratton company

Eddystone brand receivers were manufactured by the Stratton Company. The company's history can be traced back to around 1860 and was started by Gloucestershire pin maker, Stephen Jarrett, and Birmingham merchant, Charles Rainsford. The original company name was 'Jarrett and Rainsford' and they were based in Birmingham. After 38 years they were joined by 15 year old office boy George Laughton who later rose to become a manager. He bought another small company that was a supplier to 'Jarrett and Rainsford' but was in financial difficulty, for £50. He named that company 'Stratton'. George Laughton later sold Stratton to Jarrett and Rainsford in 1920 and became a substantial shareholder of the resulting company of 'Jarrett, Rainsford and Laughton Ltd', with the parent company being Stratton.

In the early part of the 20th century changes in ladies' fashion caused a downturn in some of the company's main profit lines. George Laughton's son suggested diversifying into making wireless components as this was in the early days of broadcasting, a time when the home construction of radio receivers was becoming popular. Incidentally, the son's full name was 'George Stratton Laughton' so perhaps this is the origin of the Stratton company name, or was it the other way round? Which came first, chicken or egg – dunno?!!!

The wireless components for the home constructor were manufactured under the trade name Eddystone whereas the other non-wireless 'fancy goods' items continued to be manufactured under the name of Stratton. Stratton also opened the 'Webbs Radio' chain of retail radio shops in 1924 and this survived until the mid 1960s.

Over the years the company produced such diverse items as ladies hair pins, coronation flags and badges, gentlemen's jewellery, ladies compacts, seagrass stools and bead mats. They were also instrumental in producing equipment for the home constructor and hobbyist, as well as advancing professional radio communication by developing equipment such as two-way 60MHz VHF vehicle radios for the Metropolitan Police just before WWII.

Far more detailed information on Eddystone receivers and the company in general is to be found on the Web site of the Eddystone User's Group http://eddystoneusergroup.org.uk/ .

Eddystone S680X description

In 1947 a forerunner of the Eddystone S680X, the S.680, was exhibited at the Radiolympia Show but this set never made it into full scale production largely due to overheating problems. Apparently an attempt had been made to use up surplus stocks of the mains transformers from the earlier nine valve S.640 receiver in the S.680 but they were just not up to the job of supporting 15, albeit mostly miniature, valves. In 1949, after a redesign, a larger case and the fitting of a larger transformer, the S.680/2 was released but it was still marketed as simply the S.680. This set had a 'half moon' / semicircular type of frequency scale which was used on earlier Eddystone receivers.

In 1951 the S680X was released with a much larger linear frequency scale and a phased crystal filter in the IF. Production of the S680X continued for ten years and finished in 1961 after over 1500 had been built. My set, serial number GJ1395, appears to have been built around 1958 judging by the only date that I could find which was on the S meter. It is tempting to guess that the 'X' in the model number indicated the presence of a crystal filter but I don't think this is the case. It seems more likely that the 'X' indicated several design changes including the 6AU6 audio amplifier and phase splitter valves being replaced by 6BR7s.

Model S680X is a single conversion superhet with RF coverage from 480kHz to 30MHz in 5 switched bands. There is a wide, clear tuning scale which is supplemented by a circular 'logging' dial that makes it easy to accurately return to any frequency at a later date. The tuning control is smooth with hardly any backlash (now that I've mended it!).

Thirteen of the valves are 'modern' all-glass B7G and B9A based valves but there are also two venerable octals. Valve functions and types are shown in the table at the bottom of this page

With two RF stages and two IF stages S680X certainly does not lack gain. This surfeit of RF gain ensures that the AGC, when switched on, works very effectively. An 'S Meter' is inset into the top of the tuning scale and a control at the rear of the receiver allows it to be zeroed. The two tuned RF stages also helps to maintain reasonable 'image frequency' rejection at the higher frequencies even though the IF is only 450kHz. Unlike some other manufacturers Eddystone are brave enough to publish graphs of image rejection for the two highest frequency tuning ranges in their manual. At 30MHz rejection of the (30.9MHz or +3%) image declines to 25dB but at 16MHz it increases to 50dB, and improves rapidly at lower frequencies of course.

A front panel selectivity control provides four discrete IF bandwidth settings. Bandwidth adjustment is achieved entirely mechanically with what is effectively a 'crank shaft' carrying three connecting rods that disappear up into the bottom of each IF transformer. The connecting rods move the lower coil in each of the three IF transformers either away from (narrow b/w), or towards (wide b/w), the upper coil which is fixed, thus reducing or increasing the coupling respectively. A clever idea but I can't help wondering how long the flexible wires connecting to the lower coils will last if the control is used very much however! Additionally a single 450kHz crystal can be switched in and 'phased' with the phasing control to provide very narrow selectivity for Morse reception

Valve	Function	Type	Description
V1 & V2	RF Amplifiers	6BA6, EF93, W727	Variable-Mu HF Pentode
V3	Mixer	6BE6, EK90, X77	Heptode Frequency Changer
V4	HF Local Oscillator	6AM6, EF91, Z77	Straight HF Pentode
V5 & V6	IF Amplifiers	6BA6, EF93, W727	Variable-Mu HF Pentode
V7	Demodulator and AGC	6AL5, EB91, D77	Double Diode
V8	Audio Amplifier	6BR7, 8D5	Pentode
V9	Audio Phase Splitter	6BR7, 8D5	Pentode
V10 & V11	Push-Pull (Pull-Pull!) AF O/P	6AM5, EL91, N77	Low Power O/P Pentode
V12	BFO	6BA6, EF93, W727	Variable-Mu HF Pentode
V13	Noise Limiter and S-Meter	6AL5, EB91, D77	Double Diode
V14	HT Rectifier	5Z4G	Full Wave Rectifier
V15	Stabiliser for Oscillators	VR150	150V Shunt Stabiliser

Figure 3: RF coil compartments with cover removed.

Figure 4: Left hand PSU and BFO chassis.

or to notch out an interfering carrier.

Separate RF and AF gain controls are provided. There is a BFO (beat frequency oscillator) for receiving Morse. Single side-band transmissions can also be resolved by careful adjustment of the BFO but the lack of a product detector means that the RF/IF gain needs to be fairly well backed off for this mode of reception.

A noise limiter can be switched in if required. This is achieved by the conventional method of passing the audio signal from the detector (½ of V7) through a diode (½ of V13) which is critically biased so that normal audio levels will pass but large peaks from impulsive interference spikes are not conducted through it to the AF gain control. When limiting is not required a front panel switch simply shorts across V13.

The push-pull (or should that be 'pull-pull' as neither valve actually 'pushes' to my mind!) output stage provides plenty of audio power for relatively modest DC power consumption.

The front of the receiver incorporating the tuning scale and controls is formed by a substantial aluminium casting. The chassis is separate from the front panel and consists of three sections.

On top of the centre section is the 4-gang tuning capacitor and the four RF 'front end' valves, i.e. two RF amplifiers, the mixer and the local oscillator. The underside of the casting is divided into four screened compartments which house the RF / oscillator coils and trimmer capacitors for the 5 tuning ranges. The tuning coil compartments are covered by an aluminium cover plate. Holes are provided in the plate to access the trimmer capacitors with the cover in place but this has to be removed if it is necessary to adjust the cores of the coils. I presume the Eddystone design engineers decided that initial testing and alignment of coils and trimmer capacitors would be carried out with the cover removed. Later in the production process the cover would be fitted but it would be necessary to finely adjust the trimmer capacitors to accommodate the

Figure 5: Output stage.

slight increase in stray capacitance, so holes were provided. For all practical purposes the inductance of the coils would be unaffected by the presence of the cover as they are spaced relatively far away from it, so they would not need adjustment holes – just my guess!

The left hand chassis section (when viewed from the front) is made from steel. It holds the power supply (mains transformer, rectifier, HT smoothing capacitors, choke and voltage stabiliser) and the BFO.

The right hand chassis section is also made from steel and holds the IF amplifiers, the detectors and the audio stages. The two diminutive B7G valves hiding under a brown Paxolin 'hat' are V10 and V11, the 6AM5 / EL91 audio output valves. The audio output transformer is directly behind them housed in what looks like another IF can.

According to my valve data book a pair of puny 6AM5 / EL91 valves operating in class AB1 push(pull!)-pull with an HT of 250V and each one biased for a quiescent anode current of only 11mA, are capable of producing 4W output with only 3.2% distortion. In the S680X the anode voltage is around 220V so the maximum output will be a bit lower but it's an efficient arrangement nonetheless.

The output transformer has a low impedance winding designed to drive a 2.5 to 3 Ohm 'speaker and a separate centre tapped winding to drive a 600 Ohm land line. A 1/4” jack socket on the left hand side of the front panel is provided for connection of 2000 to 4000 Ohm impedance phones. It is tapped off from the anode of one of the output valves via a 2nF coupling capacitor and a 100k resistor.

On the rear of the chassis, next to the mains inlet socket (left hand chassis), is the rheostat that controls the brilliance of the dial lamps (more on this later).

Between the mains inlet and the rheostat are terminals marked 'EXTERNAL RELAY'. When the 'SEND' switch on the front panel is set to 'OFF' it places a short circuit across the 'EXTERNAL RELAY' terminals and simultaneously disconnects HT from the receiver. The 'EXTERNAL RELAY' terminals can therefore be used to enable an associated transmitter whilst the receiver is muted. The service manual refers to the SEND switch as a 'Standby' switch. Incidentally, when

Figure 6: Right hand IF / output stage chassis.

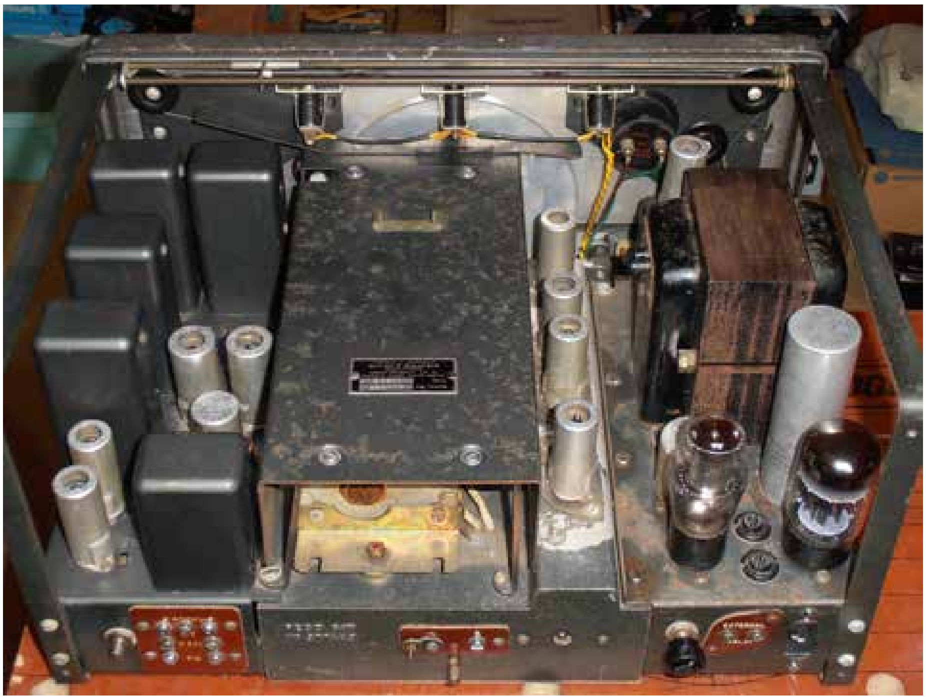


Figure 7: Rear view with case removed.

the switch is in the OFF position it leaves the HT rectifier, reservoir capacitor, choke and smoothing capacitor in operation but disconnects the HT from everything else. The result is that the HT voltage rises rather alarmingly. Whilst the 16uF reservoir capacitor is rated at 450V and should be able to cope, the 40uF smoothing capacitor is only rated at 350V and I measured just over 350V in my set!

In the centre of the rear panel are the aerial and earth terminals. A link is provided so that the earth terminal can connected directly to the chassis if an 'unbalanced' aerial is to be used. If a dipole is to be used then the earth link is disconnected and the legs of the dipole balanced feeder are connected to the two terminals. Input impedance is stated to be around 400 Ohms which provides a compromise between a generally high-ish impedance random 'long wire' antenna and the lower impedance of a half wavelength dipole.

On the rear of the right hand chassis are the speaker and 600 Ohm line connection terminals. Rather oddly for a 'communications' type receiver there is also a pair of 'PU' (pick up) terminals to which an audio source such as a gramophone could be connected. The PU terminals are simply connected across the 100k load of the detector stage and precede the noise limiter, so presumably the noise limiter could be employed as a 'scratch filter' for records! If the PU input was used it would be necessary to reduce the RF gain to minimum and disconnect the aerial to avoid radio break through because there is no PU selection switch.

At the side of the audio connection terminals is the potentiometer for zeroing the S meter. The moving coil S-meter is connected across a bridge circuit. One half of the bridge is fed from the HT rail via a pair of padding resistors and has the zeroing potentiometer near its centre. The other half is connected to a potential divider in the screen grid circuit of the 1st IF amplifier, V5. AGC action on V5 causes the screen grid current to change and this is monitored by the S meter. It is calibrated in 6dB steps: 'S0' to 'S9' and then 'S9 +6dB', S9 +12dB' and 'S9 +18dB'. Half of diode D13 is connected in series with the meter movement so that it can never read below zero.

The whole of the main part of the set is housed in a case that can be removed by taking out four screws at the rear. The case has a hinged lid that can be lifted to allow access for some simpler maintenance tasks such as changing the mains voltage tapping on the transformer, replacing mains fuses, changing valves or replacing the three dial lamps.

Resurrection / Resuscitation

I would not be so bold as to refer to the work that I have carried out on this set as a 'restoration' when I compare it with the gleaming showroom condition restorations often carried out and described by others in the BVWS magazine. I think it's more appropriate to use the terms 'resurrection' or 'resuscitation' because I did not intend to carry out a full rebuild to concours standard. The aim was just to tidy it up and replace only those components which were required in order to make it operate properly and reliably again.

When the set arrived it was quite dusty with a fair amount of surface rust and the thick cobwebs were evidence of numerous industrious spiders. It had an air of dereliction as though it had been out of use for many years. I suspect that the owner attempted to mend it but eventually threw in the towel and bought the Grundig Satellit 2000 to continue his short wave listening hobby.

The first obvious problem was the that the tuning scale didn't work. You could turn the knob but the cursor stayed put. Lifting the hinged lid on the top of the case revealed that the thin steel wire associated with the tuning drive and cursor looked very crumpled, had stray broken strands and showed signs of having been generally messed about with. On the plus side, all the valves were present and appeared to be undisturbed. Two of the three dial lamps were dangling by their wires and resting on top of the cover for the tuning capacitor. They'd probably been detached when the tuning drive 'mangling' had taken place.

When tackling the repair of anything I like to start with what I expect to be the difficult bit as I hope it will be all down hill after that. It seemed like the tuning drive was going to be the difficult bit with this set so that was where I started.

Tuning drive repair

To access the tuning drive it is first necessary to remove the complete die-cast front of the radio, a rather daunting prospect as so many things are attached to it. This involves first removing all of the knobs and then the various large nuts on the potentiometers and switches. With these out of the way the escutcheon can be lifted off to reveal four large (2BA?) brass screws that secure the front casting to the centre chassis. There are four other screws that enter the rear of the front casting and secure it to the two steel braces, one either side, that protect the valves etc. when the chassis is upside down on the bench. The grub screws securing the flexible coupling between the tuning drive and the tuning capacitor shaft were already loose so this slid off the tuning capacitor shaft as the front panel was lifted away.

I noticed that the thin aluminium logging dial was buckled and binding on the tuning scale so it would need gentle bending to flatten it. Obviously I wasn't the first person to venture into this part of the set!

After taking a few photos of the works of the tuning drive I took it apart. The metalwork, glass and tuning scale was thoroughly washed. Fortunately the paint and lettering on the scale adhered very well and was not damaged (warning - lettering on glass tuning scales will often become detached if washed and once it's gone you can't stick it back on!). The S meter was removed for its own safety and cleaned rather more gently.

Once the drive was removed it became obvious that the original frayed and bent stranded steel wire was going to need replacement. I measured its diameter and found it to 0.4mm. Oh dear, where on earth would I find such stuff? In desperation I typed “0.4mm diameter stranded steel wire” into Google and quickly struck lucky. The Scientific Wire Company had a reel of 0.4mm, 7 x 0.09mm Nylon covered stranded stainless steel wire. A 25m reel was modestly priced but unfortunately the final price wasn't quite so modest once post, packing and VAT had been added. Anyhow, I've now got enough spare wire to repair another 25 or 30 Eddystones if need be....

The tuning control shaft has small diameter spring loaded clamping washers that grip the outer edge of a smooth steel disc which is attached to the first reduction gear. This provides the first stage of reduction 'gearing'. It also provides a safeguard in the form of a torque limiting clutch action that will slip harmlessly when one end or the other of the tuning range is reached. The tuning control shaft has a flywheel which is attached by grub screws, or rather should have been but the screws were loose, another indication of previous meddling.

The first reduction gear drives the second reduction gear which in turn drives two small grooved pulleys. The steel wire winds into one of the grooved pulleys and out of the other as the radio is tuned from one end of the scale to the other. A sprung 'jockey wheel' keeps the wire under moderate tension. Both large brass reduction gears consist of double gears with springs to tension them against the smaller mating gears so that back lash / lost motion is avoided.

The original steel wire was obviously not stainless or Nylon coated because it had been crudely soldered to anchor pins on the two grooved pulleys and to part of the cursor. I wouldn't be able to solder the replacement stainless steel wire so I needed to dream up an alternative attachment method / bodge. In the end I used some small brass inserts from miniature terminal blocks. Half of an insert provided a convenient anchor that could be soldered to the pins on the pulleys and the cursor. The grub screws would be used to clamp the wire. A bit fiddly but it worked!

Next came the task of rewiring the drive. A bit of careful study of the way each pulley rotated and where it came to rest at either end of the tuning range was needed, a job only to be undertaken in good light with no distractions. Each pulley had to be meshed with the second large reduction gear so that

Figure 8: Front panel removed.

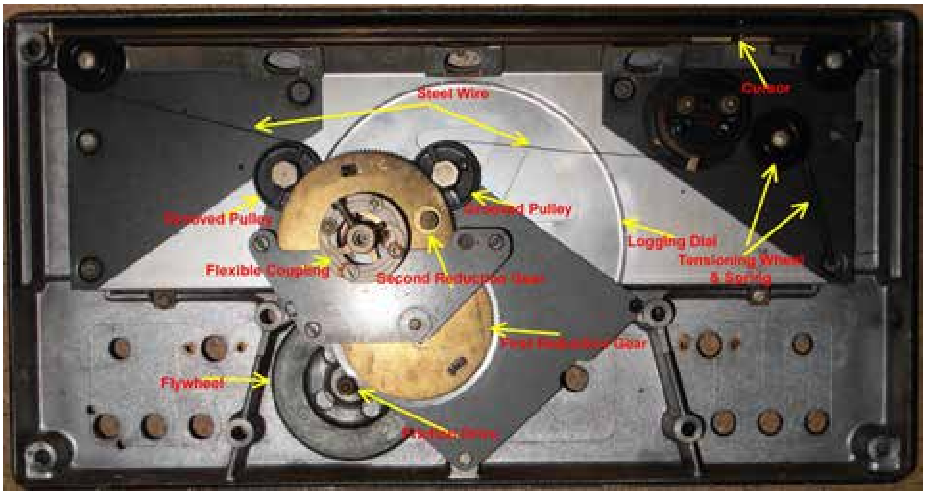


Figure 9: Tuning drive.

Figure 10: Pulleys and cursor fitted with soldered in terminal block inserts.

Figure 11: New wire on the two pulleys, left hand full, right hand almost empty apart from about 1/4”.

the wire would still be guided by about 1/4” of pulley groove when it was empty at the extreme ends of the tuning scale. This 1/4” or so head start would ensure that the wire would wind on neatly as tuning was moved away from the end stop and the pulley started to fill.

My bodged terminal block wire anchors worked a treat and made the job of adjusting the wire and cursor straightforward. I'm certain that it was much easier than if I'd been trying to solder steel wire under tension as with the original arrangement.

I played around spinning the tuning up and down the scale several times to convince myself that all was well. The flywheel certainly speeds things up for large frequency excursions because it's quite a laborious process to get from one end of the scale to the other due to the large amount of reduction gearing. The flattened out logging dial no longer rubbed on the back of the scale so things were looking good.

Turning the large 4-gang tuning capacitor with my fingers revealed that its action was a bit 'notchy'. A few drops of oil on the bearings at either end diluted the old dried out grease and resulted in a much smoother action. After cleaning and lubricating the switches and potentiometers I refitted the front panel, somewhat relieved that part of the job was complete.

The reformation:

Over the years I have found that HT reservoir and smoothing capacitors will often come back to life and provide many more years of service after gentle persuasion by reforming them from a current-limited supply. If you force current into them they will overheat and their leakage will increase, never to recover. Some years ago I built a capacitor reformer that provides a regulated zero to 500V supply with current limit adjustable from zero up to 20mA. Perhaps rather oddly I have found that the much maligned Hunts brand produced electrolytics that tend to be better than other brands when it comes to reforming after many years idle, although their (and other manufacturers') wax paper capacitors are notorious for leakage of course. The HT electrolytics in this set were made by TCC.

The reservoir and the smoothing capacitor are linked by the choke but fortunately they can be disconnected from the rest of the set by simply switching the SEND switch to the OFF position. This made it easy to reform the capacitors as a pair without unsoldering anything or getting fooled by leakage elsewhere in the set. After a few hours at an 'aiming' voltage 350V and with a current limit of 2mA, the leakage had dropped to around 0.5mA, so plenty low enough for reuse. After discharging the capacitors I checked their capacitances and they were both up to spec, but unfortunately my joy was to be fairly short lived – see later!.

Checking the other components

My main concern with the other components in this set was the large number of 0.1uF and 0.01uF decoupling capacitors that were liberally sprinkled throughout, there being no less than nine buried deep in the RF screened compartments alone. These were aluminium cased TCC tubular paper capacitors which had a 2BA stud at one end so they could be bolted to the chassis. If they proved to be leaky it would take a month of Sundays and the patience of Job to replace them all. However after testing several of them for leakage and capacitance I was pleased to find they were all absolutely fine. Thank you Mr. TCC, you saved me a lot of work by making such wonderful capacitors!

Anyone who has worked on vintage radios for any time will go straight to the grid coupling capacitor (two in this case) for the output valve(s). Any leakage here potentially spells doom for the output valve(s), and possibly the HT rectifier and mains transformer as well. Again luck was on my side as thankfully the Eddystone designers had chosen to use low leakage moulded mica capacitors in this position and there was not even a sniff of positive DC on the grids. Yippee!

Figure 13: New mains connector / filter. A bit of a squeeze but it's in!

It didn't take an expert to see that the 30uF 15V electrolytic across the cathode bias resistor for the output valves was a 'gonner'. White crispy gunge had leaked out of both ends. I also replaced its two identical chums that provide audio coupling across the cathode bias resistors of the AF amplifier and phase splitter valves because they were of the same type and I didn't trust them.

As for the resistors, I was also pleased to find that most of them were within specification. Of course some resistor values are more critical than others. For example I'd look more closely at the value of a cathode bias resistor than I would at say a nominal 1M resistor feeding a gentle waft of DC to the grid of an RF valve from the AGC line. In this set I took particular care to ensure that the resistors in the audio driver, phase splitter and output stage were reasonably in line with the correct values as any variance here is likely to result in distortion. The resistors associated with the phase splitter were the main concern in order to avoid 'lop-sided' push(pull!)-pull operation.

The signal from audio amplifier V8 is fed without attenuation to output valve V11. Resistors R49 and R50 attenuate the signal from V8 by 37dB before passing it to V9 which, with a bit of luck, has a gain of 37dB so that an identical but inverted signal is fed to the other output valve, V10. I'm not a great fan of this arrangement but presumably the feedback resistors R47 and R53 help to keep the gain of each side equal, assuming R11, R13, R49, and R50 are fairly close to their design values (which they weren't in my set!).

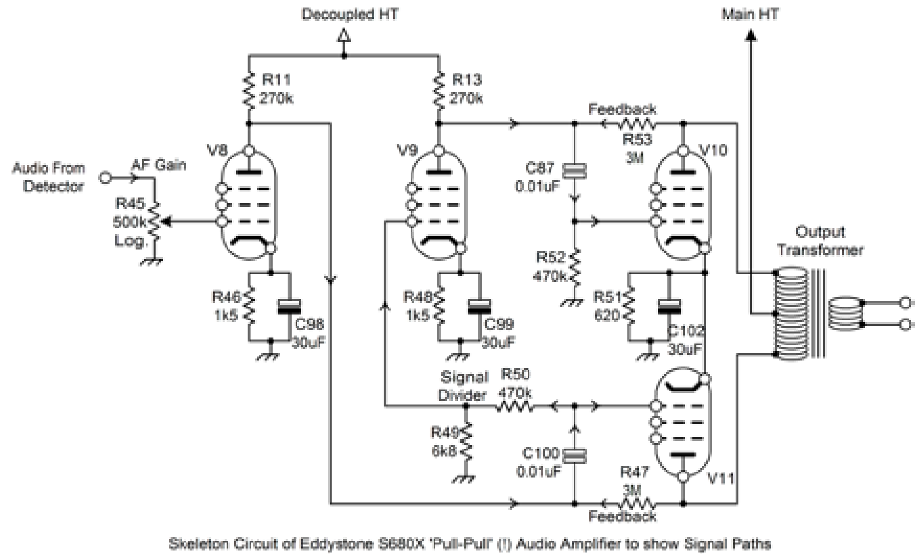


Figure 12: Skeleton Circuit of Audio Amplifier to show Signal Paths.

Whilst checking resistors and poking about in the depths of the RF die-cast compartment where V3 the mixer valve lives, I touched the end of R27 with the meter prod and found that it had never been properly soldered to its earth tag. As it's the cathode bias resistor for the mixer it's rather vital and not something that the set could live without. It's now been re-soldered. It would be interesting to know how these radios were put together in the first place because many of the components in the those deep, dark, dingy compartments are now inaccessible if they need replacing. I'm guessing that sub assemblies were built outside on a jig before being lowered into the abyss of the screened compartments, never to be seen again.

'Elf and safety!

The mains input to the S680X is by way of a two round pin chassis mounting plug, inset at the rear left hand chassis. There is no mains earth connection. The case is entirely metal with two nice big chrome handles to grab hold of if you're feeling lucky and don't think you'll be electrocuted. The only thing between the user of this set and Armageddon are a couple of thin pairs of Paxolin washers that insulate the mains plug pins from the bracket carrying them, and the potentially dubious insulation hidden within the 60 year old mains transformer. However the wiring itself was all PVC and in good condition.

I like to maintain originality but in this case I felt that it would be wise to err on the side of safety, especially as I didn't intend to keep the set long term. So, I removed the two pin plug and fitted a 3-pin C14 IEC chassis mounting plug (the type commonly used on computers etc.). The chassis plug that I used also had a built in RF filter in the live and neutral conductors, but an unfiltered direct earth connection. Fortunately no horrible hacking of the receiver was required because a standard C13 IEC line socket will just about

Figure 14: IF adjustment cores. Lower cores only accessible at 'Narrow' selectivity setting.

pass through the cut out in the rear of the metal chassis. I had to make up one small steel plate so that the original mounting holes could be used to fix the new connector. The original connector is now attached to a spare mounting hole inside the set so it can be replaced if a future owner / historian wishes.

Switch on:

I connected my workshop speaker and a 20ft length of wire as a temporary aerial. With a meter on the HT rail and one hand resting on the mains switch for a quick shut off if necessary, I applied power. After a few seconds warm up, lo and behold a bit of soft noise from the speaker and no smoke. However, there was not really enough noise to justify 15 valves, even with both RF and AF gain controls flat out. The odd weak signal could be heard as I tuned up and down various bands but it was certainly not what you'd call 'lively'. Oh dear!

A bit more prodding around with the meter on cathodes, screen grids and anodes told me that all seemed to be in order DC-wise. All the RF and IF valves were drawing healthy currents and a prod on the top end of the volume control gave a reassuring loud crackle and hum from the speaker. As a few weak stations could actually be tuned in this indicated that at least the local oscillator was running.

It began to look like some bygone saboteur may have had a play with the alignment. I certainly don't think the spiders did it! I had hoped to leave the alignment alone as the Eddystone manual had given dire warnings that it shouldn't be touched unless absolutely necessary. Oh well, here we go...

The Eddystone manual gives some ball-park figures for the sensitivities when injecting IF and RF signals at various points. This confirmed initially that the IF at least was well below parr. After removing the local oscillator valve, V4, I injected 450kHz IF signal to the anode pin connection on the socket (pin 5). This signal goes to the local oscillator injection grid of the mixer, V3. What the manual doesn't highlight but perhaps ought to, is that the anode connection of V4 has an HT feed so you need to isolate the signal generator with a DC blocking capacitor. I used 1000pF 500v that was to hand.

The lower IF transformer coil slugs can only be adjusted when the selectivity control is in the narrowest position because this is the only setting where the lower coils coincide with the trimmer tool access holes in the transformer cans. A few minutes of adjustment brought about a huge improvement in IF gain so it certainly looked like the 'phantom twiddler' had been at work.

The set was now much more lively on an aerial but some frequency ranges were rather quiet and the gain was not consistent across the ranges either. Time to check the RF alignment so off came the cover plate for the RF compartments. Again the adjustments were found to be all over the place. Fortunately the Eddystone manual gives the alignment spot frequencies for the local oscillator and RF circuits on each range. After this it perked up no end so I replaced the cover plate and gave the trimmer capacitors a final tweak.

Just when you yhink it's all over...

Now the set was running I noticed that the rheostat on the rear that controls the brightness of the dial lights was 'all or nothing' and felt very rough when turned. Indeed, to get any light at all was rather like finding the sensitive face on a galena crystal with a cat's whisker!

I removed the rheostat and rather brutally hacked off its glued-on back cover. Part of the wire wound track was burnt to a cinder at one end. Then the penny dropped as to what must have happen sometime in the past. This damage must have been caused by one or other of the dial lamps shorting out on the chassis of the receiver when they were dangling on their wires whilst the 'phantom mangler' had been fiendishly messing up the tuning drive wire.

The rheostat is 5 Ohms and I had nothing remotely suitable to replace it with. Yet another bodge was called for! Why not use the good end of the track and make the control work back to front? I improvised an additional 'stop' so that wiper couldn't reach the chewed up piece of track and reassembled the control. It works fine now but of course the lamp brightness won't go quite so low as it once did.

A few more hours of trouble free operation passed when I noticed a slight 100Hz hum from the speaker when the AF gain was set at maximum. Looking through the service hatch in the top of the set revealed that the violet glow from the VR150 stabiliser extinguished when the BFO was switched on and wasn't very bright even when the BFO was off. A meter check showed low HT voltage and a scope check on the cathode of the rectifier revealed completely un-smoothed 100 cycle DC. Obviously the 16uF reservoir capacitor had thrown in the towel. A replacement capacitor from my box (museum!) of ancient electrolytics restored hum-free audio once again.

Summary:

This is the best Eddystone valve receiver that I've encountered, although I've only played with three or four over the years so I'm certainly no authority on the brand. It's got plenty of gain, even up to the dizzy heights of 30MHz, and the AGC is very effective. The local oscillator and BFO is stable enough to listen to SSB transmissions as long as you are prepared to readjust the tuning slightly from time to time.

The tuning control is smooth and the accuracy of the frequency scale is good following realignment. The overheating problems that plagued the forerunning design have been completely overcome and the mains transformer of my set is only slightly warm to the touch after many hours of operation.

I have fitted a small elliptical ex-TV speaker beneath the ventilation mesh in the service lid so that it is not necessary to use an external speaker. This makes the set a bit more usable for casual listening but it sounds a bit 'thin' due to the lack of a proper baffle. No new holes were drilled as I used the existing holes in the mesh. The speaker could be removed easily to maintain originality of appearance if desired. Fortunately there doesn't seem to be any problem with overheating after blocking part of the vent with the speaker.

The set has been running for a couple of hours each day over the last four or five weeks and has been trouble free. Admittedly it has mostly been receiving the RF output of my simple amplitude modulator. This is fed into the S680X's aerial lead by wrapping a few turns of the modulator's RF output wire around the aerial lead over a length of three or four inches to lightly couple it in. The audio input to the modulator is derived from a DAB radio tuned to either BBC Radio 4 or Radio 4-Extra, so this hasn't really stretched the S680X's legs as regards receive performance. We are currently in the doldrums of the eleven year sunspot cycle so the high frequency short wave bands are frequently dead as a dodo.

As a final sobering thought, recently some young people were being interviewed on the TV about the 50 year anniversary of the start of BBC Radio 1. It came as a bit of a shock to me to hear that many of them had never even seen or used a radio! All of their listening was by way of smart phone, iPad or laptop etc. Perhaps our hobby of vintage radio restoration and documentation is gradually turning into a conservation and preservation role? Maybe I shouldn't have mended this set at all but just left it untouched for future generations to discover, cobwebs and all!

50 years of colour television, celebrated with a restoration of a BRC/Thorn 2000 - Part 2

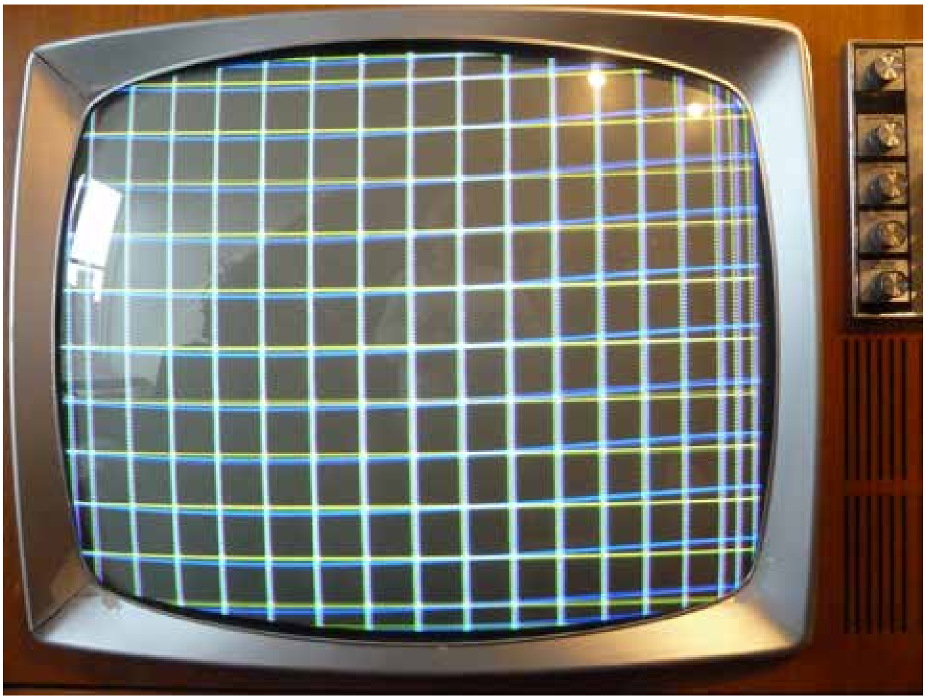
Stephen Niechcial

At the end of part one I had got as far as having repaired the set enough to get a picture. This confirmed to me that hard-to-source components such as tuner, tube and transformers were serviceable and I could now proceed to a complete restoration.

When it comes to mass replacements of components, TV sets of different makes and periods tend to have different weak spots. Unlike wireless, in the Thorn 2000 there are very few leaky waxed paper capacitors to worry about. The main culprits are the small black or red plastic-cased electrolytics dotted across all boards as couplers/ decouplers, and timing components. They are made by Callins and others. Most of them can be replaced without seriously upsetting circuit adjustments, so out they all came. Unfortunately their size and construction does not easily permit 'case stuffing' so a degree of authenticity is lost.

A second source of failure is small low value polystyrene capacitors made by Sufflex. These are mostly in tuned and aligned circuits, so mass replacement is not worthwhile unless there are alignment problems which don't seem to have a single cause. It soon became apparent from the test card frequency gratings on both standards, as well as colour strength, that the tuned circuits were pretty much as they should be. So I did the sensible thing and left well alone.

A third source of failure is dry joints, usually on hot components such as power transistors and high wattage resistors. I dealt with these by carefully examining the underside of each board through a magnifying glass and re-soldering as necessary. I also cleaned up the copper print edge connectors on the boards with wire wool before putting them back. In my experience the mating female connectors on the chassis give very little trouble. This is just as well, as over 100 connections are made through them. On earlier valve sets, heat could cook Paxolin circuit boards to such an extent that they carbonised and became conductive, leading to a myriad of strange faults. The worse that seems to happen on the 2000 is the more delicate copper track lifting and breaking. This caused the strange convergence fault shown (Figs.1 & 2). It took me some time to find the fault because the piece of track concerned had detached completely at both ends and had fallen off. I found it much later in the bottom of the cabinet.



Fig, 1, Convergence fault showing the blue horizontal convergence way out on the right of the screen.

Having completed all the above work, it was time to start a more through look at the various faults and deficiencies. I started by trying the set on 405 lines. This is a bit of a nerve-wracking procedure as the solenoids which switch over the line timebase and IF modules sound like railway points closing! The timebase systems switch does actually interrupt the supply voltage when switching systems, to prevent surges destroying the line output transistors, but there is no soft-start up beyond that. Fortunately the transistors have survived to date. I managed to tune in a 405 line test card C on Channel 1, supplied internally from my Aurora 625 to 405 converter. The tuner gain on both UHF and VHF was fine, but the tuner was temperamental when trying to tune or change systems. Clearly a strip down was required . More of that later.

The first thing I attempted to do was to adjust the convergence to get a good black and white picture without excessive colour fringing. There are in all twenty one dynamic and three static adjustments - all of which interact to a large degree (Fig. 3). I could not get the convergence anywhere like correct. Just to make matters worse, the one section of my service manual which was missing when I bought it was the circuit of the convergence board. Fortunately the give- away was that one control was not working. I thought it was probably o/c as these high dissipation wirewound pots. often go that way. However it turned out to be the above mentioned print missing.

You will remember that when I first repaired the set that I managed to achieve a good monochrome greyscale. Unfortunately it didn't last long. The colour tint of the screen started to drift all over the place. This turned out to be one of the hardest faults to track down. A block diagram of the RGB amplifier is shown at Fig 4. The circuit diagram of the three identical amplifier/output stages is at Fig 5.There are two controls in each colour channel. From the red-luminance (R-Y) channel (top of diagram), it will be seen that the whole stage is DC coupled, hence a change in any DC conditions at any point will result in follow through to the output stage as an increase or decrease in the brightness of the red picture component. DC level and stability is achieved by clamping the DC level on the base

Fig. 3, The convergence board in the service position. The system switch can be seen on the right.

of the first amplifier (VT7) using a clamping transistor (VT9). This transistor clamps the base of VT7 to a dc voltage adjustable by Set Video Bias pot. R42. VT9 conducts on line pulses fed to its base via C21. The circuit is designed so that VT9 conducts, and hence clamps, during the line flyback interval when picture content is at zero (i.e. black level). An additional pot. (R38) sets the video gain for the R-Y channel. Luminance signal (Y) is fed into the base of output transistor VT 10 with R-Y fed into its emitter, resulting in an output of R at the collector of VT11. Additionally a 1KV supply feeds a high impedance potentiometer network of three pots. on the convergence board, allowing the voltage of the Red, Green and Blue tube anodes to be adjusted independently. Again any drift in that network would produce a changing colour tint on the monochrome picture. So that adds up to a total of nine controls to set up (three per colour channel), and fifteen transistor circuits, drift in any one of which would cause a problem. It would however, be hard to isolate individual stages for fault diagnosis due to DC coupling. Aaaaaaah! In the course of carefully setting up those above mentioned pots. on the video board I discovered most of them were noisy. I replaced them, but to no avail. I then spent several happy hours monitoring voltages in all three channels. To cut a very long story short, I concluded that the drift was not confined to just one channel. We were now into educated guess-work component changing. I decided to replace the three small value polarised capacitors in each channel (C15, C18, C20

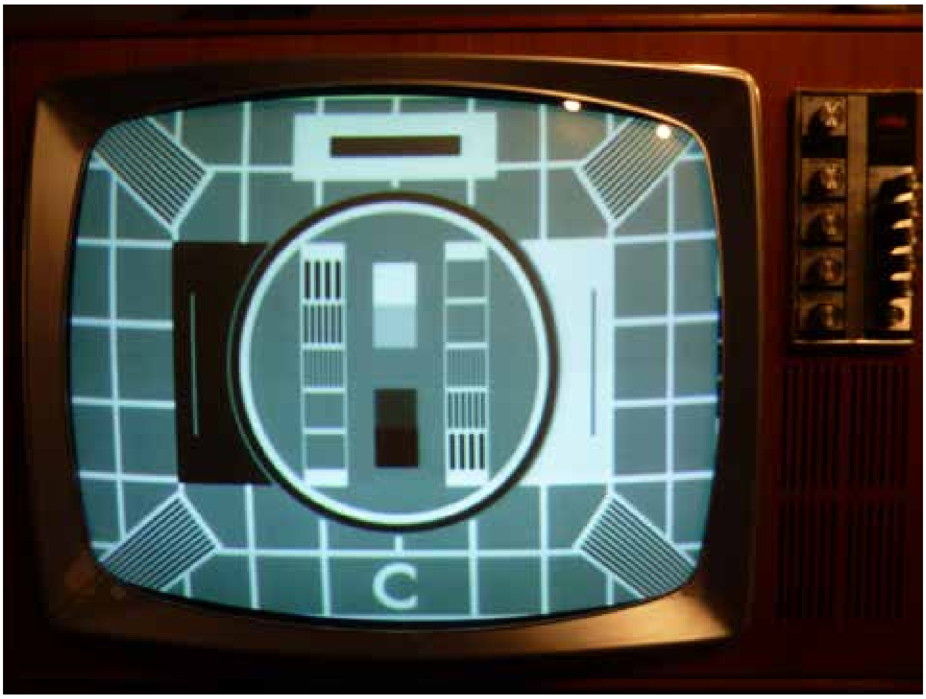


Fig. 2, A 405 test card with the convergence now correct.

in the Red channel). They are Tantalum types rather than electrolytics due to the need for very low level leakage and good temperature stability. On setting up the stages again, grey scale mercifully remained stable.

Next to be tackled was the vertical missing band of colour down the side of the picture. Putting an oscilloscope on the input to the decoder panel showed a healthy colour signal

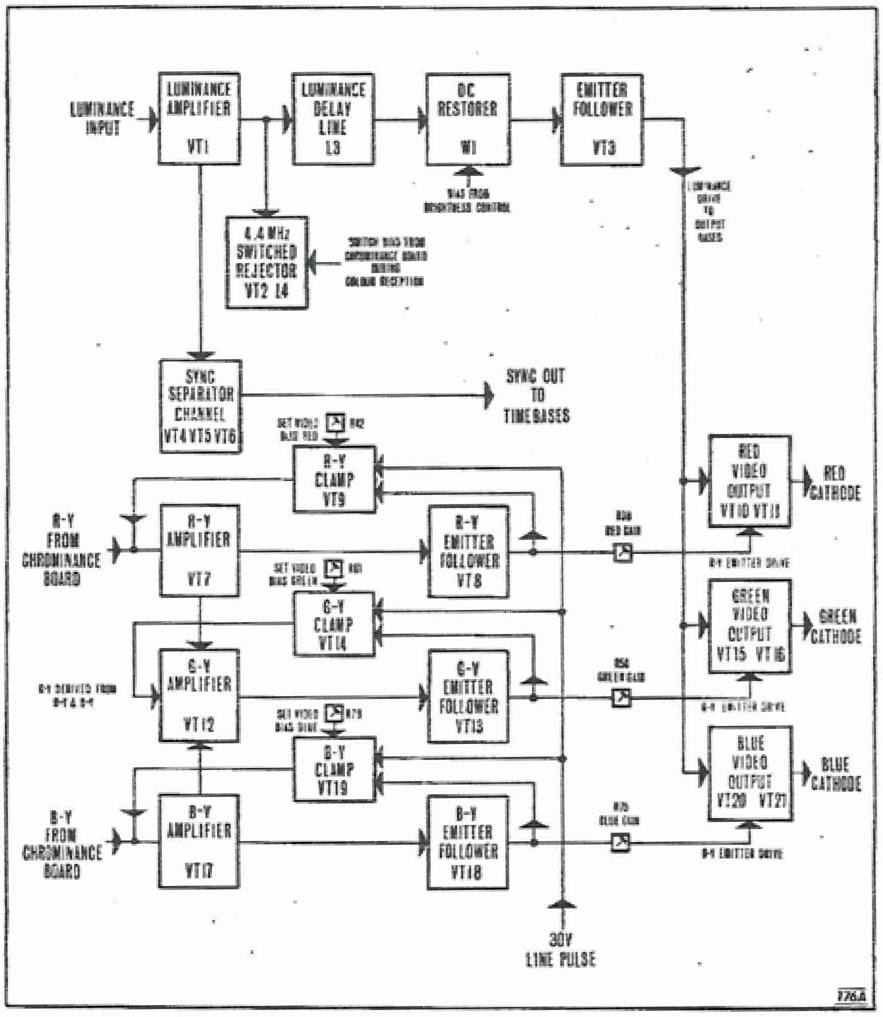
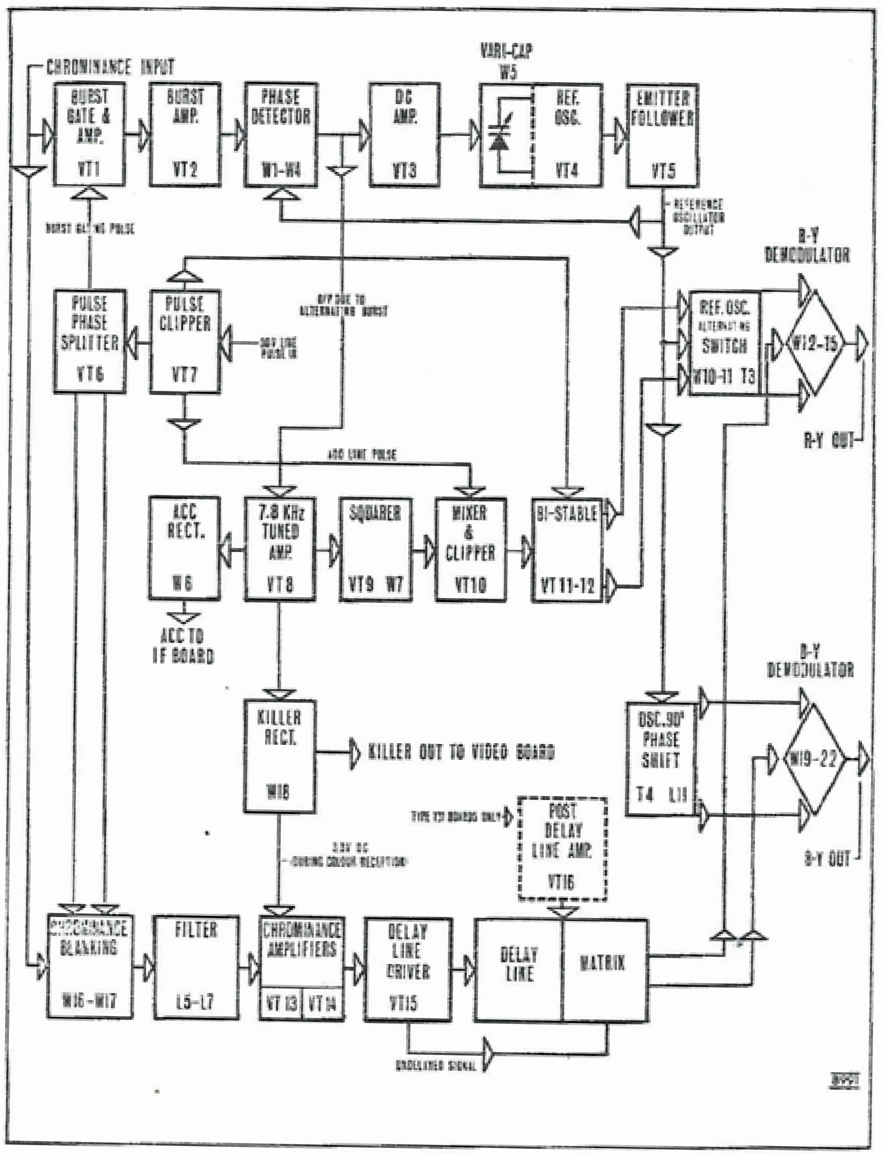


Fig. 4, A block diagram of the RGB output stages.

up to the chrominance blanking circuit. After that the chrominance could be seen to be distinctly compressed for part of each scan. The purpose of the blanking circuit is simply to switch off the chrominance channel during the line flyback period when colour burst is present which would otherwise be visible on the picture. See decoder block diagram (Fig. 6). Changing various components in the blanking circuit made no difference. The blanking action depends on a line pulse from the line timebase panel. I eventually discovered, in the depths of the service manual, that the fault was due to an incompatibility between earlier versions of the line panel and later versions of the decoder panel . Following the recommended modification of adding a resistor to a pulse shaping network on the Line board completely cured the fault.

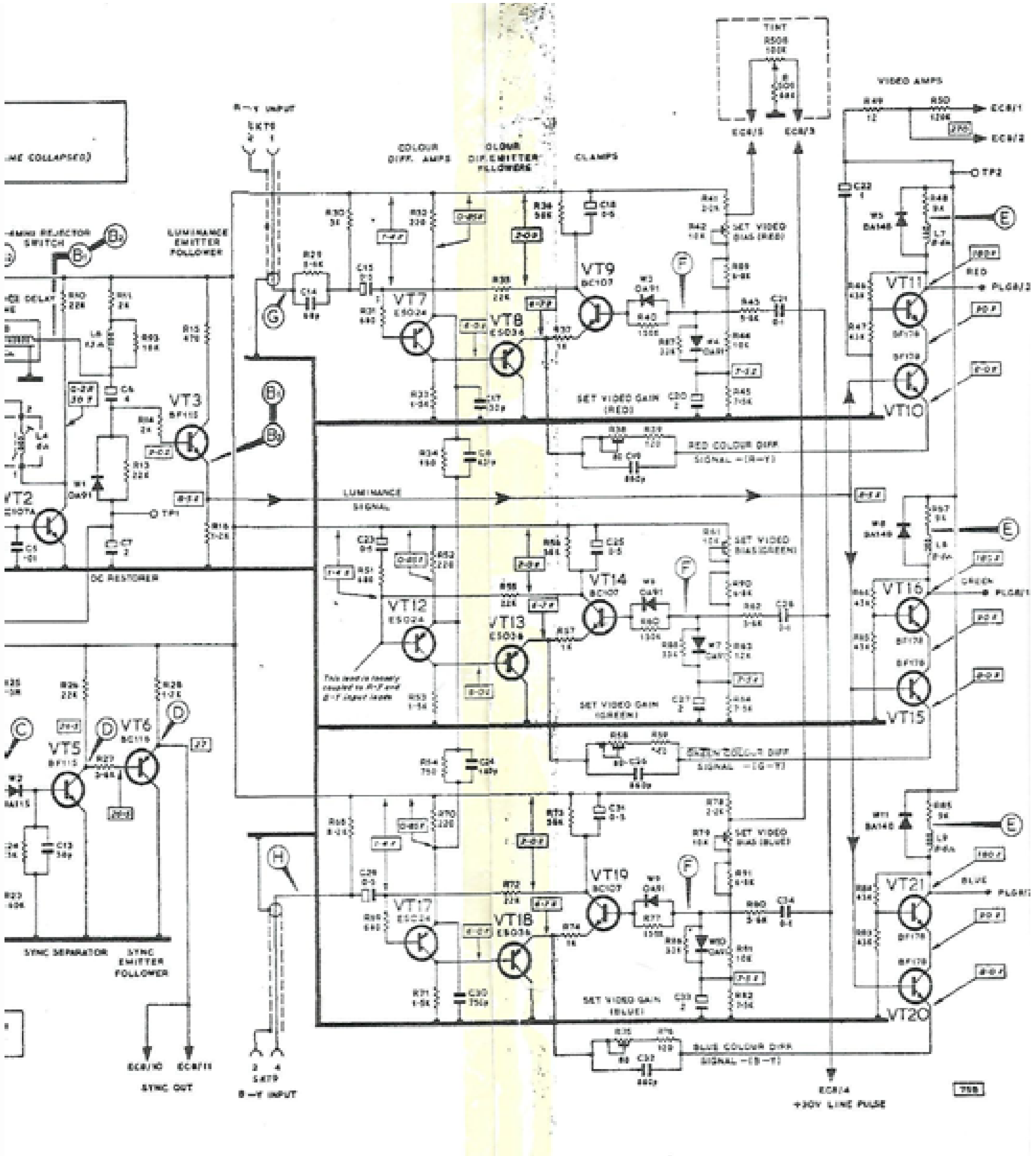
It was all plodding along nicely, then suddenly - no picture! A quick check on the power supply regulator panel showed virtually no voltage to the line timebase. The regulator incorporates a protective electronic 'trip' which shuts down the power supply almost instantaneously in the event of excess current being drawn by the line stage (Fig. 7). A few voltage checks showed that this was in the 'tripped' state. A resistance check across the feed to the line panel showed about right. This meant a fault condition loading the stage only when it was producing output pulses. This could be one of the line transformers themselves (unusual on the 2000). It was more likely that there was an overload on one of the many outputs of the line stage feeding other parts of the receiver. Everyone has their preferences for tackling this sort of fault. Simply overriding the trip protection so you can measure voltages is not a good option unless you want to risk doing a lot of damage very quickly. A less risky alternative is to gradually wind up a voltage from a variable power supply, taking circuit measurements as you go. but this is not entirely risk free either. My method is to start by resistance checks across all the diodes which rectify pulses from the line transformers, and also checking for low resistance across their respective reservoir capacitors. I hit gold

Circuit Description



Simplified Block Schematic of Chrominance Circuit Types 131 and 231

Fig. 6, Colour decoder block diagram.



Video TYPE 235

Fig. 5, The RGB colour output stages- all three are identical.

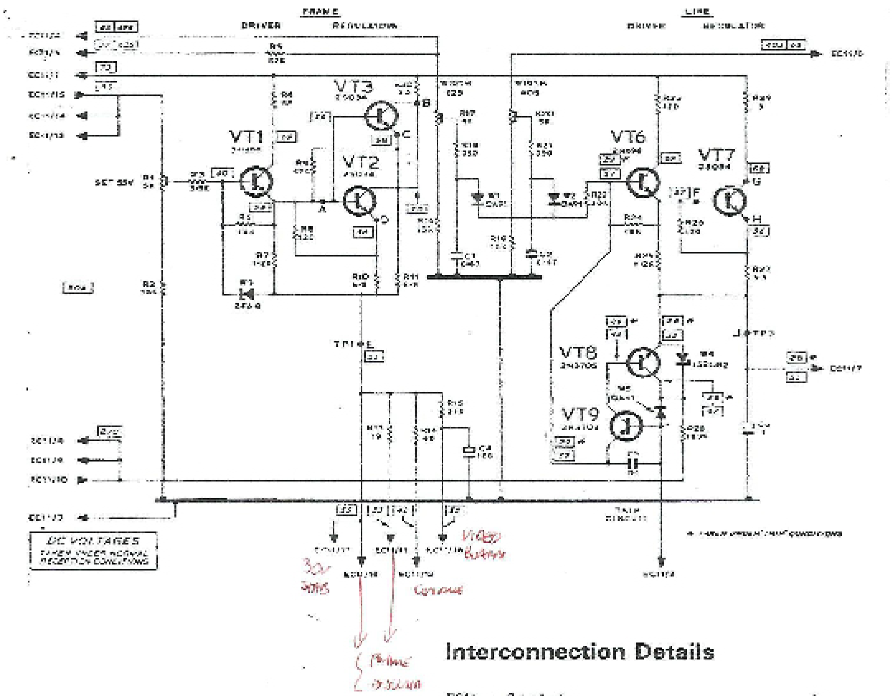


Fig. 7, Circuit of the electronic trip. VT6 drives the series regulator VT7. In the event of an overload , excess voltage drop will occur across R27, This triggers the VT8/9 circuit into a locked 'on' state, removing the voltage on VT6 emitter and shutting down VT7. Re-setting VT8/9 requires turning the power off and on again.

Interconnection Details

EC14—on flying leads

1 Power Supply EC10/13
2 not used
3 Chassis earth
4 Line Timebase EC5/15
5 Power Supply EC10/16
6 Line Timebase EC5/12
7 Line Timebase EC5/5
8 Video EC8/2
9 Frame and Sound EC6/7
10 Power Supply EC10/4
11 Frame Timebase and Sound EC6/15
12 Convergence EC7C/11, then via switch to Frame Timebase and Sound EC6/3
13 PLG19 on Focus Panel, then to EHT Generator PLG13/1
14 Line Timebase EC5/13
15 Power Supply EC10/7
16 Video EC8/12
17 Power Supply EC10/5
18 Frame Timebase and Sound EC6/10

Power Supply Regulator

Fig 8, An off-air colour picture via digibox

almost immediately with the diode which generates the 1KV supply for the above mentioned tube anodes. The diode was ok, but its reservoir capacitor (paper type!) was dead short. Replacing it solved the problem.

The only major piece of electronic work to complete was an overhaul of the tuner. This is a six push button integrated UHF/VHF type. The unit tunes by means of a five gang tuning capacitor, different sections of which are switched in and out by a three position slider switch (VHF-Band 1/VHF-Band 3/ UHF). The slider also switches in and out wound inductors to tune between the Band1/3 on VHF. A common RF amplifier stage is used for both VHF and UHF, with separate oscillators switched in between UHF and VHF. A mechanical push button unit screwed on the front of the tuner turns the tuning gangs to whatever position has been pre-set by turning an individual button. Another part of the mechanism moves the band change slide switch to one of its three positions. A micro switch on the tuner case is linked to the band switch and operates solenoids on the line, IF and convergence panels to switch the rest of the receiver circuitry between 625 and 405 lines as required. All six buttons are pre-settable to any frequency/band. Quite a few manufacturers incorporated integrated VHF/UHF tuners on both colour and monochrome dual standard sets. Many of them were a disaster. The biggest problem usually was rapid wear on the cheap plastic and soft metal mechanisms. This in turn led to poor mechanical accuracy when changing channels, and a need to retune frequently. The Thorn unit is mercifully quite robust and doesn't usually suffer from this problem. Sometimes a transistor will fail, but its main bugbear rests on Thorn's liberal use of a grease (silicon?) on the separate clips which earth each gang of the tuning rota individually to the tuner case. There are five in all. Over time the grease picks up dirt and hardens, resulting in intermittent poor earthing of the tuner gang. The only certain cure is to unsolder each spring with a high wattage, iron, remove all the grease with Isopropyl alcohol and re-assemble. Needless to say, great care must be taken not to disturb any of the capacitor vanes which have been precision bent into shape when the tuner was aligned by the manufacturer. Completing the job involved removing similar grease from the slide switch, reassembling, lightly oiling the mechanism and fabricating a paxolin aerial socket panel to replace the missing one. The tuner now performed reliably.

The rest of the restoration was mainly adjustment, and occasional replacement, of the numerous internal preset controls. Including convergence controls there are over fifty in all! There was little to do cosmetically. The cabinet is in good condition. In fact the only thing that needs attending to is cracks in the corner of the plastic screen surround. I intend to fill those with Isopon, sand down and re-spray with aerosol silver one day.

Electronic restoration of this set was not technically complicated. There is just a lot of it to go wrong! Had there been serious mis-alignment in the IF stages that would have been another story. Getting the correct bandwidth response is very tricky, even with good test equipment. I reckon the picture quality of this design is about average for the period. I rate it considerably above its Pye and Bush contemporaries, but it doesn't live up to the Phillips G6. One of the things that rather lets it down is its use of mean level video AGC. This works by averaging picture content to determine signal strength and produce the AGC control voltage. If you adjust the contrast to be correct for highly contrasted scenes such as studio shots, the picture will look washy on outdoor shots or sports shots. Gated AGC where the gain control is dependent on the black level of the picture eliminates this problem. Still, all in all, it was an amazing bit of domestic kit for 1967!

Dear Editor

Thank you for the letters published in the last few issues. It's been really interesting to read your responses regarding the 'BVWS name change' debate. Please keep your views coming in (by email is fine), they are all being duly noted. Let's keep this discussion going for the rest of this year, we'd still like more input and opinions from you, then the committee can make a decision next year as to the way forwards…

Regards,

Greg Hewitt,

BWVS Committee Chairman

Dear Editor

I see no point in wasting time in considering changing the name of the Bulletin or the name of the organisation. It would be just a name change. BVWS members know what the organisation stands for and what it provides. I don't believe a name change would attract new and/or younger members. We have to think of some other way to attract new members.

I agree with the suggestion in the letter (Bulletin Vol 42 Winter 2017) by Ian Liston-Smith that it may be worth recycling selected articles from earlier editions.

I came across an early Bulletin the other day and found a very interesting article spread over three editions (Vol 19 Nos 1-3). It was titled

Super-inductance, and all that

Early days with Philips at Mitcham Works.

by Carl Van der Meulen

and tells a story of someone who worked as a fault finder for the Philips 830 in 1932. Maybe this could be reproduced in future editions if you are short of material.

This led me to the BVWS CD titled "BVWS Bulletin: the first twenty years" in order to get the entire article. Isn't it time we received one for the second 20 years or maybe the first forty years. The bulletin is much fatter than it used to be and of course the photos are very superior to what we got in the earlier editions. Maybe it would have to be on a DVD as opposed to a CD.

Well there you are. A few thoughts for the future.

Regards,

Richard Stow

Dear Editor

Many thanks for the latest Bulletin which arrived today and contains some interesting articles this time.

I would like to make a contribution to the "wireless v radio" debate as invited in your recent editorial and further to the letters already published.

When I was first getting interested in the subject as a hobby at the beginning of the 70s, the terms were used interchangeably. But the people who referred to a "wireless" usually did so in a rather dismissive and patronising way and such people would also refer to table tennis (which I pursued in my youth before taking up darts) as "ping pong". As I considered my hobby as a serious pursuit and not as a dumbed down distraction I became, and still am, a supporter of the "radio" camp.

Recent events within IT and especially the use of the term "wireless" in connection with the internet, for example, have given support to my view in an unexpected way. Wireless is, I believe, a term most accurately reserved for a process which occurs outside of the receiving set whether it be radio or PC and therefore applying this argument logically it is no more correct to refer to a radio as a wireless because it receives "wireless" transmissions than referring to a computer as a wireless because it can receive internet transmissions wirelessly.

Convincing people with long held views based largely on historical perceptions is of course another matter altogether. As a historian I know that policy is often determined on historical precedent by people who have grown up when it was current rather than historical, and as they are usually people of more senior age and experience the risk of losing their support and experience is often considered too high even if the reasons for change are otherwise overwhelming. I suspect that you may be faced with a comparable situation and with a group of members declining in number but great in experience and commitment suggesting that their continuing support is dependent on things remaining as they want. The older you get the more resistant to change you tend to become.

The decision that the Committee has to face therefore is to ask the question is it really "not broke" as some members claim and does it need to be "fixed" at this point, or can it be put off longer until such members who strongly oppose any change are so few in number that losing their support is considered a worthwhile risk in comparison to the survival of the society going forward. I regret that I do not have an answer to this as I do not know how strong the opposition to change is and where it comes from. Maybe letters and opinions received since the debate was initiated give an answer to this.

As to what the renamed society should be, well as a historian who is interested in broadcasting and popular entertainment in the 20th century, could the interest of many members in vintage television be included as an addition to radio and maybe even other vintage equipment?

In the meantime and as an immediate change I would ask the editorial board of the BVWS bulletin to respect individual members' wishes and if they write in referring to radio then use that term when published and if they refer to wireless then use that term when published. This is obviously a controversial and divisive issue, one of the reasons I stopped writing letters for publication to the Bulletin was that the previous editorial board (they know who they are!) persistently edited my letters for stylistic reasons changing my references from radio to wireless and other changes which meant that my letters did not sound like me anymore and were frankly embarrassing and annoying to read as published, I trust that this no longer happens.

As someone who worked in an industry for over 25 years where proof reading and editing was a part of my job then I feel that changes can legitimately be made for editorial reasons on grounds of factual inaccuracy, libel or grammatical error but not simply because the editor or sub editor does not approve of the style in which it is written.

The future belongs to the next generation whether we like it or not, and rather than being required to accept existing policies simply for historical reasons which may have no relevance to them, I fear that they will be discouraged from participating and vote with their feet instead until the society eventually diminishes to a position of irrelevance. There are any number of examples that can be given of words which alter in meaning with the passage of time, "wireless" is one of them.

Best regards,

Del Burgess

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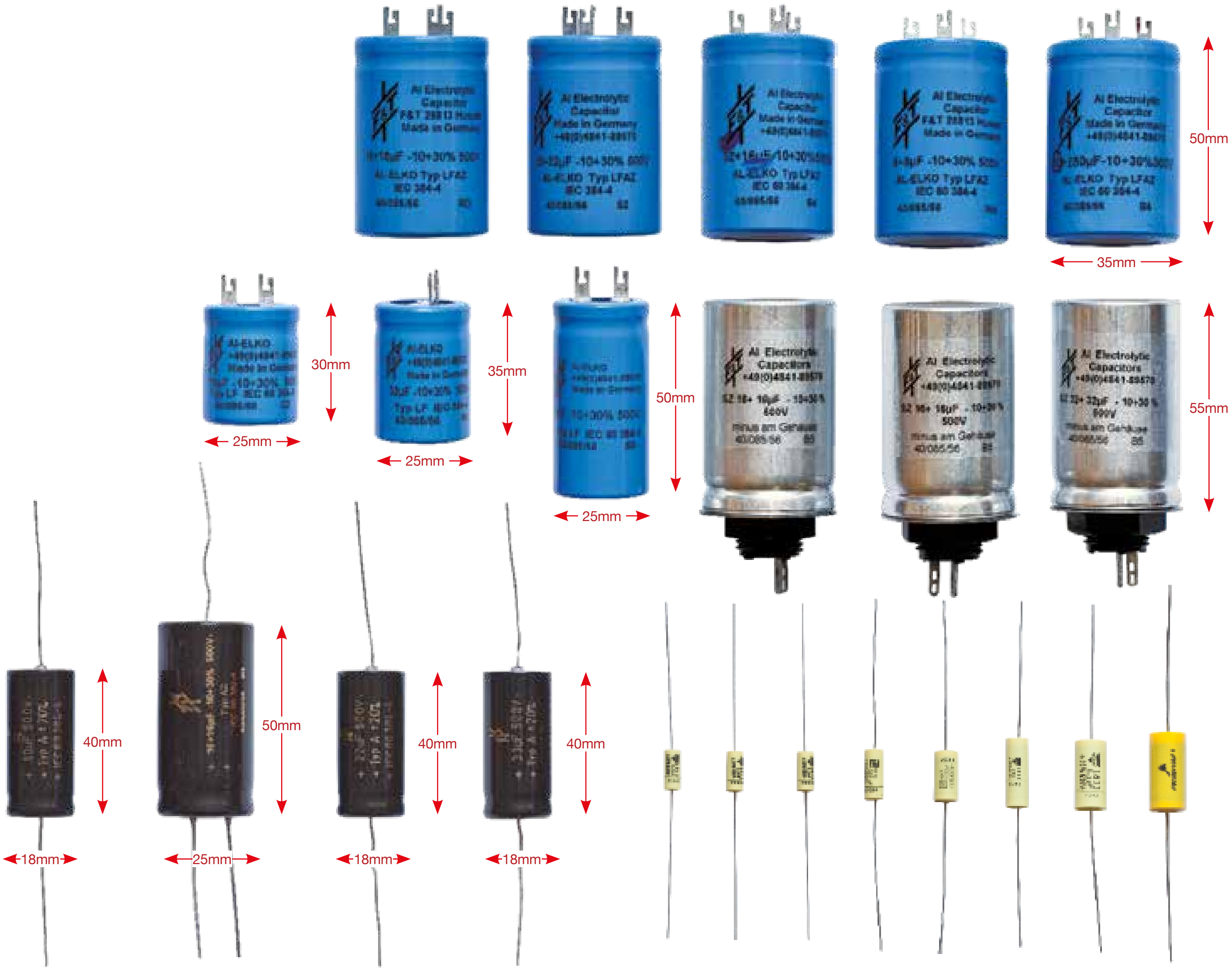

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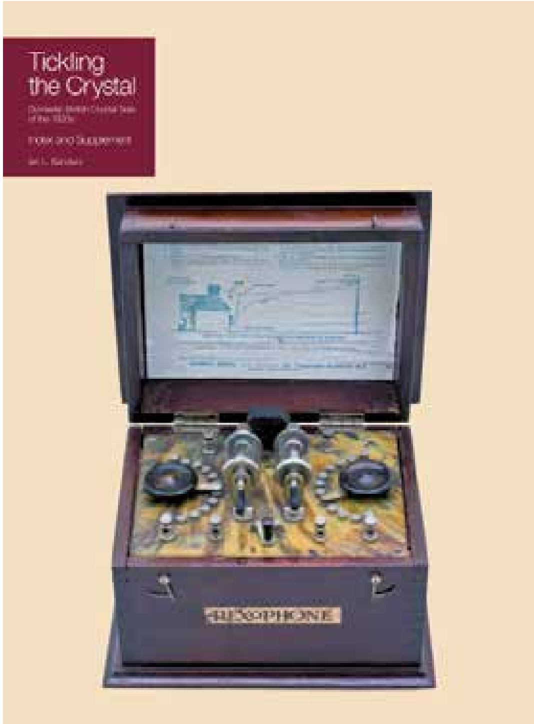

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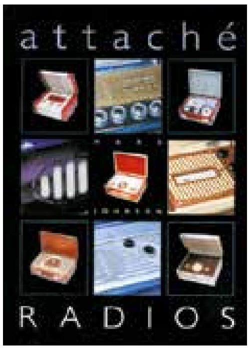

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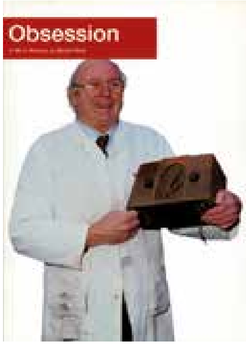

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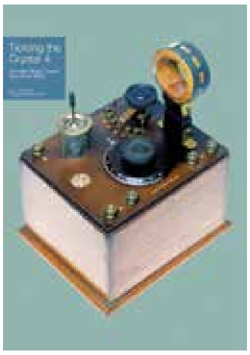

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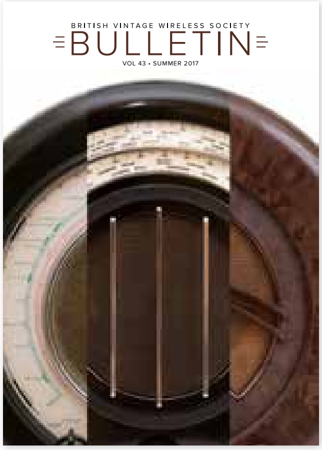

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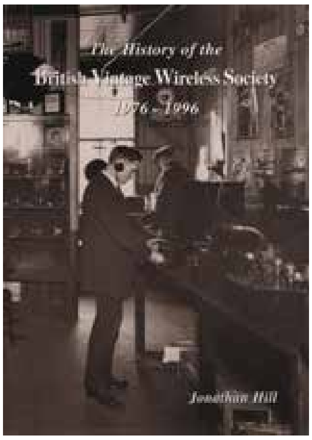

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Contact Vic Williamson 07805 213369

8th April 2018
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Golborne Parkside Sports & Community Club, Rivington Avenue, Golborne, Warrington. WA3 3HG
Contact Mark Ryding 07861 234364

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Contact editor_bulletin@bvws.org.uk for more infomration.

Events Diary

2018 Meetings

11th March Harpenden
25th March BVW&TVM Tabletop Sale
8th April Golborne
13th May NVCF
8th July Royal Wootton Bassett
5th August Punnetts Town
9th September Murphy Day
23rd September Harpenden
7th October Audiojumble
11th November Golborne
9th December Royal Wootton Bassett

GPO Numbers
Martyn Bennett is the custodian of the BVWS GPO Registration Numbers list. As many members know, the project of assembling this list was started in the early days of the BVWS and was carried on by the late Pat Leggatt. Members are strongly urged to help build the list, whenever they get the opportunity, particularly as it is something that will help with the identification of vintage wireless in years to come. The list is by no means complete and the GPO no longer have a record of the numbers granted to wireless manufacturers. The BVWS Handbook contains the current listings - one in numerical order and one ordered by name. Please let Martyn have any additions, or suggestions for corrections, by mail or over the phone.
Martyn Bennett, 58 Church Road, Fleet, Hampshire GU51 4LY
telephone: 01252-613660 e-mail: martyb@globalnet.co.uk

The British Vintage Wireless and Television Museum:
23 Rosendale Road, West Dulwich, London SE21 8DS
020 8670 3667
Harpenden: Harpenden Public Halls, Southdown Rd. Harpenden.
Doors open at 9:30, tickets for sale from 09:00, Auction at 13:00.
Contact Vic Williamson, 01582 593102
Audiojumble: The Angel Leisure Centre, Tonbridge, Kent.
Enquiries, 07873 862031 info@audiojumble.co.uk
NVCF: National Vintage Communications Fair
For more information visit: www.nvcf.co.uk
Royal Wootton Bassett: The Memorial Hall, Station Rd.
Wootton Bassett. Nr. Swindon (J16/M4). Doors open 10:00.
Contact Mike Barker, 01380 860787
Golborne: Golborne Parkside Sports & Community Club.
Rivington Avenue, Golborne, Warrington. WA3 3HG
contact Mark Ryding 07861 234364
Punnetts Town: Punnetts Town Village Hall, Heathfield,
East Sussex TN21 9DS (opposite school)
Contact John Howes 01435 830736
Mill Green Museum: Bush Hall Lane, Mill Green, Hatfield, AL9 5PD

For more details with maps to locations see the BVWS Website:
www.bvws.org.uk/events/locations.htm

8th July 2018
Auction & Swapmeet, Royal Wootton Bassett

Royal Wootton Bassett: The Memorial Hall, Station Rd,
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