BVWS bulletin

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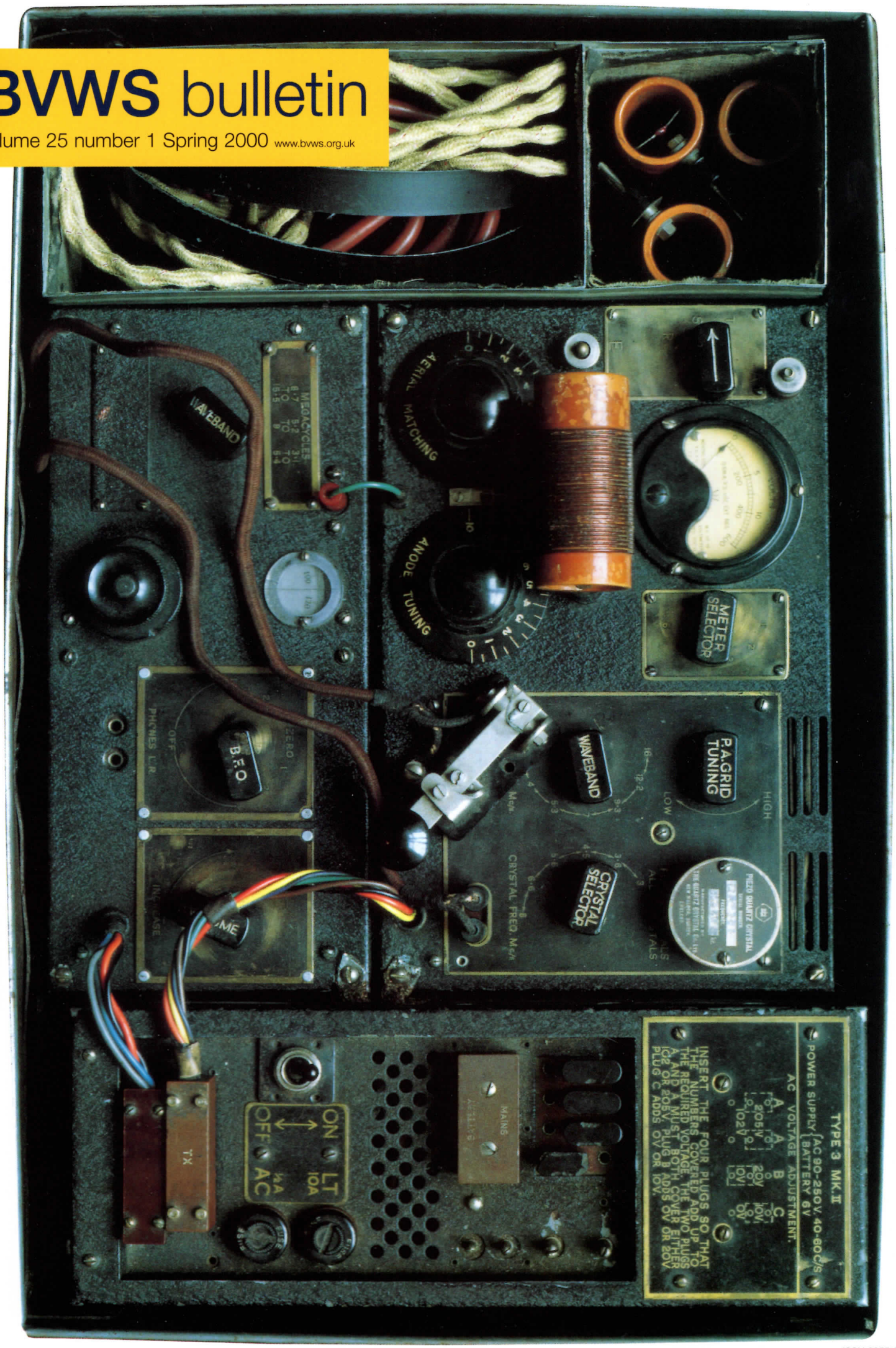

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From the chair

Bulletin of the British Vintage Wireless Society
Volume 25 No.1 Spring 2000

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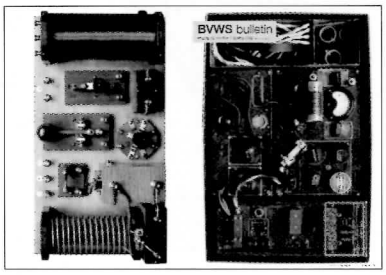
Separations by Cutting Edge
Printed by Apollo

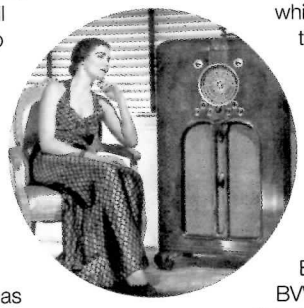


Front and rear cover: WWII spy set and mint condition Gamages set.

Front and rear cover photography by Carl Glover
Graphic Design by Carl Glover

This issue Edited by Rob Chesters and Carl Glover. Proofreading by Mike Barker, Ian Higginbottom and David Read

Lets start the new Bulletin year off with some good news! After another appeal at Harpenden, we have a new Membership Secretary. Steve Pendleburry and his wife, will be taking over the role from the beginning of April. Whilst finding his feet, which I know from our discussions will not take long at all, I would ask you to help him in every way when contacting him, and be patient when seeking a reply. Steve, who has a Vintage TV website (http://welcome.to/oldtellys) is very capable and professional and I know he will do an excellent job!



With the Christmas issue, we entered into a new venture with the Trader Service sheet CD-ROM. This has been widely acknowledged by you, the members as the best Bulletin supplement you could remember. I have been overwhelmed by the number of letters and phone calls in support and asking for more. I even had one member write to tell me he had purchased a new PC and laser printer after a friend had shown him what was on the CD. And to show that it's never too late to use new technology, even in a Society like ours, a member of 86 years sent me an email, after getting a new PC and hooking up to the internet to tell me he was busily reading through the Trader sheets which brought back so many memories of the sets he had worked with and repaired. Many ideas have been suggested for content, but we have decided that for this year we will supply another which will cover the rest of the Vintage Trader Service sheets. One CD a year is about all we can handle right now, but the plans are for more next year and maybe create a complete library of manufacturers Service data. Unfortunately, some of the production run of the CD-ROM's have imperfections in the lacquer which causes problems when reading the disc. If you find that your CD does not work, please send it back to me and I will supply a tested copy. For Mac users who have experienced problems, we have found that opening the PDF files directly has worked on all the different Macs we have access to.

To further our relationship with ERT (Electrical & Radio Trader) the BVWS will be showing a small number of Radios at the ERT Show from March 26th to 28th at the NEC. A Marconi V2 with Sterling horn and headphones, a Pye Model G, a Murphy A122M and a Pam 710 will be in the Evolution Zone. Various BVWS publications and period advertising will also be shown. These show the development of the 'Domestic' radio within the space available. My thanks go to the members approached to help with this display.

The Pat Leggatt Award, for most popular Bulletin article of 1999 was presented to Mike Izicky for his article on the Mc Michael 382 restoration. An article with plenty of interesting facts, photos and heaps of Mikes special wit. Well Done!

Lastly my thanks go to all of those members who sent their renewals in promptly. It made a big difference.

Mike Barker

New Editor

Some of you may already be aware of me through my interest in collecting Ekcos; but I am now going to be "Y'know, the one who edits The Bulletin?". I am extremely pleased to be taking on the job and this is no doubt due to the help and support that I have already received from the outgoing editor who has graciously met me at railway stations when I started helping out last year. With luck I shall be able to maintain and perhaps even improve upon the high standards that Carl has already attained.

This means that the Bulletin will need contents. If you have any queries or articles that you feel could advance the debate about, or the understanding of vintage wireless and would like to submit them, I will be delighted to publish your contributions. Who knows, the world might learn something from you. Over the next year it is my intention to introduce a few regular features; the first being "The Second-Hand Book Review". So, should you have read a book that is 2nd hand and you think that members might benefit from reading it, then compose a review and send it in. Please get writing; the journal of the BVWS is only as good as its membership and at the moment it reflects them in a very favourable light.

It only remains for me to thank you all for showing confidence in me enough not to vote against me. Thank you.

Ex-Editor Speaks!

Due to work pressures, fatherhood and a yearning for a good nights sleep, I am passing the mantle of Bulletin Editor to the capable hands of Robert Chesters. Over the last five years we have seen the Bulletin grow from sixteen pages to an occasional forty eight. It is a long throw from the days of the emergency committee back in 1995, when I had to meet Gordon Bussey at London Bridge train station and put together my first Bulletin in one day flat. It takes a lot longer now, though I must admit that the advent of email has made things easier.

My involvement with the production of the Bulletin will still continue as I will be responsible for the design (my humble trade). I will also be looking after the mechanics of print and production so that the Bulletin appears on your doorsteps on time.

I would like to thank all those that I have met and had dealings with regarding the Bulletin and also to wish Robert as much enjoyment as I have had in the last five years. This issue has been a joint endeavour but you will see more of Robert's hand in Bulletins to come.

Contents

Rare 'finds' to be shown at NVCF

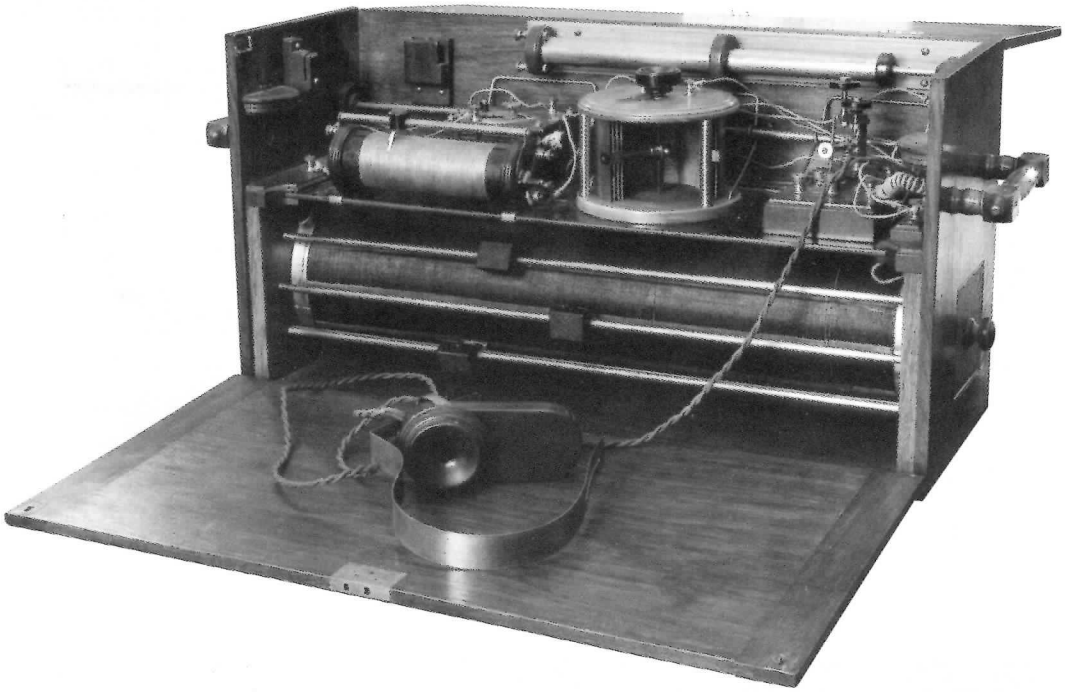
Right and lower right: 'Titanic' Set c.1910

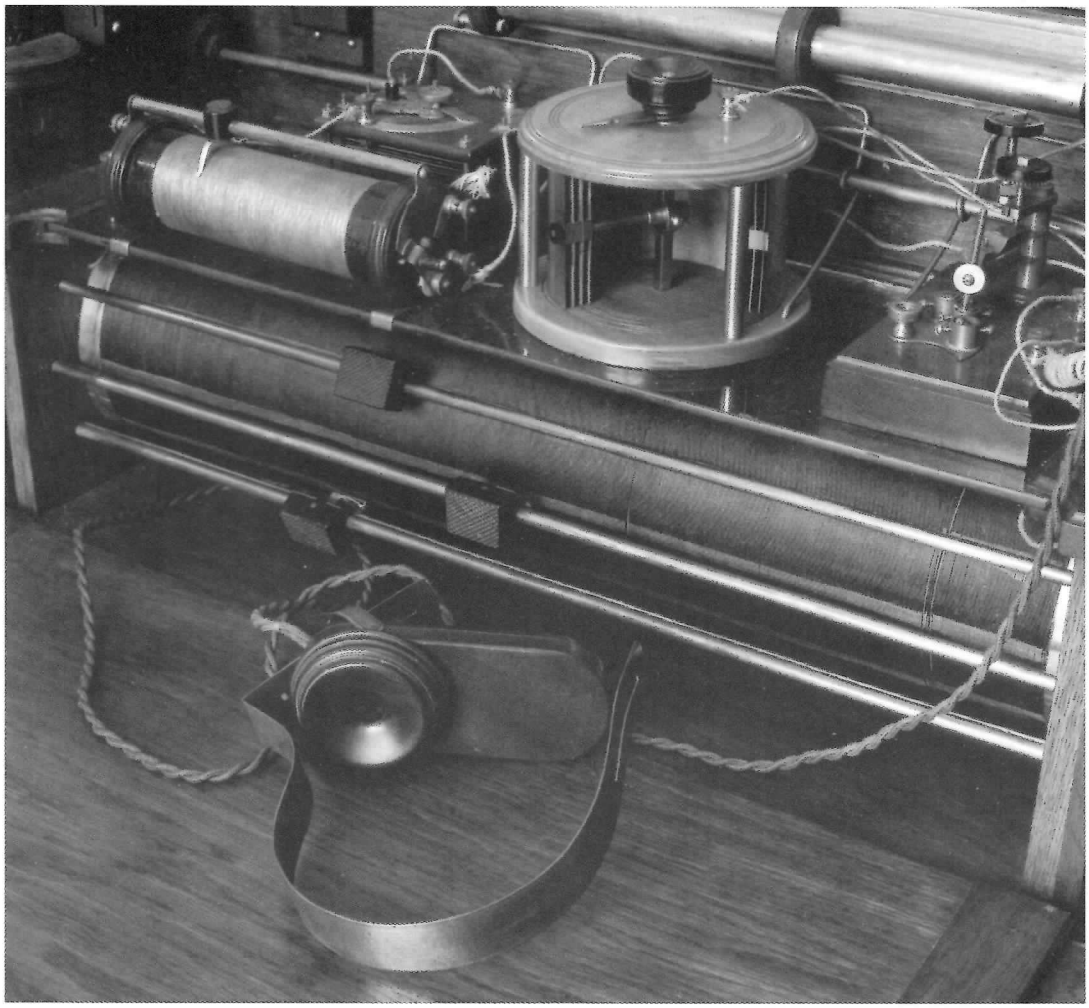
This unusual and beautifully-made Edwardian crystal receiver has recently been unearthed in the north of England, and has been acquired for a private (BVWS) collection. Early radios of the pre-WWI period are rare enough, but what makes this particular set especially unique is that its maker, Mr George Leadbetter, (a machine turner and clock repairer then living in Ledbury, Worcestershire) while listening-in on the set's earphone on the morning of Monday 15th April 1912, claimed to have heard the sinking Titanic's CQD/SOS Morse distress signals. Unfortunately, having run round to the local police station to tell the sergeant what he had heard, he was turned away, none of the police officers on duty believing what he had to say!

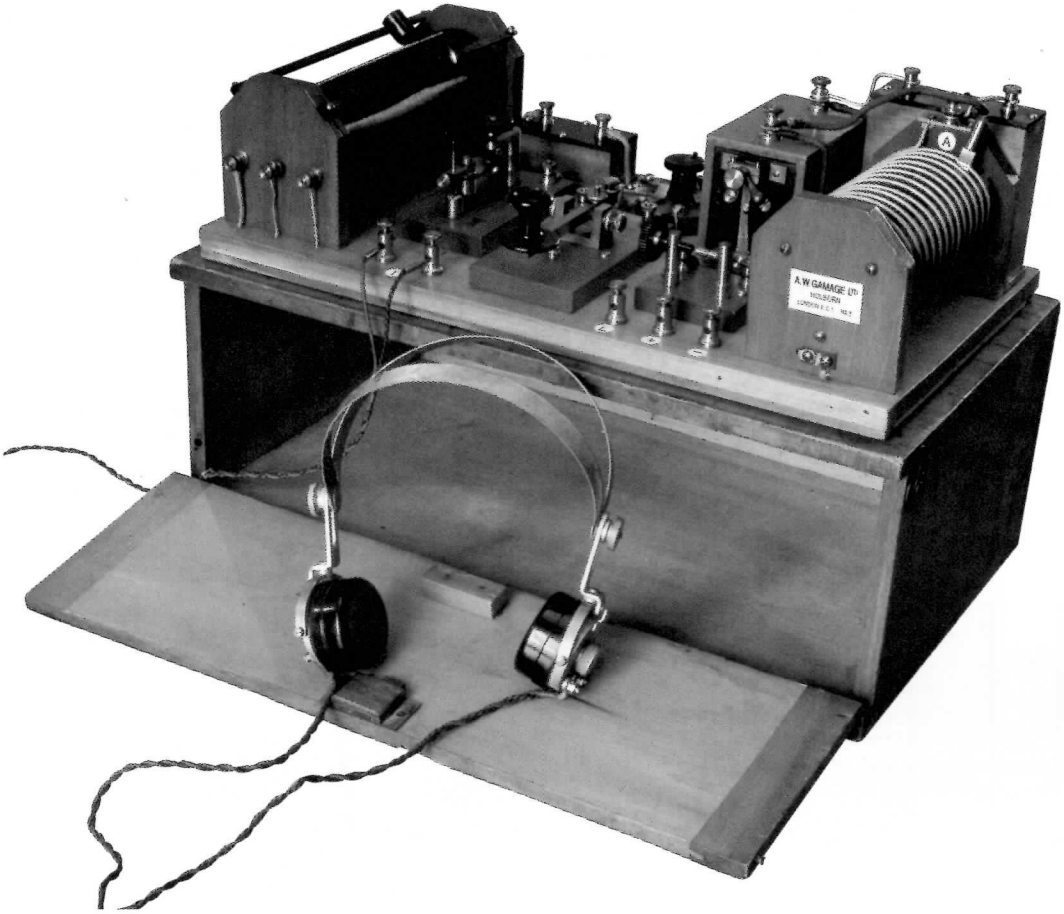
It would be difficult to know what help Mr Leadbetter's news could have been had he been believed (the Titanic was some 3,000 miles away across the other side of the Atlantic), but help was nearby and the distress signals were picked up by ships close at hand, resulting in the rescue of over 700 passengers and crew. Such a pivotal role did wireless play in saving many hundreds of lives onboard the stricken ship that its value was dramatically demonstrated and acknowledged around the world.

Exquisitely-engineered and housed in a mahogany case measuring some 2 feet long x 14" x 9" and weighing 42 lb [18 kg], the crystal set is the only surviving radio receiver purported to have heard the distress cries from the Titanic - a fantastic relic from this most famous of historic disasters.

It will be on show in pride of place at the next National Vintage Communications Fair which will be held at the NEC in Birmingham on Sunday 30th April 2000. Other exhibition items on show at the fair will be a comprehensive collection of WWII spy radios, the Horophone time-signal receiver (another unique Edwardian radio), and a display depicting the history of recorded sound.

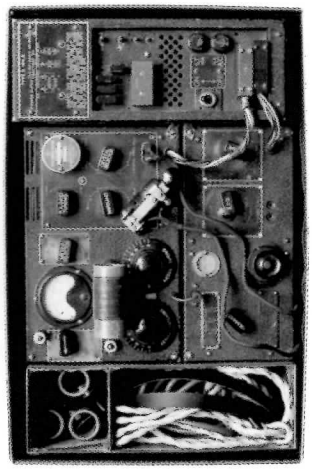


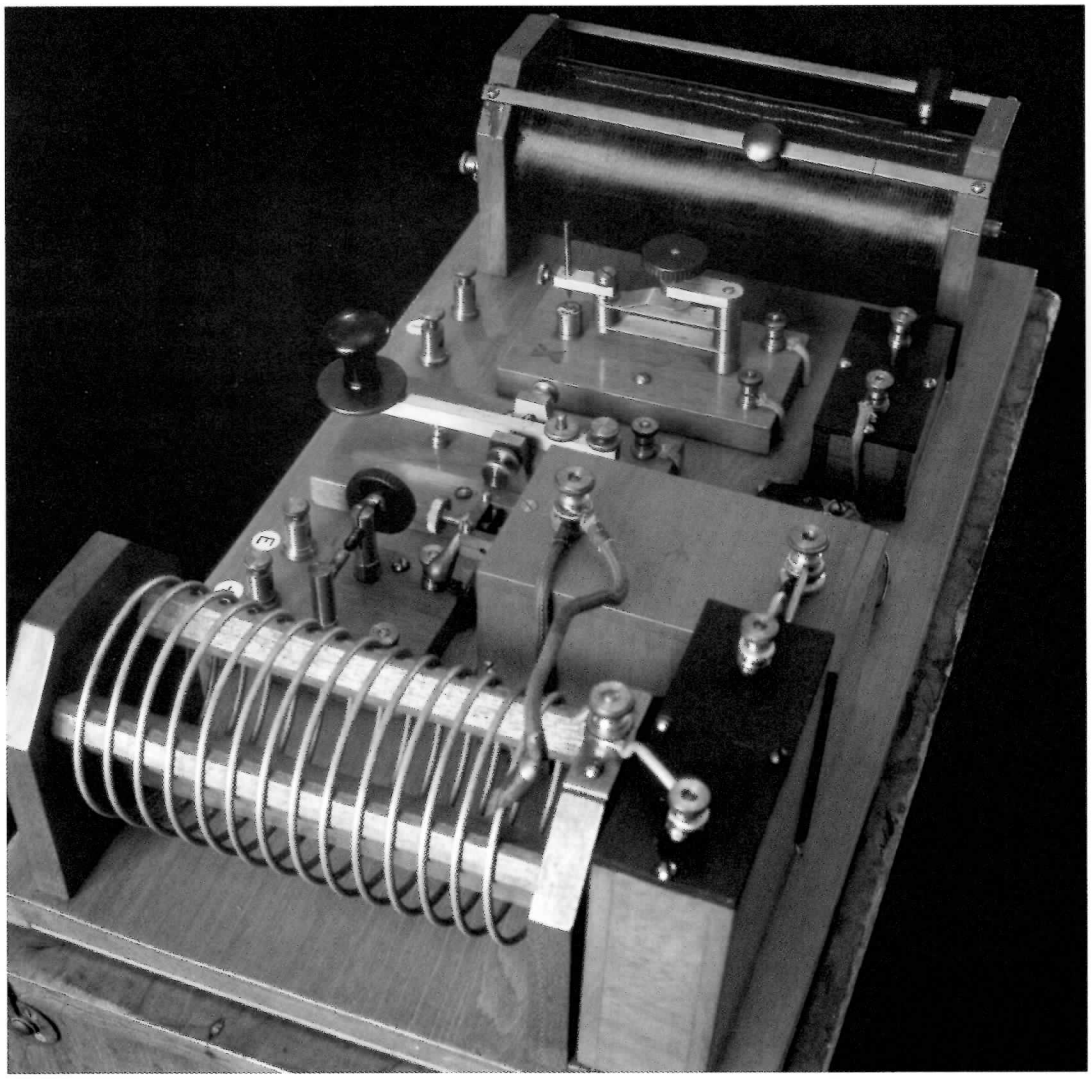




Left and below left: Gamages Transmitting/Receiving Station, No:3, c.1910/12

This set, when discovered recently, was still in its original mahogany transit case, and this must have protected it over the best part of a century from deterioration - the various components, coils, spark gap and Morse key etc. were in fantastic near-mint condition with little, if any, sign of use. It was one of a number of wireless stations sold by Gamages of Holborn for the amateur radio market in pre-WWI years. Transmitting range, 8-12 miles, receiving range 300 miles, original price £18.10s.0d (£18.25p). Used with a pair of Brown's Type 'A' headphones (patented 1910).





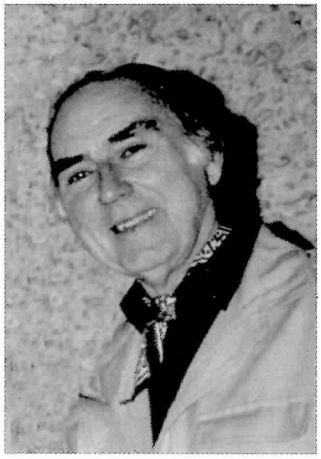
Above: WWII transmitter/receiver Type 3, Mark 2 ('B2') - designed by Major John Brown.

A very early production model of this famous S.O.E. spy set (note the circular control knobs for aerial matching and anode tuning as opposed to the later, and more common, rectangular shaped ones), actually used in the field by Partisans in Yugoslavia during the war. Complete with original coils, crystals, Morse key and headphones and housed in the original "3-catch" suitcase - the whole ensemble weighing an unwieldy 32 lb (13.2kgs) - a weight which must have been extremely difficult to disguise when walking around the streets.

I first met Ralph Barrett at Gerry Wells' BVWS Garden Party in 1999. Having found the only empty table I left my wife guarding our excellent lunch and wandered across to the bar. When I returned I found the table fully occupied by Ralph, Peter Brunning and his wife, Daphne, along with John Bailey. As I approached the table bearing our drinks my wife gave me the slightly quizzical look that most wives give husbands from time to time. This can mean anything from, what on earth are you wearing those trousers with that jacket for to, in this case, who are these people? Should I really be here? Within seconds, the answer to the latter question was answered.

Profile of a busy man

an Interview with Ralph Barrett by John Holloway



Having introduced ourselves, laughter and the revelation of extraordinary coincidences in our various lives were the main activities of the next few hours. The laughter was generally sparked off by a man with a jolly face and twinkling eyes set under bushy eyebrows topped by a Breton Cap who turned out to be the subject of this article. However, our other companions turned out to be just as interesting. Peter Brunning, who worked at EMI and the Inner London Education Studios at Battersea and wonder of wonders John Bailey, or Bill as he is known to some, who was at Alexandra Palace in 1938. To a person who had worked in television for some thirty years, I couldn't believe I was sitting next to someone from the very beginnings of broadcast television in this country.

We didn't win any of the raffles but as we drove home that afternoon, having had a really enjoyable day, the thought struck me that something ought to be done to preserve the memories of our newly acquired companions. We are all dedicated to preserving the artefacts of the golden age of wireless and television, but if it hadn't been for these people and others like them, the sets wouldn't have been designed and manufactured and the programmes wouldn't have been produced and transmitted. Today there are still people pioneering the development of new forms of broadcasting and communications. We may not always agree with the programmes but then neither did our grandfathers all those years ago.

Before we'd reached home I knew what I was going to do. In my work as a director, I've spent hours interviewing people. I would start interviewing some of the older members of the BVWS, starting with the three I had just met. An audio recording and typewritten transcript of the interview would be lodged with the Society and a profile of the member in question, based on the interview, could provide copy for the magazine. I wrote to Carl and soon received a call welcoming the idea. I then trotted off to see Gerry Wells to add a few more names to my initial list. I assembled some digital recording equipment with the help of another member, Bill Milne, who lives near to me in Wimbledon and one wet Thursday evening in early September I found myself in the lift ascending to Ralph Barrett's apartment on London's South Bank.

I was a little apprehensive about this first interview; people are often quite diffident about talking about themselves. I needn't have worried. He was waiting for me as the lift doors opened and quickly made me welcome. Although I had picked up a little foreknowledge of the man from our earlier conversation and from my chat with Gerry Wells, apart from Jonathan Hills' excellent History of the Society, I knew very little about the man. Once I had set up the microphones, one for each channel in order to make transcription easier, I asked him when and where he was born. His answer set the tone for the interview.

'I was born in the most important maternity hospital in the world. Guess where that is?'

'Queen Charlottes' I said. For once inspired.

'That's right' he said, 'hundreds of years ago'

He wouldn't tell me exactly when but after talking with him for about two hours I think I've worked it out to within a year or two. His early years were spent with his brother living in Chiswick but just after starting school, his father, who worked for the famous Hobbies company, was moved to Dereham in Norfolk to take over as Works Manager. According to Ralph, there was always radio equipment in the house. Initially his father had a crystal set. This was eventually replaced by a three-valve set with swinging coil reaction, driving a loudspeaker. Ralph immediately collared the crystal set, but within six months had taken it apart and so the beginnings of a life long interest combined with a career began. A Cossor Melody Maker donated by a friend followed sometime later, again to be cannibalised in the interest of ever more interesting and efficient reception. By the time the storm clouds were gathering over Europe Ralph's father was called upon to sign his amateur radio licence since he was still under age.

During this period the world of work beckoned. Ralph's first job was with Elliott Brothers in the measurement department but, following his growing interest in television he joined Baird Television who by that time were manufacturing 405 line models. Their factory was located in part of what remained of the Crystal Palace after the fire in 1936. The factory and laboratory where he worked was by the South Tower, and had originally been called The School of Arts in the 1851 exhibition. Ralph reminded me that in those days many manufacturers also made their own tubes. In the case of the Baird Company, the plant was housed in the building called The Rotunda. Twenty or so vacuum pumps for the CRTs were mounted around the walls of the building. During this time the short necked magnetic tube started to replace the electrostatic type allowing what we would recognise today as the more conventional front facing tube that is viewed directly.

As a very junior employee working as a Laboratory Assistant, he worked under Mr Bentley who, along with his counterparts in other companies, were solving the problems of technical design and manufacturing on their feet, so to speak. Ralph saw Mr Baird but had no idea of what to say to him and so, like all junior staff in those days, said nothing. I would bet that he would not be quite so shy today. Nor indeed would junior staff!

I asked Ralph what it was like working for a company like Baird.

'It was marvellous, because in those days you were what we would call a Jack of all Trades. You were pioneering and you did anything. I took Wireless World

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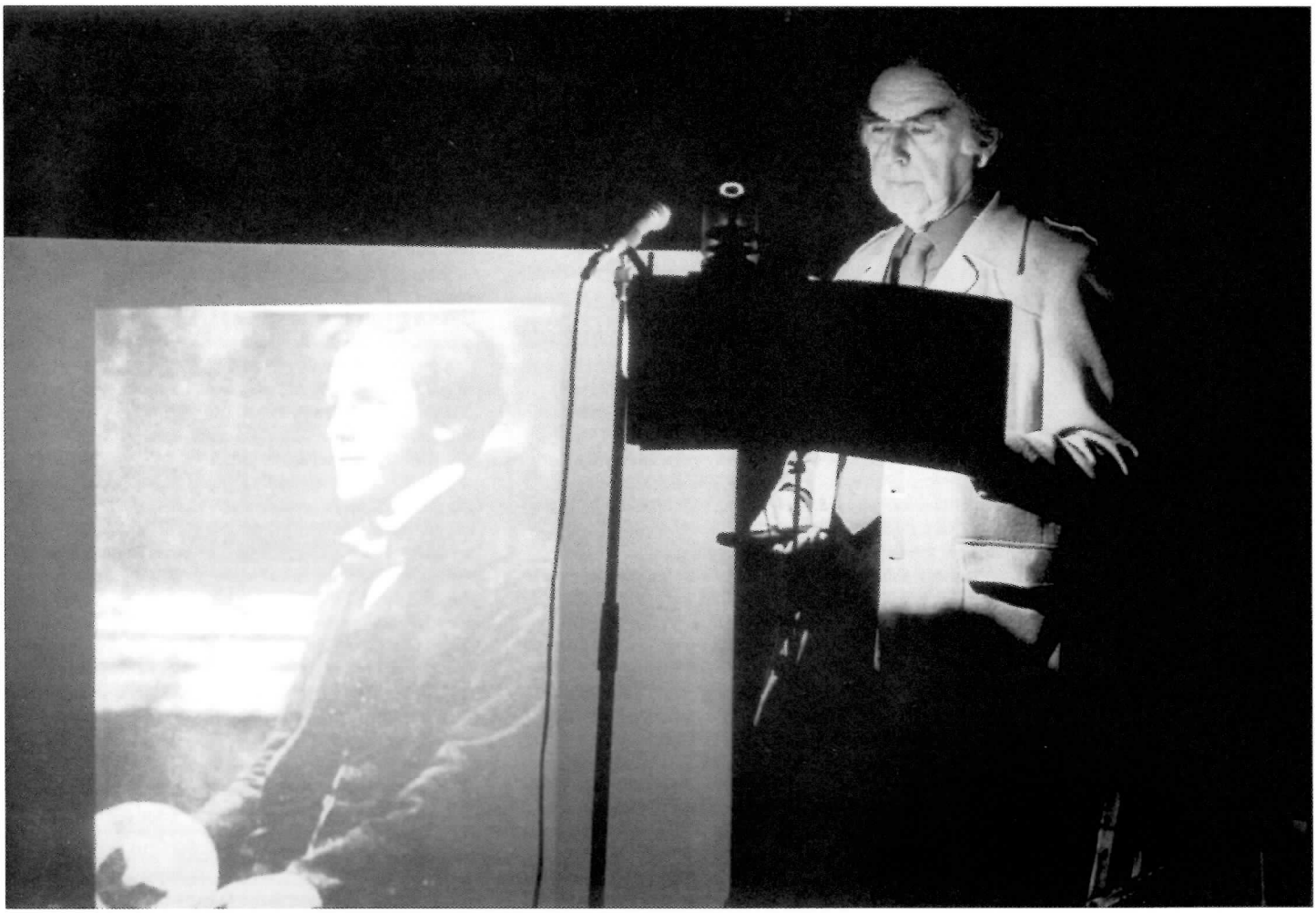

and read everything, like we all did'

It was about that time that he started a course in Radio and Electronics with ICS, the International Correspondence Schools. This was to be the foundation, along with professional qualifications, on which he was to build a substantial career in the years to come. But with the coming of war, the production lines at Baird were to stop producing television sets for the privileged few and in his mid to late teens, Ralph was out of a job.

As he put it 'I managed to get a job with the Post Office, and moved to a radio station near Rochester. It was a MUSA station. Multiple Unit Steerable Aerial made up of 16 rhombic aerials pointed toward Schenectady in America. The system would select the best downcoming ray from the Ionosphere. Three beams coming down, get them in the same phase, three were locked up. There would be no fading. A Diversity Receiver'

At that time just before the war the main purpose of the station was as a communications station for telephones linked to AT&T in the States. It also carried the programmes of a man soon to be overshadowed by Alistair Cooke, Raymond Gram Swing, giving a weekly talk on life in America.

With the coming of war the work of the station also included the monitoring of coded signals from agents operating in Europe. Frequencies, selected by the people in London, were searched using HRO receivers. These messages, mostly in Morse, in five letter groups were recorded and sent to London for decoding. The operators never knew whether they were listening to allied or enemy agents.

The station worked a 24hour shift with anything from two to five operators. One of these, the appropriately initialled R.F Jones, had been a wireless op on the Queen Mary. He took Morse straight down onto the typewriter. Years of wearing unpadded earphones had raised two bumps just above the front of his ears!

The unit also was part of the search for U-boats during the War in the Atlantic. Three stations, one in Wales, another in Scarborough and the third, Ralph's, near Rochester in Kent monitored for signals from U-boats surfacing to take on fuel and supplies. They were only on the surface a matter of minutes so, once a station had locked on they would telephone one of the other two who would also lock on. The third station would confirm the fix and the position was plotted and passed on to the ships in the area.

This operation was not without its local dangers, however, as this equipment was housed in an isolated building in the marshes manned by two men who maintained a 24-hour watch. Nothing unusual there one might say, except that one of the operators always kept a loaded service revolver next to him just in case. As Ralph said, 'Whenever you went to see whether they were all right you went very carefully.'

Being located in Kent, the station saw a great deal of the action of the Battle of Britain, Spitfires and Messerschmitts wheeling about in the skies above in the classic dogfight action which was such a feature of that part of the war. Occasionally though, the action was closer to home. One memorable day a crippled Nazi bomber flew past the listening station. It was about six feet above the ground and as it went past, curiosity got the better of Ralph and his companions who all rushed to the window only to be met with a hail of bullets. The plane was crashing but the crew were determined to keep firing to the very end. Luckily neither Ralph nor his comrades were hit.

Ralph spent the entire war at this location monitoring and tracking but at the end of hostilities he was fired with the ambition of 'doing something more glamorous.' Seeing off a good deal of competition he managed to get a job in BBC radio outside broadcasts. In those days a great many programmes were of dance music broadcast from nightclubs. Portable equipment was set up on site and the signal was sent back to Broadcasting House via GPO telephone lines equalised for music. Certain locations like the Albert Hall had

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There are just not enough hours in the day according to Ralph, and it's pretty obvious that his decision to get rid of his television set fifteen years ago was the right one. Add to all this appearances as a song and dance man at the Player's Theatre here in London for a two week booking in August of this year and it's obvious that his approach to his career and to life itself is a lesson to us all

permanent lines but most relied on routing through the exchange. On one occasion, at what is now the London Casino Theatre, a GPO engineer was spotted nearby in a hole surrounded by wires. The microphones and equipment were rigged ready for Edmundo Ros and his orchestra. The rehearsal was completed but 30 minutes before transmission the line to BH was lost. The man in the hole in the road had struck. Without further ado Ralph was instructed to join all the spare microphone cables together and run it out of the theatre to the nearest telephone box. He then informed the exchange that it was needed as a music circuit and requested that they over plugged it so that it could not be used. This temporary link was then hooked into the circuit back to Broadcasting House.

What with these shows and the transmission of extracts of plays from West End theatre, Ralph was kept pretty busy. He was also pretty busy on his own account studying for his Institute of Electronic and Radio Engineers and HNC which gave exemption to Electrical Engineers. Some five years of studying at night school. No paid-for courses in those days and all in one's own time.

By the time of the Festival of Britain in 1951 Ralph had moved across to BBC Television and was part of the crew who covered the first great post war extravaganza promoting Britain and British products. In these days of relatively lightweight chip cameras, the 3inch Image Orthicon camera of the fifties and early sixties was a massive beast in itself to say nothing of the rack of equipment that supported it. Ralph was involved as a racks engineer controlling the output of cameras and of course maintenance of the camera chains and ancillary equipment.

One thing led to another and with the upsurge of interest in Europe the next big event was the first live Eurovision link with Calais. The event saw Ralph based at Calais and the programme hosted by Richard Dimbleby. The equipment was reliant on a 50cycle locking signal from London and at the appointed time the tower of the Hotel de Ville Calais came through onto our screens. The next era of television had begun. The BBC motto of 'Nation shall Speak Peace unto Nation' which used to be seen every day on our screens seemed to take on even greater significance for those watching this historic event.

During this time his passion of self improvement was preparing him for the next phase in his career with the BBC and following his maxim that everyone should learn a foreign language, a musical instrument, work a typewriter and drive a car, he decided to learn French. Just as well as, following a period into Standards Conversion, he was selected to go for an interview with Eurovision. The interview was conducted in French and he got the job. Which says a great deal about the course at Goldsmith's College and Ralph himself.

By the way, the Standards Conversion technology started off as a camera looking at a high definition monitor. The different scan rates were camouflaged as much as possible and using spot wobble on the vertical part of the display the lines were partially disguised.

Ralph remained in Eurovision until the EBU was established in Brussels and then returned to the BBC and immersed himself in the change to colour. His work now involved commissioning camera chains and other equipment and working closely with manufacturers like Marconi, EMI and Link Electronics to ensure that their equipment worked as well when installed as it did at the factory. Apart from the early tubes from RCA, all the cameras were British made unlike today, where apart from a few from Philips and BTH in France, all the cameras are Japanese, with the majority coming from Sony.

The next move was back into networking. Land lines were fast giving way to microwave links and with the GPO and latterly BT establishing a system of towers around the country and a growing exchange of material across continents, Ralph was seconded to TRT in Paris to get involved with microwave equipment for the cross channel link. His work in this area continued and he eventually became Assistant to the Head of Television Network Department at the BBC.

In 1972 he was asked to give a public lecture about the BBC's 50th Anniversary at Brazier's Park in Oxford. His latent talents as a performer were now to be given an outlet. No longer a backroom boy, he started a second career that flourishes to this day. As readers of the History of the BVWS will know, lectures have been given on Marconi, in costume let it be said, and the early wireless equipment on board Titanic. To coincide with the current interest a series of eight talks were prepared about the history of the liner from the time it was designed and constructed to the time it sank. These were given at the Post House Hotel at Southampton. It was from berth 44 at the Ocean Terminal that the liner set forth on its tragic voyage.

This year, at the Institute of Physics in London, Ralph is again taking to the stage to talk about use of wireless on board the liner, complete with working equipment. Harking back to Michael Faraday's lectures, his eyes twinkling, he said 'I'm not one of these fellows who talks in the dark with a few slides. Faraday got a lot of ideas from me!'

Following a suggestion from the Imperial War Museum, his next subject is to be a lecture on the courage and ingenuity of POWs designing and building radios. The stories of overcoming the incredible obstacles of life in a Japanese Prisoner of War Camp to achieve radio reception are quite incredible.

All this from a man who doesn't collect or restore radios but probably has more bits and piece stored away than he would admit to. There are just not enough hours in the day according to Ralph, and it's pretty obvious that his decision to get rid of his television set fifteen years ago was the right one. Add to all this appearances as a song and dance man at the Player's Theatre here in London for a two week booking in August of this year and it's obvious that his approach to his career and to life itself is a lesson to us all.

As I thanked him for sparing the time to talk to me he did make one tongue in cheek request.

'Please don't tell my Mum and Dad I'm on the stage!

Don't worry Ralph, your secret is safe with us.

Pat Hildred

Many of you will remember Pat Hildred. Although not a BVWS member when he died, he had belonged to the Society for many years. His enthusiasm for 405 line television was infectious.

On Friday 11th February he was working under one of his beloved 1960s Fords when the car collapsed on him. He was killed instantly.

Pat was collecting 405 line televisions before most of us were even interested. His collection of sets ranged from the early post-war Pyes with mains EHT through to the first generation of dual standard receivers. Although born in the mid sixties he lived as though a true child of that decade. Classic Fords, scooters (definitely a mod, not a rocker), a home decorated true to that era with "Homemaker" plates, and much else besides. His wife, Fiona, not only tolerated all this but actively supported him.

Pat spent many happy hours at the Vintage Wireless Museum where Gerry Wells was teaching him the tricks of vintage wireless restoration. Fiona has asked for any donations in Pat's memory to be made to the Vintage Wireless Museum.

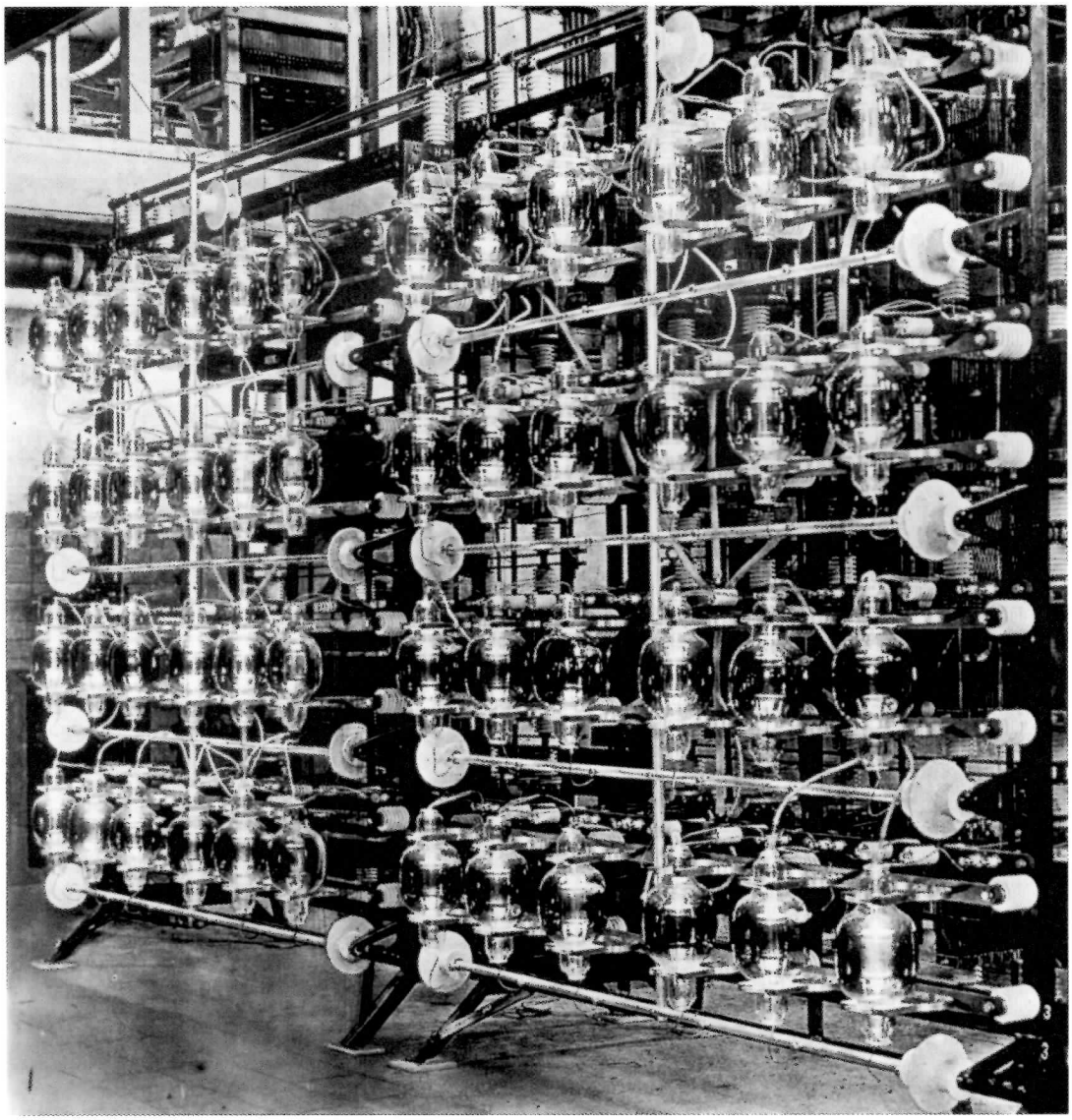
Jeffrey Borinsky

'The Saga of Marconi-Osram Valves' by George Jessop and Barry Vyse Part 2: the inter-war years - the start of public broadcasting, 1920 - 1939

The first of these brief articles covered the background to the formation of M-OV in 1919 and the impact of the First World War which saw the Osram site at Brook Green, Hammersmith, embrace valve manufacture to become one of the principal, if not the principal, valve manufacturers in the country. The third article will cover the period of the second great conflict of the century and its aftermath from 1939 through to 1958. This article deals with the intervening years which, in their own way, were just as revolutionary, equally fascinating, because these were the years in which public broadcasting and global wireless communications burst upon the scene; a period of unprecedented development in the state-of-the-art of the hi-tech devices of the day - thermionic valves. Throughout the period, M-OV was operating at the cutting edge of the new technology.

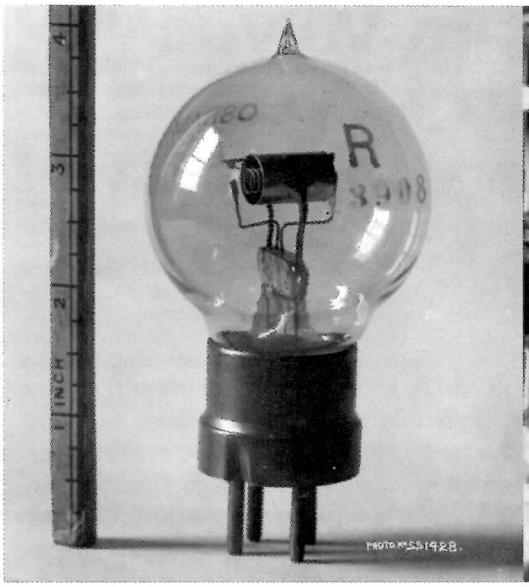
If this inter-war period is to be dubbed the 'era of broadcasting', then it should be sub-titled the 'era of the dull emitter' for the world of the receiving valve and the 'era of the big cats' for the world of the transmitting valve. At least this should be the case for the first half of the period up to about 1930 because the major theme of development for receiving valves was the improvement in the efficiency of filaments so that batteries could be lighter and last longer or possibly eliminated altogether. At the other end of the scale, national and international communications demanded hugely increased radiated power. By 1930, solutions to both problems had been discovered, so the second decade could perhaps be sub-titled the era of the 'all-mains superhet receiver'

The inter-war period witnessed the emergence of entirely new categories of thermionic valve, ever-increasing proliferation of types, huge growth in volume and continuous evolution of manufacturing techniques and processes. At the exhibition of its products in



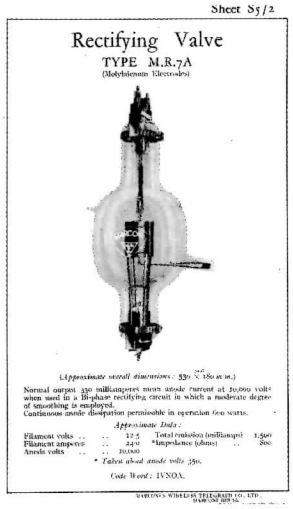
Above: MT2: used in the first, high power valve transmitter, Caernarvon and in 2LO.

Left: Caernarvon transmitter showing bank of MT2s.



R-Type: war-surplus stock snapped up by amateur radio enthusiasts.

Duke of York: watching intently the seal-in operation during visit to M-OV, 1922.



Sheet S5/2

Rectifying Valve

TYPE M.R.7A

(Molybdenum Electrodes)

(Approximate overall dimensions: 53½ × 18½ in.)

Normal output 350 milliamperes mean anode current at 10,000 volts when used in a Bi-phase rectifying circuit in which a moderate degree of smoothing is employed.

Continuous anode dissipation permissible in operation 600 watts.

Approximate Data:

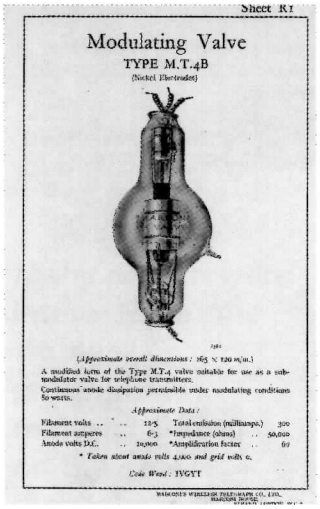
Filament volts	12·5	Total emission (milliamps)	1,500
Filament amperes ..	24·0	*Impedance (ohms) ..	800
Anode volts	10,000		

* Taken about anode volts 350.

Code Word: IVNOA.

MARCONI'S WIRELESS TELEGRAPH CO. LTD.

Above: MR7A: high power rectifier used in 2LO.



Sheet R1

Modulating Valve

TYPE M.T.4B

(Nickel Electrodes)

(Approximate overall dimensions: 16½ × 12½ in.)

A modified form of the Type M.T.4 valve suitable for use as a sub-modulator valve for telephone transmitters.

Continuous anode dissipation permissible under modulating conditions 80 watts.

Approximate Data:

Filament volts	12·5	Total emission (milliamps.)	300
Filament amperes ..	6·3	*Impedance (ohms) ..	50,000
Anode volts D.C. ..	10,000	*Amplification factor ..	60

* Taken about anode volts 4,000 and grid volts 0.

Code Word: IVGYT

MARCONI'S WIRELESS TELEGRAPH CO. LTD.

Above: MT4B: used as sub-modulator in 2LO.

1920, described in the last article, M-OV displayed a range of twenty-five valves made up of six receiving, six rectifier and thirteen transmitting devices. The total output of the factory would have been in the region of 10,000 valves per year. By 1939, this had soared to around 400 different types with a total output exceeding a quarter of a million valves per week! M-OV was a very interesting place to be.

Progress in all spheres of activity throughout the period was so intense that we can only hope to sketch the progress made.

High Power Transmitters - the Caernarvon Station

M-OV had emerged from the Great War with a unique series of high power, glass transmitting valves. The range of such valves expanded into the early twenties. One notable example was the MT2 which had an anode dissipation in the region 3-400 watts and which was made specially for Marconi's. In 1921, a bank of 56 MT2s was installed in the Marconi transatlantic transmitter, Caernarvon, to replace the Alexanderson alternator and create the world's first high power valve transmitter.

At receiver power levels, the end of the Great War had seen a slowdown in the demand for valves for military purposes but a growth in other markets. Experimental transmissions carried out by Marconi's Wireless Telegraph Company and the activities of private enthusiasts, many of whom had gained experience of wireless operation during the war, stimulated a significant and growing interest in wireless as an amateur pursuit. The challenge was to build one's own receiver from whatever parts one could lay hands on. In the first instance, demand was largely satisfied by the sale of war-surplus valves of the R-type but, as time progressed into the twenties, the demand for more specialised, higher performance valves continued to grow. The trend was given an enormous boost with the start of public broadcasts in the months leading up to the formation of the BBC in 1922.

2LO - the Dawn of a New Era - Start of Broadcast

Without question, one of the most momentous developments of the twentieth century was the inception of broadcasting; first wireless, then television. Wireless broadcasting, unlike television a generation later, seems in retrospect to have happened almost as an after-thought. Certainly, this would appear to be the case from the technological point of view because all necessary components were already in place by the time wireless broadcast became a reality. By the early twenties, M-OV was already firmly established as one of the world's foremost valve companies and, because of its association with Marconi, the foremost wireless company in the world, M-OV was destined to play a major role in the establishment of broadcast in the UK and around the world.

The story of the start of Broadcasting and the creation of the BBC has been told elsewhere (ref 6,7). Suffice it to say here that the Marconi experimental transmitter 2MT had been broadcasting experimental transmissions from Writtle from 1920 and by 1922, a new higher power transmitter, 2LO, had been designed, built and installed at Marconi House in the Strand in anticipation of the BBC coming into being. It went on the air within hours of the event; a new era had dawned.

Both 2MT and 2LO were powered by M-OV valves. In 1925, 2LO was increased in power and moved to the roof of Selfridges in Oxford street. Here is a brief description of the valve line-up:

MR7A: see the illustration: high voltage, high power rectifier with molybdenum anode and 12.5 volt, 24 amp filament. A bank of four valves was used to generate the 10kV HT rail used by all the high power valves. The valve was designed to work with peak anode current of 1.5 amps, mean rating of 350mA and maximum continuous anode dissipation of 600 watts. It was air-cooled and featured characteristic corrugated clamps round each end supporting the anode and filament terminals. As can be seen from the illustration, the anode was supported on four legs. The filament had the form of an inverted 'V', tensioned at the bottom with a side hook, and fed at the top by large flat molybdenum strips. This was a big valve, over 21 inches long.

MT2: see the illustration: medium power triode, 300 watts continuous anode dissipation, used as the master oscillator. It had nickel anode and characteristic flying leads dressed with glass beads for insulation giving it a sort of 'dread-locks' appearance. The filament operated at 17 volts, 15 amps and, as with the rectifier, took the form of an inverted 'V' suspended from molybdenum supports and tensioned at the bottom by a hook attached to the grid structure. The valve worked with a maximum cathode current of 1.0A. The grid was extended well outside the anode and domed at the bottom to prevent stray, high-energy electrons bombarding the glass walls; a potential cause of local over-heating and 'suck-in'.

MT4B: see the illustration: medium power valve with 80 watts anode dissipation designed originally as a sub-modulator for telegraph transmitters. In general appearance, it looked very much like the MT2 but was smaller; only 10 inches long. Like the MT2, it had a nickel anode but the grid was brought out via a small appendage on the well of the end-seal. Maximum current was about 300mA. The filament operated at 12.5 volts, 6.3 amps.

MT7B: see the illustration: this was a high power triode with molybdenum anode designed as a modulating valve for high power wireless telephony; the state-

The popular Duke thronged by M-OV workers during visit, 1922.

of-the-art at the time. It was a large valve, 20 inches long, and had a maximum anode dissipation of 500 watts. Like the MT2 and MT4B valves, the MT7B had glass beaded flying leads providing flexible insulation for grid and anode connections. Seven valves of this type were used as the power modulator.

MT9: see the illustration: a very large valve; the state-of-the-art in high power valves at the time, standing nearly 23 inches high and with long anode capable of dissipating 750 watts under continuous oscillation. A pair of these valves was used as the power oscillator. The filament operated at 16.5 volts, 24 amps and the valve drew a continuous current up to 2.0 amps. It featured characteristic threaded terminals attached to the bulb by corrugated clamps as with the MR7A. The grid employed a smooth bezel connector also with a threaded terminal.

On the day after the opening of 2LO, the Met-Vic station, Manchester, 2ZY, and the Western Electric station, Birmingham, 5IT, also went on air to be followed over the next eleven months by another five Marconi stations, Newcastle 5NO, Cardiff 5WA, Glasgow 5SC, Aberdeen 2BD, Bournemouth 6BM. One year later in October 1924, a ninth station, Belfast 2BE, also built by Marconi, was added. The system was augmented by eleven satellite stations set up to boost the signal from the main stations. Most of these satellite stations were also of Marconi design and therefore, operating with M-OV valves, though it is not known for sure how many. On completion of this network, up to 70% of the population of the UK could receive broadcasts from these local stations by means of a simple crystal or one valve wireless set.

Visit by the Future King

So, by the early twenties, M-OV was already established as a major supplier of state-of-the-art valves to Marconi, the Post Office, the military and many other users. The importance of M-OV at the time was recognised by a visit from the Duke of York, future King George VI, to the factory in 1922. Fine pictures of the event have survived, two of which are reproduced here. One shows the future King watching with great attention as one of the operators sealed-in a valve. The other shows a great crowd of employees and indicates just how popular the young Duke was.

The Era of the Dull Emitter

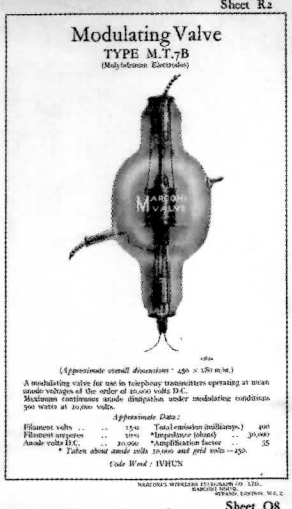
From 1922 onwards, new types of valve were required on an almost continuous basis to meet the needs of a rapidly evolving wireless industry. To keep up with, and supply, the needs of the set-makers, M-OV and other manufacturers, designed and produced a range of detectors, rf amplifiers, power amplifiers and power rectifiers. Initially, these used filaments of 2, 4 or 6 volt ratings so as to be compatible with available accumulators. Not surprisingly, reduced filament power became a premium attraction. M-OV was the first on the market with the DER (Dull Emitter Receiver) which was a direct derivative of the R-type but with a thoriated tungsten filament that reduced filament power consumption by a factor of 5! It was followed by a whole range of dull emitter valves using similar filament technology designed to fulfil specific functions; valves like the LS5 and LS6 (Loud Speaker) types which were used as audio output devices and as line amplifiers and the DE series which embraced valves like the DE3 which could be run from dry batteries and became, therefore, most popular.

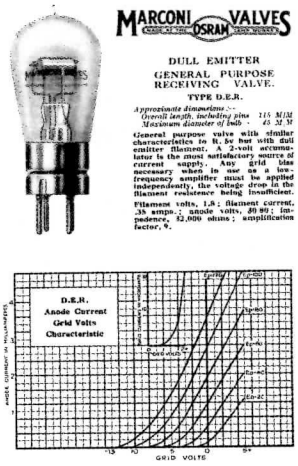
By the middle twenties, thoriated tungsten filaments had given way to even more efficient dull emitters made by what became known as the barium vapour, azide or continental process and suites of such valves designed to fulfil various specific functions within the wireless set were being made in large volume; valves such as the DEP210 created to perform the audio output job in 2 volt wireless sets and the DEH610, see illustration, used as detector in 6 volt filament sets. The same improving filament technology was applied to the rf screened tetrodes from which emerged the classic S625 and the S215 (2-volt version of the S625 but using a more conventional bulb)

The state-of-the-art in sound reproduction around this time in the mid to late twenties was the PX4 triode; a classic M-OV design that remained a great favourite for many years. The PX4, 10 watt output type, was developed as a higher power version of the P410. It was outstanding for linearity and was never quite equalled by other makers whose equivalents all suffered from relatively low sensitivity. The PX4 became renowned for its use in the Wireless World First Quality Amplifier in which it was used in push-pull pairs; the other stages of the amplifier utilised indirectly heated triodes. Initially the valve employed a dull emitter filament of the barium vapour type but it remained in service for over thirty years and evolved over time, as the illustrations show, to become a 15 watt valve with vertical electrode structure, more modern bulb and oxide filament but still with the same superb characteristics.

Dull Emitter Process

'Dull', in this context refers, of course, to the brightness of the filament, not to its performance as a cathode which was anything but. The term, I should



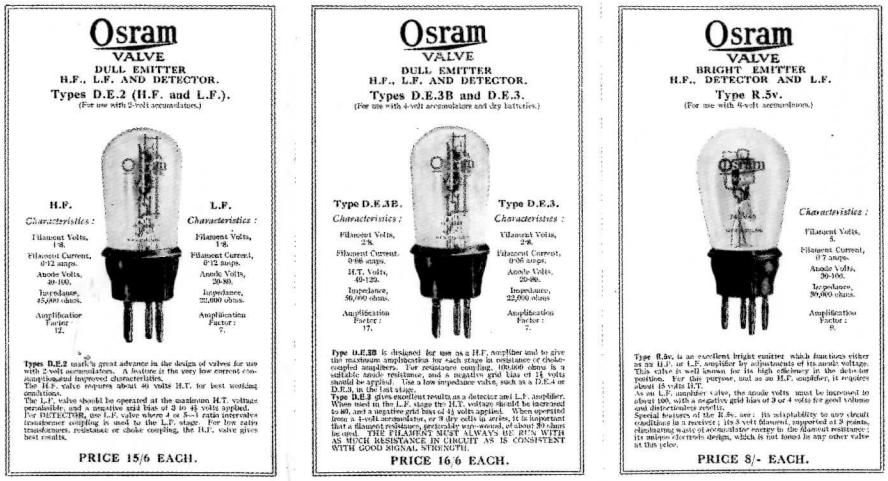


Top: MT7B: seven of these high power valves were used as the modulator in 2LO.

Middle: MT9: a pair were used as the power oscillator in 2LO.

Bottom: DER: first dull emitter valve.

Above: LS5: early example of the popular 'Loud Speaker' valve.



Osram
VALVE
DULL EMITTER
H.F., L.F. AND DETECTOR.
Types D.E.2 (H.F. and L.F.).
(For use with 2-volt accumulators.)

H.F.
Characteristics:
Filament Volts, 1·8.
Filament Current, 0·12 amps.
Anode Volts, 40-100.
Impedance, 45,000 ohms.
Amplification Factor: 12.

L.F.
Characteristics:
Filament Volts, 1·8.
Filament Current, 0·12 amps.
Anode Volts, 20-80.
Impedance, 20,000 ohms.
Amplification Factor: 7.

Types D.E.2 marks great advance in the design of valves for use with 2-volt accumulators. A feature is the very low current consumption and improved characteristics.
The H.F. valve requires about 40 volts H.T. for best working conditions.
The L.F. valve should be operated at the maximum H.T. voltage permissible, and a negative grid bias of 2 to 4½ volts applied.
For DETECTOR, use L.F. valve where 4 or 5—1 ratio intervalve transformer coupling is used to the L.F. stage. For low ratio transformers, resistance or choke coupling, the H.F. valve gives best results.

PRICE 15/6 EACH.

Osram
VALVE
DULL EMITTER
H.F., L.F. AND DETECTOR.
Types D.E.3B and D.E.3.
(For use with 4-volt accumulators and dry batteries.)

Type D.E.3B.
Characteristics:
Filament Volts, 2·8.
Filament Current, 0·06 amps.
H.T. Volts, 40-120.
Impedance, 56,000 ohms.
Amplification Factor: 17.

Type D.E.3.
Characteristics:
Filament Volts, 2·8.
Filament Current, 0·06 amps.
Anode Volts, 20-80.
Impedance, 22,000 ohms.
Amplification Factor: 7.

Type D.E.3B is designed for use as a H.F. amplifier and to give the maximum amplification for each stage in resistance or choke-coupled amplifiers. For resistance coupling, 100,000 ohms is a suitable anode resistance, and a negative grid bias of 18 volts should be applied. Use a low impedance valve, such as a D.E.4 or D.E.3, in the last stage.
Type D.E.3 gives excellent results as a detector and L.F. amplifier. When used in the L.F. stage the H.T. voltage should be increased to 80, and a negative grid bias of 4½ volts applied. When operated from a 4-volt accumulator, or 3 dry cells in series, it is important that a filament resistance, preferably non-wound, of about 20 ohms be used. THE FILAMENT MUST ALWAYS BE RUN WITH AS MUCH RESISTANCE IN CIRCUIT AS IS CONSISTENT WITH GOOD SIGNAL STRENGTH.

PRICE 16/6 EACH.

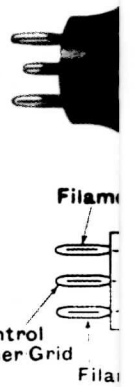
Osram
VALVE
BRIGHT EMITTER
H.F., DETECTOR AND L.F.
Type R.5v.
(For use with 6-volt accumulators.)

Characteristics:
Filament Volts, 5.
Filament Current, 0·7 amps.
Anode Volts, 30-100.
Impedance, 80,000 ohms.
Amplification Factor: 8.

Type R.5v. is an excellent bright emitter which functions either as an H.F. or L.F. amplifier by adjustments of its anode voltage. This valve is well known for its high efficiency in the detector position. For this purpose, and as an H.F. amplifier, it requires about 15 volts H.T.
As an L.F. amplifier valve, the anode volts must be increased to about 100, with a negative grid bias of 3 or 4 volts for good volume and distortionless results.
Special features of the R.5v. are: its adaptability to any circuit condition in a receiver; its 5 volt filament, supported at 3 points, eliminating waste of accumulator energy to the filament resistance; its unique electrode design, which is not found in any other valve at this price.

PRICE 8/- EACH.

Above: R5, DE2, DE3: typical publicity brochure from around 1923.



Above: S625: original rf scre

In particular, the material used by M-OV had better emission properties than most. The reason for this was not known at the time, but the observation remained intriguing. In fact, the material used by M-OV was not pure tungsten at all but a carefully controlled alloy of tungsten with traces of thoria

explain is strictly relative; bright emitters were very bright, just like lamps, operating at perhaps 2,400°C. Thoriated tungsten dull emitters were less bright, orange rather than white hot, radiating at perhaps 1,700°C, not nearly as hot as bright emitters but still well above the melting point of most metals. Filaments of the barium vapour type operated at much lower temperatures, around 850°C.

The work of Gossling, Richardson, Townsend, JJ Thomson, Langmuir in the US and others around 1916/18, had greatly improved the scientific understanding of thermionic emission. In particular, the dependence of emission on temperature had been established both theoretically and empirically. Also, it had been appreciated that the level of emission available from a metal at any particular temperature was a characteristic of the material itself, the so called 'work function' that determined how much energy an electron must have to escape from the pull of that particular surface. Tungsten has a particularly high work function so it needs a high temperature to obtain a high emission density. B S Gossling (ref 1) noticed that tungsten from some sources gave higher thermionic emission than nominally similar material from other sources. In particular, the material used by M-OV had better emission properties than most. The reason for this was not known at the time, but the observation remained intriguing. In fact, the material used by M-OV was not pure tungsten at all but a carefully controlled alloy of tungsten with traces of thoria (the oxide of thorium). Thoria was not present by accident but was there as the outcome of painstaking research by Osram's (M-OV's) German partners in the years around 1910-1914 into the workability of tungsten, a notoriously difficult, brittle material. Thoria worked wonders in the drawing process and was added in small but precise quantities (about 0.7%) for this purpose. As it turns out, the presence of thoria had the effect of reducing the work function of tungsten. All that was needed was to recognise the effect. On the basis of this discovery, Gossling who by this time had joined the staff of the newly formed Hirst Research Centre, set to work to establish the optimum concentration of thoria in tungsten alloy for best thermionic emission. The result was a material called 'thoriated tungsten', containing about 5% thoria, which had a huge impact on valve development for many years and is still in use today. Thoriated tungsten could produce around 20mA per watt, about five times greater than pure tungsten! The thoriated tungsten process was improved later by adding a further stage in which the outer layers were carburised, the effect being to stabilise the emission and greatly improve life of the filament. The LS6 mentioned above was one of the first to use the improved process.

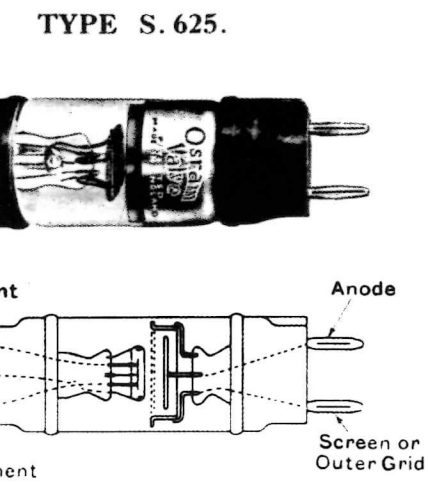
Thoriated tungsten filaments were neither mechanically nor chemically as robust as pure tungsten. Phosphor getters were certainly out of the question because they killed the emission dead, so better vacuum was needed to prevent contamination of the surface of the filament. Once off the pump, thoriated tungsten valves were activated in a process called 'flashing and forming' in which the filament was run at high temperature, e.g. 2,300°C, approaching bright emission temperatures, for a short period then reduced to a lower temperature for a longer period to stabilise the emission. Such filaments were renowned for the fact the they could often be 'recovered', if emission was found to be flagging, by this same 'flashing and forming' technique.

As we have noted, by 1925, thoriated tungsten had largely been displaced in receiving valves by the barium vapour process which worked by creating a layer of barium oxide on the surface of the filament. At operating temperature around 850°C, free barium was released at a controlled rate which greatly reduced the work function of the material. The result was a cathode that could produce 200mA per watt, more than fifty times better than bright tungsten and 10 times better than thoriated tungsten!

In the barium vapour process, a pure tungsten filament was plated with copper or, less usually, drag-coated with aluminium. The treated filaments were oxidised to create a suitable interface onto which barium would be deposited using a process known as 'green glowing'. Barium, in the form of powdered barium azide (BaN^6), was applied to the inside of the anode during assembly. During processing, the azide was broken down to free barium by heating in the ovens, the resulting nitrogen being pumped away. The whole process had to be carefully controlled; too rapid decomposition took place with almost explosive violence scattering the material all over the inside of the bulb, leaving little or none on the anode.

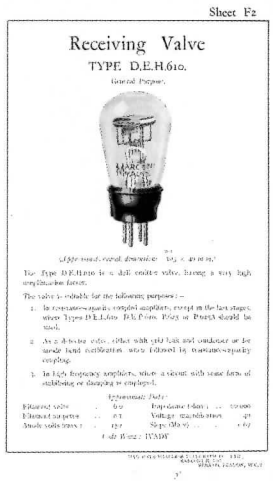
Once the valve had been sealed off the pump, it was capped and subjected to the 'green glowing' process which consisted of heating the anode and grid by electron bombardment, achieved by applying a voltage of about 110 volts DC to anode and grid strapped together and switching on the filament. The current was limited by a series resistor in the anode/grid circuit in the form of a 16 or 8 candle-power carbon lamp. During this process, the valve glowed green as the barium evaporated off the anode and deposited itself elsewhere on the cooler parts of the valve, including the cathode filament, where it formed a barium oxide layer by reduction of the copper or aluminium oxide on the surface of the filament.

Valves made by the barium vapour process suffered from rather unsightly black, or in some cases bronze, coloured deposits of barium on the inside of the bulb at the top. For cosmetic reasons, therefore, it became normal practice to attach a small piece of magnesium ribbon to the centre of the anode outer surface and this was vaporised by eddy-current heating to produce a bright silver coating to the bulb crown.

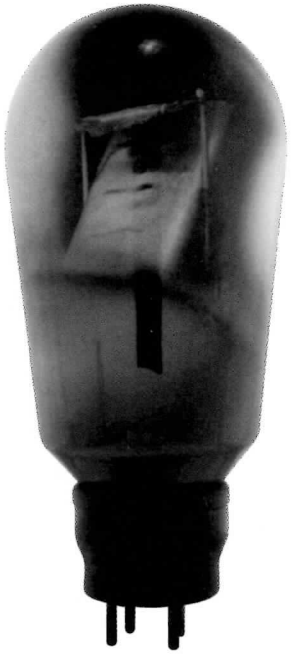


ned grid tetrode.

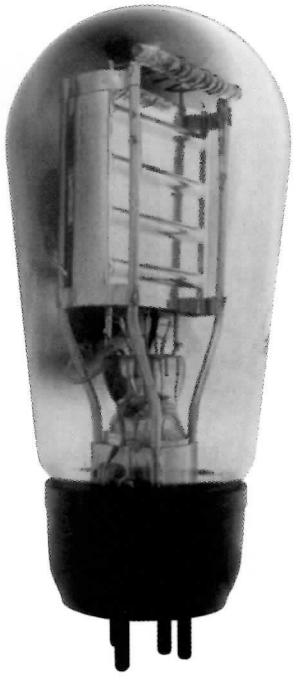
Above: S215: later version of screened grid tetrode in more conventional bulb.

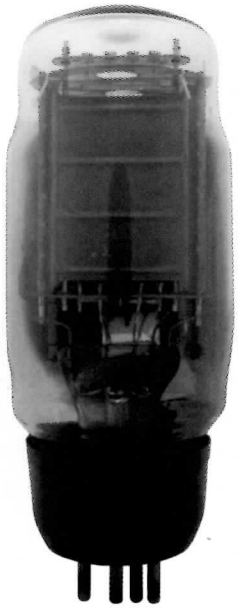


Above: DEH610: dull emitter triode of the barium vapour type.



Above and below: PX4: sequence showing development over time of this classic audio output valve.





The lower temperature required by filaments of the barium vapour type resulted in even longer filaments, allowing a 'W' formation to replace the single wire or 'V' form. Cathodes made this way had copious emission, thereby allowing valves of considerably enhanced mutual conductance to be designed.

An indirect advantage of the vapour process was that the barium metal was itself a very good getter and, in consequence, valves made by this method had an extremely high degree of vacuum. A related disadvantage was that the barium went everywhere and could, indeed often did, cause leakage between support wires in the valve seal (pinch). For this reason the valve bases were coated with magnesia to try to suppress the leakage. Also, valves made this way had to be 'sparked' i.e. cleaned up by applying high voltages from a high impedance source to the leads in order to vaporise barium deposited in unwanted places.

The Big Cats

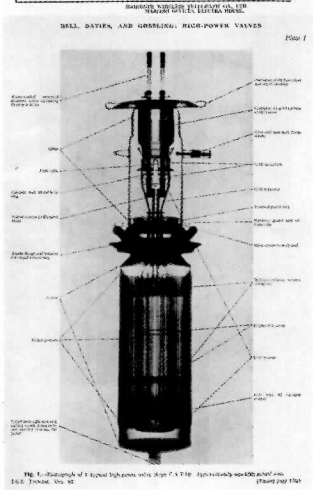
As we have seen, the early broadcast transmitters, 2LO for example, used glass transmitting valves such as the MT9 as the power amplifier, each with anode dissipation approaching a kilowatt. Such transmitters worked well in medium-wave over distances of 100 miles or so but were not adequate in power for full national coverage. To be more accurate, they were not adequate to provide reliable broadcast over the whole country. With the right aerial on the right day and with favourable propagation conditions it was possible to receive over very much larger distances than 100 miles, indeed it was possible to do this with very much less power than a kilowatt. However, a broadcast service demanded good reception by everyone, all the time, whatever the local geography, propagation conditions or less than perfect receiving equipment. Everything conspired to demand much greater transmitter power; the race was on to find ever more radiated power, ever more powerful valves.

The limiting factor in the design of high power transmitter valves was the dissipation of the anode. More than adequate electron emission could be obtained from bright tungsten emitters by increasing the size of the cathode filament; scaling up the size of the triode enabled a further increase in power through increase in the operating voltage. Power input was not the problem; it was the power lost in the anode that proved the limitation. Even in the most efficient valves and circuits, 40% of the input power was dissipated as the electrons smashed into the anode. Since the anode of a conventional glass valve resided in vacuum with no convection cooling to assist and only limited cooling by conduction down the anode supports, the anode became hot - very hot - and dissipated its heat in the form of radiation. The anode of an MT9 was made of molybdenum in order to maximise its heat dissipation by allowing the anode to operate at as high a temperature as possible; when working at full load the anode glowed cherry red, perhaps 750°C. A related problem was out-gassing. Processing temperatures had to be even higher than operating temperatures to ensure that the vacuum would retain hard in operation. The only way of increasing the dissipation further was to increase the surface area of the anode, which meant increasing the size of the already large glass bulb - the practical problems became impossible. Of course, multiple devices could be used in parallel as had been done at Caernarvon, but that was costly and complicated, so a better, higher power, solution was needed.

Above: CAT1: original cooled-anode transmitting valve used in the PO station, Rugby.

In 1923/24, the UK Post Office threw out a challenge to the valve industry. Their need was to establish a world-wide broadcast service for the provision of time signals and information for shipping. The system was to be capable of simultaneous transmission from two transmitters each of output power of 500kW on 18,000 metres (16.7kHz). Valves used in the transmitter were to have a minimum anode dissipation of 10kW. Even so, five transmitters each with 18 valves in parallel would be needed as we shall describe later. The target being set was not only an order of magnitude greater than the state-of-the-art but implied very high circuit efficiency.

For valves of this power, some improved method of cooling the anode was an absolute necessity. The valve industry, M-OV-HRC in particular, rose to the challenge. The strange thing is, that once the problem had been expressed in such bald terms, the solution arrived



Top: CAT6: used in the BBC Regional transmitters.
Middle: CAT9: used in the BBC experimental long-wave transmitter, Daventry.
Above:CAT14: Radiograph of 150kW valve used in the BBC National long-wave transmitter, Droitwich.

relatively easily. Making the anode part of the vacuum envelope of the valve was the conceptual leap, the use of copper for the directly cooled anode the solution. Designing a glass seal to the copper became the real challenge. M-OV developed a seal based upon a matching alloy of nickel and iron in a geometry known as the Housekeeper seal whilst the competitor, Western Electric (ST&C), pursued a technique borrowed from their American associate in which glasses with graded expansion properties were used to spread the strain. Both were successful though the M-OV design was generally preferred because the seals were shorter and less vulnerable to damage. Thus were born the CATs, the first cooled-anode transmitting valves.

The Post Office Rugby station used the 10kW CAT1 which also found application in a new BBC, long-wave transmitter at Daventry. This was followed by the CAT2 designed specifically for the Marconi short-wave Beam Stations. The CAT6 and CAT9 were developed for the BBC Regional stations and the Daventry experimental long-wave transmitters. These were followed by the 150kW CAT14 designed for the BBC high-power, long-wave transmitters at Droitwich and a high frequency version of the same valve, CAT17, designed for the World Service transmitter also at Droitwich. Modulator and Rectifier versions of these cooled-anode devices, known as CARs and CAMs, were also pressed into service.

CAT Processing

The design of these high power CAT devices was a masterpiece of thermo-mechanical engineering and the construction techniques reflected the challenge. These were very high voltage, high power devices with very special problems regarding cooling, electronic emission, insulation, X-radiation, mechanical strength, vacuum integrity and above all differential expansion at extreme temperatures. Manufacturing techniques had to reflect the fact that CATs were physically very large. Unlike receiving valves, they were only ever made in modest quantities and, for these reason, were fabricated using solid machined components, mechanical fastenings with clips and bolts and welds and always assembled, handcrafted, by skilled workers using traditional fitting and glass-working techniques.

Detailed discussion of the CAT design, components, assembly and processing techniques would be inappropriate in a brief article such as this but many of the structural features of the valves can be seen clearly in the illustrations, especially the artistic representations in which the artist has been able to show details normally obscured by reflections. The line drawings of the CAT2 and especially the CAT17 are particularly helpful in this regard; so is the radiograph. Those who wish to gain more detail are referred to the papers by Picken (ref 2) and Bell, Davies and Gossling (ref 3).

The CATs were very successful and facilitated the boom years of wireless, world-wide radio and telecommunications and later, television. The developments covered military as well as civil applications and opened up other avenues such as industrial heating.

CAT technology brought about hundred-fold increases in rf power and made possible advances towards higher frequency, higher stability, better reliability and improved reception.

All Change

By the end of the twenties the range of products produced by M-OV was already larger than that of any other UK manufacturer. There was a whole range of new and replacement receiving valve types: rectifiers, triodes, rf tetrodes, audio output pentodes and high power transmitter valves for both civil and military customers. This had been the era of the dull emitter valve and the giant CAT transmitting valves. M-OV was supplying valves to Marconi, EMI, GEC, the military, the Post Office, the BBC, the amateur enthusiast and many other general users. The last few years of the decade were to see the start of fundamental changes in nearly all aspects of the business which were to set the scene for the decade to come. Valve technology was about to change, as were the types of valves demanded by the setmakers. Methods of manufacture were to advance to no less a degree, bringing with them greatly reduced prices. M-OV was to acquire a new parent and, with it, a whole new perspective.

EMI - a New Parent - the RCA Link:

Marconi in the twenties, whilst dominating in broadcast and wireless transmission, was less so in the growing but highly competitive world of domestic receivers. They made sets under the name of 'Marconiphone' but eventually came to the conclusion that this was not a product likely to meet their corporate objectives. Accordingly, in March 1929, Marconi sold the domestic wireless business, and with it their interest in M-OV, to the Gramophone Company (HMV), a major and growing name in the production and manufacture of records and gramophone equipment. The deal included the rights to the Marconiphone brand and use of the Marconi name. HMV themselves had recently been acquired by RCA of the USA. Thus was established a link with the major US valve manufacturer, albeit indirect, that was to play an important part in the development of specific valve types by technology exchange and cross-fertilisation. A particularly striking example of this co-operation occurred in the mid-thirties with the development of an entirely new class of valve known as 'beam tetrodes'.

Amongst the many personnel acquired by RCA in 1919 when it was formed out of the American side of Marconi's was the young David Sarnoff, see the photograph, who was born Russian of Jewish parents. He emigrated to the USA in 1900, joined Marconi's Wireless Telegraph Company of America as an office boy around 1907 and progressed rapidly up the ladder on the back of his great speed and skill as a wireless operator. By 1919, he had become commercial manager and within a few years would become the boss and leading light of RCA itself, a position from which he was able to influence not only the progress of what was to become another of the world's great

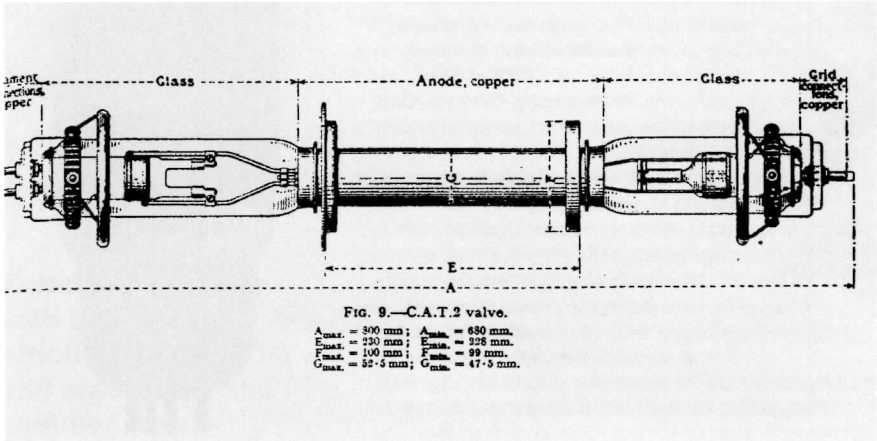
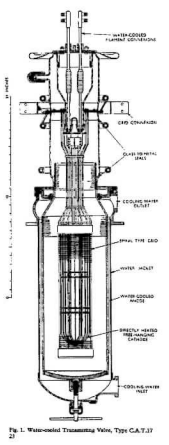


FIG. 9.—C.A.T.2 valve.

$A_{max.}$ = 300 mm; $A_{min.}$ = 680 mm.
$E_{max.}$ = 230 mm; $E_{min.}$ = 228 mm.
$F_{max.}$ = 100 mm; $F_{min.}$ = 99 mm.
$G_{max.}$ = 52·5 mm; $G_{min.}$ = 47·5 mm.



Far left: CAT2: line drawing showing the construction of valve used in the Marconi Beam stations.

Left: CAT17: line drawing of 150kW valve used in the BBC short-wave Empire service.

Right: David Sarnof: boss of RCA and indirectly of M-OV. Marconi-Osram-RCA: cartons revealing M-OVís parents.

companies but also M-OV itself. We believe that the shadowy hand of David Sarnoff can be detected in the furthering of the collaboration between these two great companies.

Two years after the acquisition of its stake in M-OV, the Gramophone Company merged with its great rival, the Colombia Gramophone Company, to form EMI. As it turns out, M-OV remained under joint ownership of GEC and EMI for the next twenty five years, a relationship which was to attract M-OV into new business sectors such as special low noise valves for microphones and recording purposes.

From the shop-floor the change in ownership was not seen as dramatic in any way. Indeed, there appear to have been no changes in management personnel at the factory nor in manufacturing methods, as a direct result of the change. By this time, Hugo Hirst was head of the greatly expanded GEC and, no doubt, directly involved in the corporate changes taking place within M-OV. Chris Wilson, of whom we have heard in the first article, remained boss of the Hammersmith site throughout the thirties, competently aided by Freddie Smith who oversaw the valve side of the business. Over time, however, discernible changes did take place with the introduction of some new and important influences. Chief amongst these was Isaac Shoenberg, acquired as one of the assets of the Marconiphone organisation, who became Director of Research for EMI, see the photograph. Isaac Shoenberg was a very clever and innovative man and a prime-mover. My old colleague George Jessop remembers him as rather stern and self-opinionated but 'sharp as a tack'.

Marconi may have shed its formal links with M-OV after ten years of fruitful interaction but this did not in any way diminish the business relationships associated with the design and supply of valves for Marconi's mainstream businesses in broadcasting, communications and military systems. The commercial and technical liaison continued to thrive for the next fifty years, even after Marconi spawned its own valve Company in the mid-thirties; indeed, M-OV was involved at a fundamental level with its formation by way of technology transfer and training of its personnel. Its aim appears to have been the establishment of small satellite factories, particularly in Eastern Europe, to manufacture and repair specific valve types needed for Marconi transmitters operating in these territories. Jim Young and Dr Serge Aisenstein, later to become founding members of English Electric Valve, Chelmsford, in 1948, were trained for this job at M-OV, Hammersmith, prior to being sent by Marconi to set up a valve plant in Warsaw. In later years, Jim Young was to become managing director of both EEV and M-OV. He become well known in the industry for being a tough businessman and a hard taskmaster but we know from personal experience that he greatly appreciated his early training at M-OV and always had a soft spot for the 'old Company'.

The indirectly Heated Cathode - the Era of the 'All Mains' Set

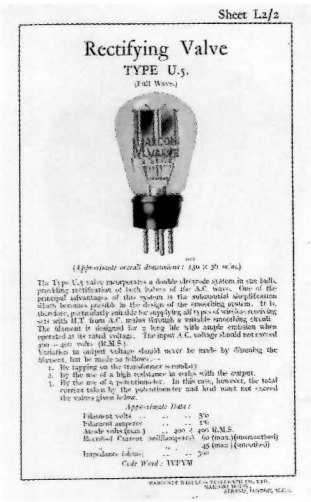
Up to the mid-twenties, all wireless sets operated entirely from batteries with all the limitations and inconvenience that this entailed. Indeed, this was one of the reasons that crystal sets remained in favour for so long; although they were less sensitive than valve receivers, they were less expensive and consumed less power. With the development of efficient dull emitter valves it became clear that portable sets would use 2-volt filament valves. Larger, more powerful sets for the home, however, needed something better.

The great challenge of the late twenties and early thirties was the total elimination of batteries for domestic wireless sets. The ultimate aim was the 'all mains' set. Starting from the mid-twenties, rectifier valves like the U5, designed at M-OV, the first full-wave rectifier, were produced for 'battery eliminators' or for use in mains sets themselves. These were most effective in displacing the HT battery. There followed parallel attempts to solve the heater battery problem by designing a cathode that could be run from AC derived from the mains. One partially successful attempt is represented by the M-OV classic, but short-lived, Point 8 suite of valves which used very low impedance filaments to minimise hum, see the illustration of the D Point 8. The alternative, and ultimately totally successful approach, was kick-started by the KL1, the first indirectly heated valve, another first from M-OV, which achieved best of all performance through the use of an indirectly heated, oxide coated cathode of low temperature.

The KL1 and KH1 were classic M-OV valves that mark a changing point in cathode design. They established a principle and demonstrated that mains hum could be eliminated. They were also distinctive valves as the illustration shows. However, they were not entirely successful as a commercial product; shorting of the heater to the cathode was certainly a problem. Over the next four to five years, new generations of indirectly heated cathodes of more advanced design evolved and were introduced. These valves, using insulated heaters and magnesium activated cathodes, like the MH4, were highly successful and displaced not only the KL1 but the competing Point 8 series.

Manufacturing techniques were advancing alongside valve technology and device design. For example, large rotary pumps were displacing bench pumps. Self-jigging mica construction was being introduced, allowing much needed improvements in accuracy and reproducibility of assembly. Indeed better assembly methods had to be found because the new cathodes were driving valve design towards ever closer grid spacings.

There were very important knock-on effects from the new cathode technology. Operation from the mains implied release from the limits imposed by the power available from batteries, allowing the set designer to worry less about the use of moving coil speakers, which were less efficient but capable of greater volume and better quality of sound, and more inclined to use higher power and more specialised valves in his circuits. This in turn stimulated the demand for new and


Sheet L2/2

Rectifying Valve

TYPE U.5.

(Full Wave.)

(Approximate overall dimensions: 130 × 50 m/m.)

The Type U.5 valve incorporates a double cleavage system in the bulb, providing rectification of both halves of the A.C. wave. One of the principal advantages of this system is the substantial simplification which becomes possible in the design of the smoothing system. It is, therefore, particularly suitable for supplying all types of wireless receiving sets with H.T. from A.C. mains through a suitable smoothing circuit. The filament is designed for a long life with ample emission when operated at its rated voltage. The input A.C. voltage should not exceed 250 – 300 volts (R.M.S.).

Variation in output voltage should never be made by dimming the filament, but be made as follows:–

1. By tapping on the transformer secondary.
2. By the use of a high resistance in series with the output.
3. By the use of a potentiometer. In this case, however, the total current taken by the potentiometer and load must not exceed the values given below.

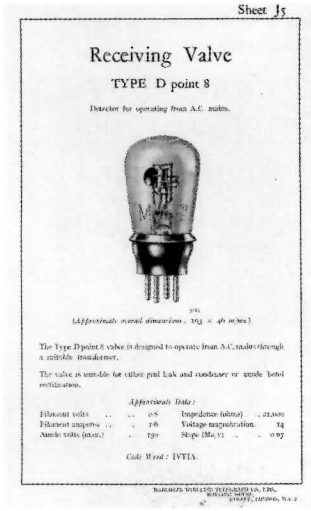
Approximate Data:

Filament volts	.. .. ..	5·0
Filament amperes	.. .. ..	1·0
Anode volts (max.)	.. 200 × 400 R.M.S.	
Rectified Current (milliamperes)		60 (max.)(intermittently)
	.. ..	45 (max.)(continuous)
Impedance (ohms)	.. .. ..	500

Code Word: IVFVM

MARCONI'S WIRELESS TELEGRAPH CO., LTD.
MARCONI HOUSE,
STRAND, LONDON, W.C.2.

Above: U5: first full-wave rectifier for domestic use.
Below: D Point8: low impedance filament detector for AC operation.


Sheet J5

Receiving Valve

TYPE D point 8

Detector for operating from A.C. mains.

(Approximate overall dimensions: 105 × 40 m/m.)

The Type D point 8 valve is designed to operate from A.C. mains through a suitable transformer.

The valve is suitable for either grid leak and condenser or anode bend rectification.

Approximate Data:

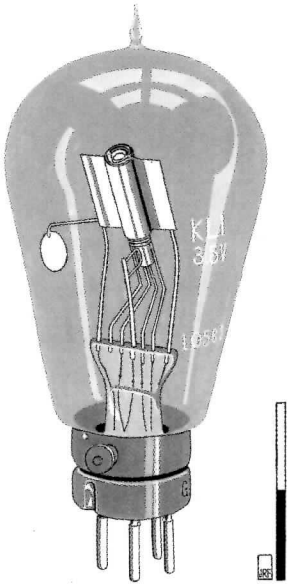
Filament volts	0·8	Impedance (ohms)	21,000
Filament amperes ..	1·6	Voltage amplification	14
Anode volts (max.)	150	Slope (Ma/v) ..	0·67

Code Word: IVFIA.

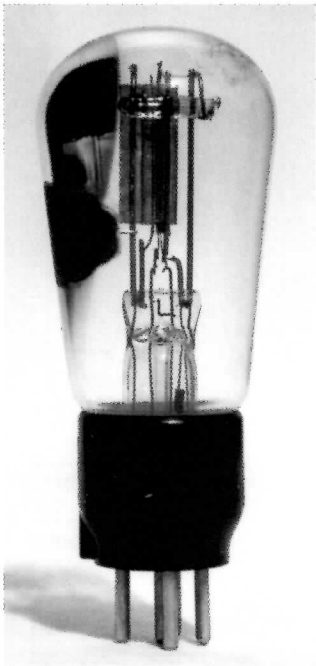
MARCONI'S WIRELESS TELEGRAPH CO., LTD.
MARCONI HOUSE,
STRAND, LONDON, W.C.2.

Below: Isaac Shoenberg: EMI director of research and important influence on M-OV.

Below: A J Young: trained at M-OV and later MD of both EEV and M-OV.



Above: KL-1: the first indirectly heated valve.



Above: MH4: example of an early indirectly heated triode.

Below: MX40: indirectly heated heptode frequency changer.

better valves, so we see the emergence of more powerful audio output devices, triodes, pentodes and beam tetrodes.

The thirties were to become the age of the superhet receiver demanding new types of valve, see illustrations; frequency changers like the MX40 heptode, compound valves like the WD40 diode pentode and variable-mu rf pentodes like the VMS4 as well as the more usual rf detectors such as the D41 and low frequency amplifiers like the ML4 and MH4. It was also the age of the AC-DC set that would run off either variety of mains supply, for which a special range of high resistance heater valves was developed to run in series, but otherwise equivalent in all other respects to the more conventional valves. Included in this range were valves like the H30 amplifier, DS variable-mu tetrode and DPT output pentode.

In the late thirties, valve designs became more universal with the adoption of the American Octal standard and the development of a whole new class of valves to satisfy the increasingly competitive market in which several manufactures were making direct equivalents of all the popular designs; valves like the H63 general purpose triode and the X63 heptode frequency changer, see illustration. M-OV with its close links with RCA was quick to exploit its advantage with the new format and was first on the market with many new types.

The Oxide Process

For many years it had been known that oxides of various materials, including calcium and barium oxide, could produce enhanced emission at low temperatures but it was not until the late twenties that the optimum formulation had been discovered together with the means of applying and activating the material. Actually, the barium vapour process was a means of creating a barium oxide cathode but the method of manufacture was so distinct that it needs to be treated quite separately. In the end, the magic formula turned out to contain co-precipitated double or triple carbonates of barium, strontium and calcium which, when mixed in the right proportions and heated in vacuum (to convert the compounds to the oxides), produced a further marked reduction in the work function and with it a great increase in the current density available at temperatures as low as 800°C. Since refractory metals were no longer essential for the manufacture of the cathode, other metals were tried and nickel found to be particularly suitable. Further, if the nickel were alloyed with a small proportion of magnesium, even better performance was achieved. As an additional bonus, the new oxide cathodes could be assembled outside the valve envelope with the result that quality and uniformity could be checked and improved whilst, at the same time, reducing contamination of other components within the valve envelope.

Having satisfactorily adopted oxide coating for indirectly heated cathodes, it seemed only wise to adapt the same technology for application to the directly heated case which was successfully achieved. The filament wire was changed from tungsten to nickel, later 'O-nickel' which contained magnesium, and the oxide applied by drag coating. The first of the new directly heated oxide valves appeared in 1930; the H2 triode which replaced the H210 but with higher mutual conductance. Within a few years, all the barium vapour types had been replaced and the process scrapped.

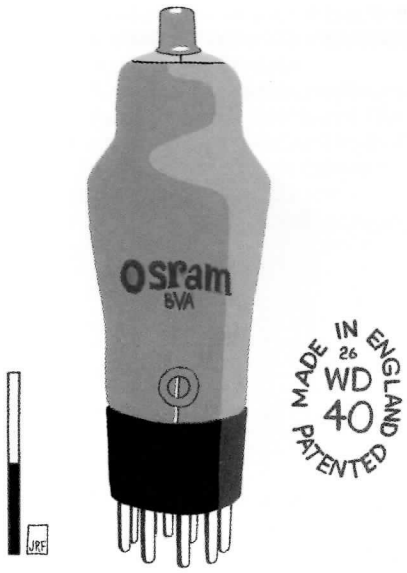
To emphasise the degree of advance, it was reckoned that one could obtain 1-5mA per watt from pure tungsten whereas 25mA per watt were achievable with thoriated tungsten and 250mA per watt from oxide coated materials; quite an improvement! The rate of advance had been spectacular. In ten years, emission density of cathodes had improved by over an order of magnitude whilst the heating power had fallen by the same degree. The staff at M-OV and HRC had contributed to this advance in no small measure. Their particular contributions included the co-precipitation of the triple oxides, the invention of 'O-nickel' as the activated cathode material and the means of applying and processing the new cathodes.

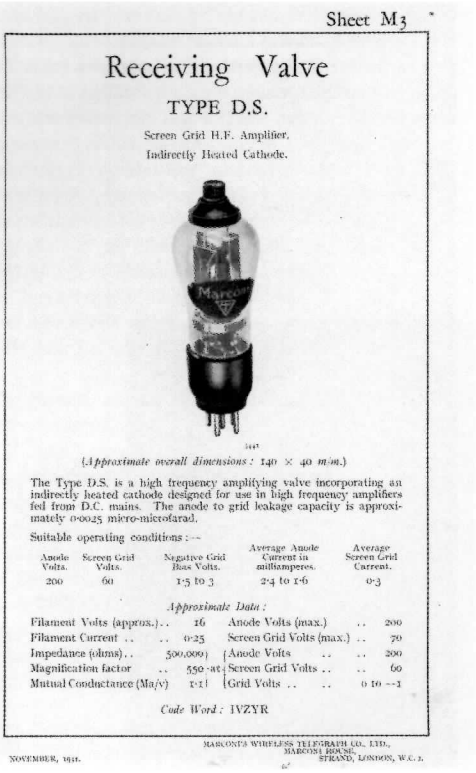
The emissive materials were most commonly mixed with a binder and sprayed onto the cathode. The operation could be carried out automatically but was often done by hand. As the house expert, Dr R O Jenkins, used to say, spraying was best done by hand in time with a tune running through one's head. I must say, I love the idea of the cathode of a superb audio output valve like the KT66 being born to the music of some unsung hymn.

Vacuum processing of the oxide valve was carried out on modified 24 head Hoffman pumps. These were circular, indexing pumps which rotated the valve through a sequence in which the valve was evacuated, baked and the electrodes out-gassed by ECH whilst the cathode or filament was raised in temperature to drive off the binders and break down the carbonates to form the oxide. Towards the end of the cycle, the

Below: WD40: indirectly heated diode pentode.

Right: DS: variable mu tetrode with high impedance heater for AC-DC set application.





Sheet M3

Receiving Valve

TYPE D.S.

Screen Grid H.F. Amplifier.
Indirectly Heated Cathode.

(*Approximate overall dimensions:* 140 × 40 m/m.)

The Type D.S. is a high frequency amplifying valve incorporating an indirectly heated cathode designed for use in high frequency amplifiers fed from D.C. mains. The anode to grid leakage capacity is approximately 0·0025 micro-microfarad.

Suitable operating conditions:—

Anode Volts.	Screen Grid Volts.	Negative Grid Bias Volts.	Average Anode Current in milliamperes.	Average Screen Grid Current.
200	60	1·5 to 3	2·4 to 1·6	0·3

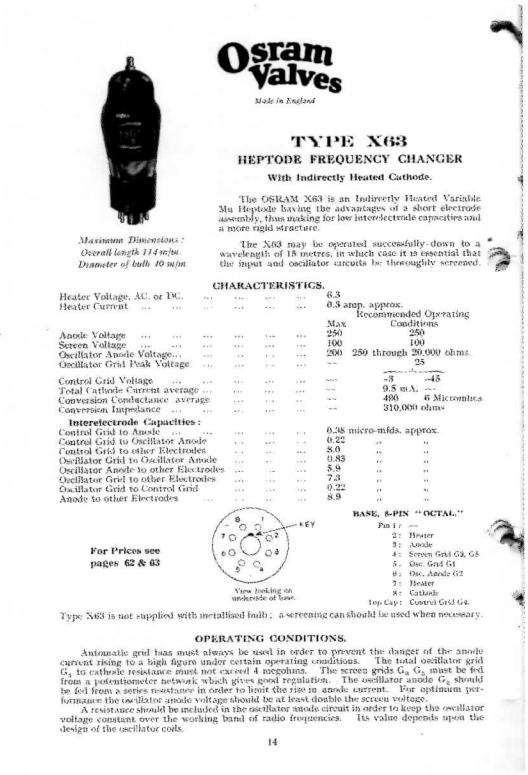
Approximate Data:

Filament Volts (approx.) ..	16	Anode Volts (max.) ..	200
Filament Current	0·25	Screen Grid Volts (max.) ..	70
Impedance (ohms) ..	500,000	Anode Volts	200
Magnification factor ..	550	Screen Grid Volts	60
Mutual Conductance (Ma/v)	1·1	Grid Volts	0·10 —1

Code Word: IVZYR

NOVEMBER, 1931.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.,
MARCONI HOUSE,
STRAND, LONDON, W.C. 2.



Osram Valves

Made in England

TYPE X63

HEPTODE FREQUENCY CHANGER

With Indirectly Heated Cathode.

The OSRAM X63 is an Indirectly Heated Variable Mu Heptode having the advantages of a short electrode assembly, thus making for low interelectrode capacities and a more rigid structure.

The X63 may be operated successfully down to a wavelength of 18 metres, in which case it is essential that the input and oscillator circuits be thoroughly screened.

Maximum Dimensions:
Overall length 114 m/m
Diameter of bulb 19 m/m

CHARACTERISTICS.

		Recommended Operating Conditions
Heater Voltage, AC. or DC.		6.3
Heater Current		0.3 amp. approx.
	Max	
Anode Voltage	250	250
Screen Voltage	100	100
Oscillator Anode Voltage	200	250 through 20,000 ohms.
Oscillator Grid Peak Voltage	—	25
Control Grid Voltage	—	-3 -45
Total Cathode Current average	—	9.5 mA. —
Conversion Conductance average	—	480 6 Micromhos
Conversion Impedance	—	310,000 ohms

Interelectrode Capacities:

Control Grid to Anode	0.08 micro-mfds. approx.
Control Grid to Oscillator Anode	0.22 " "
Control Grid to other Electrodes	8.0 " "
Oscillator Grid to Oscillator Anode	0.83 " "
Oscillator Anode to other Electrodes	5.9 " "
Oscillator Grid to other Electrodes	7.3 " "
Oscillator Grid to Control Grid	0.22 " "
Anode to other Electrodes	8.9 " "

KEY

View looking on underside of base.

BASE, 8-PIN "OCTAL."

Pin 1: —
2: Heater
3: Anode
4: Screen Grid G2, G3
5: Osc. Grid G1
6: Osc. Anode G2
7: Heater
8: Cathode
Top Cap: Control Grid G4.

For Prices see pages 62 & 63

Type X63 is not supplied with metallised bulb; a screening can should be used when necessary.

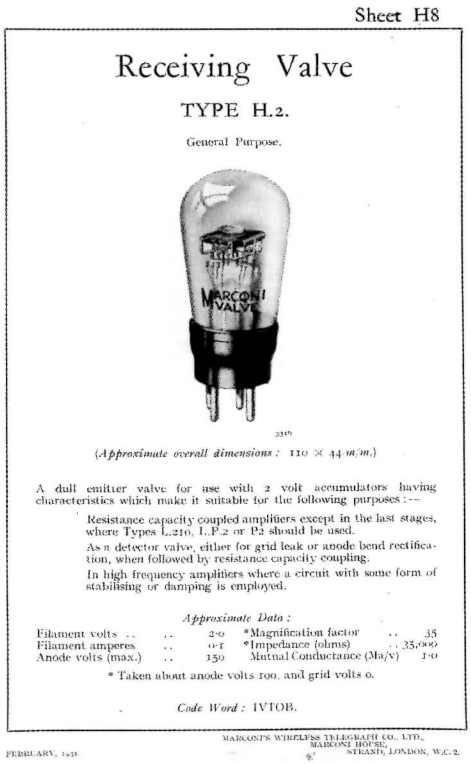
OPERATING CONDITIONS.

Automatic grid bias must always be used in order to prevent the danger of the anode current rising to a high figure under certain operating conditions. The total oscillator grid G_1 to cathode resistance must not exceed 4 megohms. The screen grids G_2 G_3 must be fed from a potentiometer network which gives good regulation. The oscillator anode G_2 should be fed from a series resistance in order to limit the rise in anode current. For optimum performance the oscillator anode voltage should be at least double the screen voltage.

A resistance should be included in the oscillator anode circuit in order to keep the oscillator voltage constant over the working band of radio frequencies. Its value depends upon the design of the oscillator coils.

14

Above: X63: heptode frequency changer of the octal type.



Sheet H8

Receiving Valve

TYPE H.2.

General Purpose.

(*Approximate overall dimensions:* 110 × 44 m/m.)

A dull emitter valve for use with 2 volt accumulators having characteristics which make it suitable for the following purposes:—

Resistance capacity coupled amplifiers except in the last stages, where Types L.210, L.P.2 or P2 should be used.

As a detector valve, either for grid leak or anode bend rectification, when followed by resistance capacity coupling.

In high frequency amplifiers where a circuit with some form of stabilising or damping is employed.

Approximate Data:

Filament volts	2.0	*Magnification factor	35
Filament amperes	0.1	*Impedance (ohms)	35,000
Anode volts (max.)	150	Mutual Conductance (Ma/v)	1.0

* Taken about anode volts 100, and grid volts 0.

Code Word: IVTOB.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., MARCONI HOUSE, STRAND, LONDON, W.C.2.

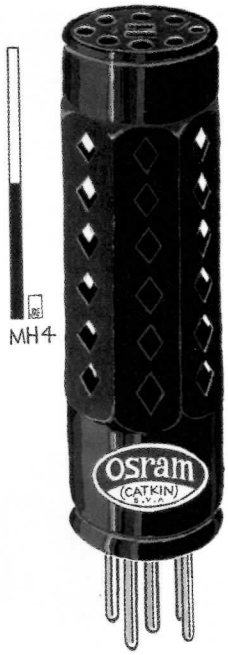
FEBRUARY, 1931

Above: H2: first M-OV valve using oxide-coated nickel 2-volt filament.

Below: Catkin Ad

Middle: MH4/K: Catkin version of the general purpose triode.

MPT4/K: output pentode of the Catkin type.



temperature of the filament would be raised by switching on the heaters or filament to a level about 200°C higher than normal operational temperature for a few minutes to 'activate' the cathode. Getters were fired by ECH and the valve sealed off.

Catkins - an Intriguing Cul-de-Sac

In early 1932, M-OV introduced a entirely new design of receiving valve which was christened the 'Catkin' as a rather obvious reference to its appearance as a small-sized CAT. Catkins made up a near complete set of valves for the construction of a superhet wireless set and included, for example, the MH4/K screened-grid rf tetrode and the MPT4/K output pentode. Later, around 1934, a few 2-volt battery valves were made using the Catkin principle, which became known as 'Batkins'. The HL2K was a case in point.

The Catkin was, in its time, revolutionary in both concept and design; in some ways ahead of its time, in others eccentric and ill-conceived. Whatever, it remains one of the most fascinating blind alleys in the evolutionary tree of valve development. Like the 'Round' valve and the KL1, the new valve was technically successful and possessed a distinctive character and appearance, as can be seen from the illustrations. It was the sort of valve that collectors love to possess because of the completely unique appearance and styling.

The outstanding feature of both big brother and baby brother was the external anode which had the distinct advantage that it could be effectively cooled by air or liquid, but the equally clear disadvantage that large portions of the valve were exposed at anode potential; the anode was painted with an insulating lacquer which offered some, though not very convincing, protection. In the event, this feature proved of little consequence in the protected professional environment of a broadcast transmitting station but a more serious drawback when used in a domestic wireless set. Because of it, Catkins were nearly always supplied with an outer earthed screen, as shown in the illustration, the main exception being the high-power audio output type, MPT4K, for which the screen was often omitted.

Because of the use of an accurately formed anode structure, Catkins can claim to be the first receiving valves to be constructed to precise engineering dimensions and this impacted favourably on the spread of valve characteristics, justifying the claim that Catkin valves could be exchanged without adjustment to the set. The case is adequately made by control curves published at the time (ref 4), as illustrated, which show how much more tightly controlled were the operating characteristics of the Catkin as compared with its conventional equivalent.

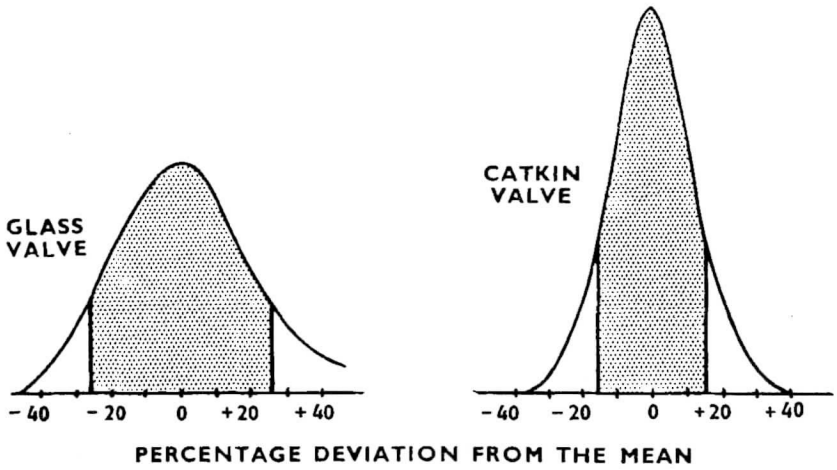
Catkins were significantly smaller than their conventional glass-envelope contemporaries and of quite different shape as can be seen in the illustration. They were even more different in internal construction, as the cutaway drawing taken from publicity material at the time will illustrate. It is interesting to note in this regard that construction methods were themselves considered valuable publicity at the time and avidly studied by schoolboys and adults with a lingering sense of curiosity.

Although the Catkin design remained in manufacture for only a few years, its innovative features generated much interest in other valve designers and it was instrumental in stimulating consideration of forms of construction quite different to the prevailing conventional glass envelope design. There is little doubt, for example, that the metal envelope valve of M-OV's American cousin, RCA, was an outcome of these considerations. Furthermore, the experience gained, and new techniques developed, in designing the Catkins was put to good use in a new generation of very high frequency valves which were to be of such crucial importance in the years leading up to the Second World War.

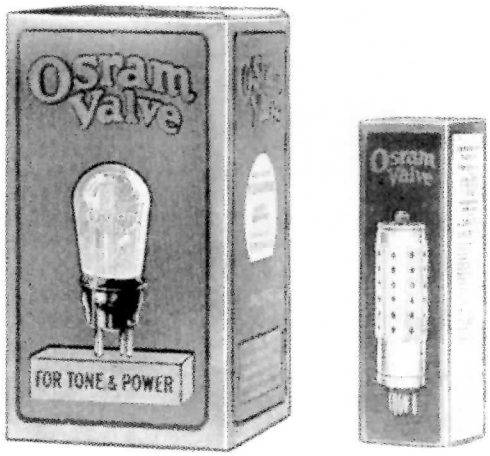
In a bizarre twist to the story, Catkins continued to be manufactured and sold long after the type had been rendered obsolete. The reason for this apparent paradox lies in the fact that glass envelope valves, e.g. HL2/K, with the same performance, electrode structure and compatible base were introduced and sold under the Catkin trademark directly the metal anode valves were withdrawn. The subterfuge was perpetuated when the valve was redesigned with smaller conventional base, pinch and electrode mounting structure, by which time the only remaining resemblance to the original was the name!

Audio Output Beam tetrodes - the KT Series

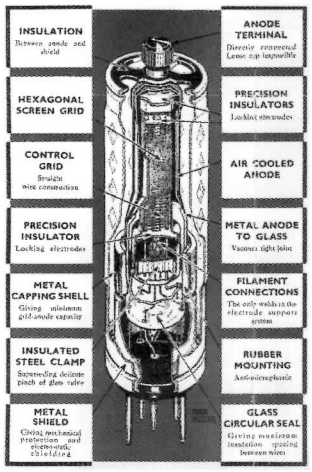
Screened grid tetrodes like the MS4, although excellent hf amplifiers, suffered from secondary

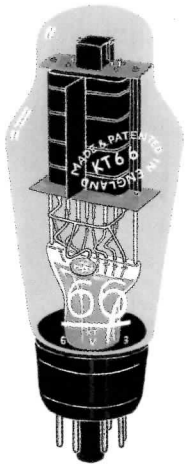


Diagrams showing the tighter control of characteristics of the Catkin design.



Catkin carton compared with that of conventional equivalent.





emission which put a kink in the operating characteristic and which made them unsuitable for use as power output types. The invention of the 'critical distance' tetrode (in which the distance between anode and screen was arranged in such a way that the space charge suppressed secondary emission from the screen) and the pentode provided not only the possibility of large anode voltage swing, and thereby output power, but also a considerable improvement in sensitivity.

The Philips pentode patent raised serious issues for other manufacturers. Out of adversity, however, came triumph because the work devoted to avoiding the Philips patent led directly to the invention of the beam tetrode by C S Bull who was working for M-OV's parent EMI, see British Patent 432932. Valves made to this design were marketed by M-OV under the type reference 'N40'. Bull's device proved difficult to assemble but the basic design when worked on by the engineers at RCA and M-OV emerged in 1936 as the classic audio output tetrodes, RCA 6L6 and the M-OV KT66, a story to be told in greater detail elsewhere. Incidentally, the KT66, when anode and screen are connected together (triode connection), has a characteristic almost identical to the earlier classic PX4 directly heated triode. The Americans described this new class of valve as beam tetrodes but M-OV, uniquely, hung on to their own graphic terminology 'Kinkless Tetrodes'. The KT series was expanded to cover audio output functions in all types of wireless, car radio, television and, of course, guitar amplifier and PA systems and remained in production for the next fifty years. Their characteristics as the power amplifier in audio systems have never been surpassed and original valves, still working today, are highly prized.

DETs

There is one further category of valve emanating from the inter-war period that needs to be mentioned - the DETs (Dull emitter Transmitting valves). In the receiving valve world, the change from bright to dull emitter happened suddenly and with dramatic impact. The reduction in heater power came as a major advance that could be readily appreciated by the guy whose job it was to have the family accumulators recharged. By contrast, the introduction of lower power filaments in transmitting valves came about so slowly that oxide coatings and indirectly heated cathodes were often available and were sometimes preferred, depending on the application.

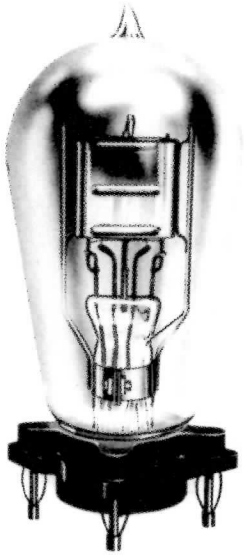
The term 'DET' has two meanings in our story. It was the name given to a famous series of innovative, medium power transmitting valves developed by M-OV-HRC starting from the DET1 and ranging up to the DET40, each in its way state-of-the-art. It is also a generic term covering any transmitting valve incorporating a dull emitter such as, for example, the water-cooled CAT27 and many of the air-cooled ACTs. It also embraces the parallel TT series of tetrode devices such as the TT11, used famously in the Spitfire radio, and the PT pentode devices with numbers stolen from the receiving valve series from which they were derived. Also, there were a few high power audio amplifier triodes, like the DA100 and DA250; the 'talkie' valves, which could be used as modulators but which became better known in application to high power PA and cinema systems where they were often used in push-pull pairs. In addition, there were whole series of rectifiers covering both conventional hard vacuum devices carrying the U label and mercury vapour rectifiers using the GU label (G for Gas).

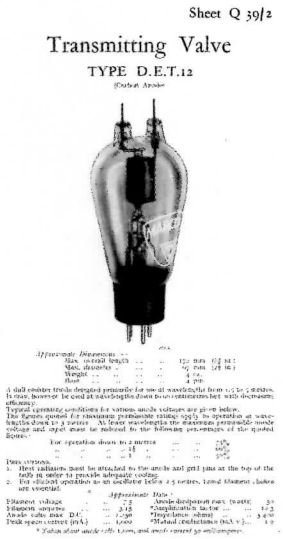
The DET series is striking in that it covered more than thirty years of wireless needs and a wide range of evolving valve fabrication techniques. In consequence, it is difficult to find a short phrase to describe the DET series but we think it fair to say that the members of the series generally track the evolving state-of-the-art in small transmitting devices as the demand moved upwards in frequency over this period towards the microwave region.

Here are short descriptions of just two members of the DET series dating from the inter-war period.

DET1 (POVT25, VT25), see the illustration: designed by M-OV-HRC around 1924 was the first thoriated tungsten filament transmitting valve, certainly in this country, possibly in the world. It was a conventional triode with flat nickel anode, ribbed for strength and an anode capable of dissipating 35 watts at anything up to 1,000 volts. The cathode operated at 6 volt, 1.9 amp. The valve had a pear-shaped bulb with seal-off pip on the top and sported the characteristic square 4-pin base as required by the Royal Navy. Originally this base was handcrafted out of relatively thin fibreboard but later a more substantial moulded plastic was used. The valve was suitable for use in long or medium-wave self-oscillator circuits and also as a power amplifier or modulating valve. As a power valve it soon became a favourite with experimenters, replacing the smaller 10 watt LS5. The relatively low filament consumption made it attractive for airborne equipment and it was adopted by the Air Ministry as type VT25. A few years later, a short-wave version (DET1SW) was produced. When, in later years, the VT25 was required in larger quantities for rugged military service the fragility of the carburised filament caused considerable losses so the valve was redesigned as the DET25, a plug in replacement with a nickel ribbon oxide filament of the same rating but about five times the length of the thoriated tungsten original. As a result the DET25 was built with 'M' filament replacing the 'V' form and much larger grid and anode cross section; the anode of carbonised nickel, in particular, was so large that it could only just

Top left: Catkin construction, cut-away drawing.
Centre left: HL2K: all glass Catkin of 'conventional' type.
Lower left: KT66: classic M-OV audio output 'Kinkless Tetrode'.





Far left: 6L6: classic RCA Beam Tetrode closely related to the KT66.

Centre left: DET1: first dull emitter transmitting valve.

Left: DET12: starting point for RDF.

be inserted through the neck of the bulb.

DET12, see the illustration: a very unusual triode using thoriated tungsten filament but with both grid and anode brought out on top wires, hence its unique appearance. In its original form, it was a near copy of an American design but was subsequently improved. It had a high temperature cylindrical carbon anode capable of dissipating 50 watts; very high for a valve only 15 cm high. It was strongly recommended that external radiators be attached to both grid and anode leads to assist cooling. The device was specifically designed for short-wave performance. A pair of these valves in push-pull could generate 30 watts at 1.5 metres, much more at longer wavelengths; pretty much state-of-the-art at the time. The device earned an elevated place in history when it was used as the pulsed oscillator in early RDF (Radio Direction finding - later known as RADAR) trials in which it could produce a kilowatt or more of peak power at 200MHz, albeit at low duty. As such, the DET12 became the starting-point for the design of the famous micropup valves that were to power the metric radars of such critical importance in the Second World War. It also found favour in early developments of UHF wireless transmitters for police use in which the DET12 was used as the transmitter in the base station whilst the mobile receivers used the DET19 (CV19) (equivalent to the Raytheon valve RK34).

All in all, the DET series, in its generic form, represents a most impressive sequence of contributions to the electronics revolution. It embraces advances in construction technique and device performance over a very wide range of types, in particular, the move towards higher frequency. The DETs were important in their own right but can also be seen as stepping stones on the route towards the development of microwave valve technology.

Summary

The inter-war years witnessed a revolution in communications brought about by the inception of wireless broadcasting and its development. To a major degree broadcasting became possible, and advanced at a pace determined by the developments taking place in valve technology. This was as true of the high power transmitters as it was of the wireless sets themselves. M-OV played its full part in both.

The state of the art advanced continuously throughout the period with the emergence of new technologies, new devices and new production methods. From the technological point of view, there was a particularly fertile decade starting from around 1922 in which emitter technology was transformed from early bright emitters to the indirectly heated oxide-coated cathodes that were to become the norm for the next fifty years.

The period also saw the realisation dawn that the new electronics, founded on the thermionic valve, could be applied in the service of entirely new systems: television, radar, instrumentation, computers. M-OV was to play a major role in these too - but that's a different story.

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All in all, the DET series, in its generic form, represents a most impressive sequence of contributions to the electronics revolution. It embraces advances in construction technique and device performance over a very wide range of types, in particular, the move towards higher frequency.

BOOK REVIEW

The Inventor of Stereo: The Life and Works of Alan Dower Blumlein
by Robert Charles Alexander
Focal Press 1999 ISBN 0 240 51577 3
About £30

Robert Alexander is to be congratulated on producing a long awaited and much overdue biography of Alan Blumlein. The story is compelling and generally well told. He brings life to Blumlein's brilliant work on telephony, stereo, television and radar as well as giving us a glimpse of the man himself. He also covers the sad history of previous attempts at a biography and the commemorations of his tragic death in a wartime air accident.

The book is not quite what it might have been. It might be construed as carping that so much space is given to the background of radar development with which Blumlein had no connection. There is also a certain amount of repetition of detail. My main criticism is the apparent lack of editorial input and the book has suffered badly here.

Many writers are guilty of saying "*Institute* of Electrical Engineers" though the correct "*Institution* of Electrical Engineers" is also to be found in the book. To make Emitron tubes from "Perspex glass" sounds like a difficult endeavour and the explanation of the long tail pair amplifier is strange indeed.

These are a just a few examples of items that need attention if there is a second edition.

Rather like buses, biographies of Blumlein seem to come in twos. It will be interesting to see Professor Burns' volume which should be available by the time you read this. Alas, the £60 price tag will be a deterrent to most.

Jeffrey Borinsky MIEE CEng

The early history of wireless sparkles with personalities whose names ring out over the years with resonances that canít help but whet our appetites. Maxwell, Hertz, Marconi, Lodge, Popov, Bose, Braun and Branley have become major signposts of that remarkable development that culminated with wireless telegraphy in the closing years of the nineteenth century. As we move out into the twenty first century it is worth remembering yet another name that is all too frequently missed from this roll of honour, Captain Henry Jackson.

Henry Jackson. Pioneer of Wireless Communication

by A.R.Constable

Henry Jackson was at the very centre of wireless development at a time when everything was up for grabs. All the wonderful theoretical and experimental work of Hertz was well understood by only a few scientists and engineers. These people were known as Maxwellians and, with all their understanding of Hertz, they were not really looking for a means of communication. Their interests lay rather in refining their understanding of the theoretical work of Maxwell in the light of the brilliant experiments of Hertz which, in 1888, demonstrated conclusively that simple electrical circuits could generate electromagnetic waves which propagated through space with the speed of light and could be detected with small sparks generated in resonant receiving loops.

Henry Jackson was perhaps the very first man to begin thinking that these Hertzian radiations might be used for communication between ships at sea. In a letter to Vice-Admiral J.A.Fisher dated 28th November 1900 (1) Jackson stated quite clearly that this application of Hertzian waves came to him in 1891. He did not immediately begin experimental work and had no opportunity to do so as the demands of his regular naval commitments made this impossible. But we can be fairly certain that the idea continued to germinate as the work of Hertz disseminated throughout the engineering world. Jackson's early appreciation of the possibilities of Hertzian wave wireless telegraphy rank him with the other men whose insights have been well recorded such as Richard Threlfall in 1890, William Crookes in 1892 and, most importantly, Alexander Trotter who very pointedly suggested the use of Hertzian wave signalling in 1891 (2) at the time when the campaign for improved coastal communications was under way.

Henry Bradwardine Jackson was the son of a farmer and was born in Barnsley, Lancashire, in 1855. At a young age he decided on a career in the Royal Navy and joined the service in 1869 just before his 14th birthday. He trained in the torpedo branch and thus came into contact with the world of science and engineering more thoroughly than was possible in any other branch of the Royal Navy at that time. He received some early technical training at the Torpedo School at HMS Vernon but was not a trained scientist or engineer in any conventional academic sense. In this important branch of the navy, he gained considerable experience in electrical science and telegraphy and was elected an Associate of the Society of Telegraph Engineers (which later became the IEE) in about 1883.

Many years passed in routine naval duties before Jackson was appointed in 1890 to the Command of HMS Vernon, the Royal Navy's Torpedo School where the latest developments in modern electrical technology were taught and practised. One of the major tasks confronting naval officers at that time was how modern fast torpedo ships could communicate friendly intentions as they approached their parent ships. At HMS Vernon enthusiastic naval personnel attempted to solve tactical problems using modern technology and

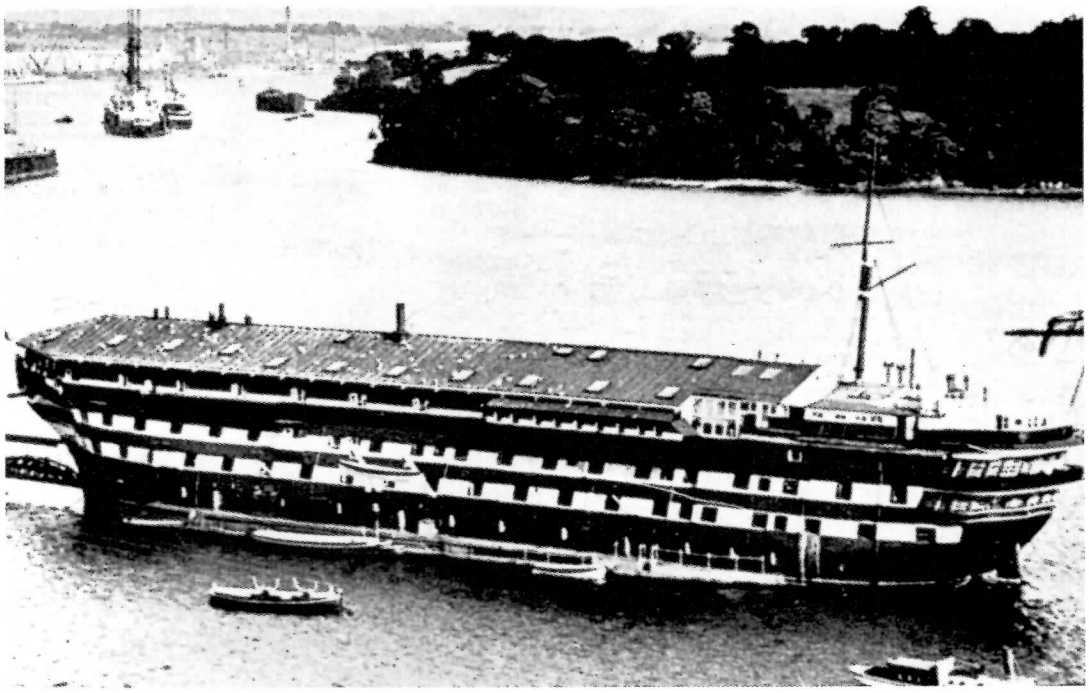


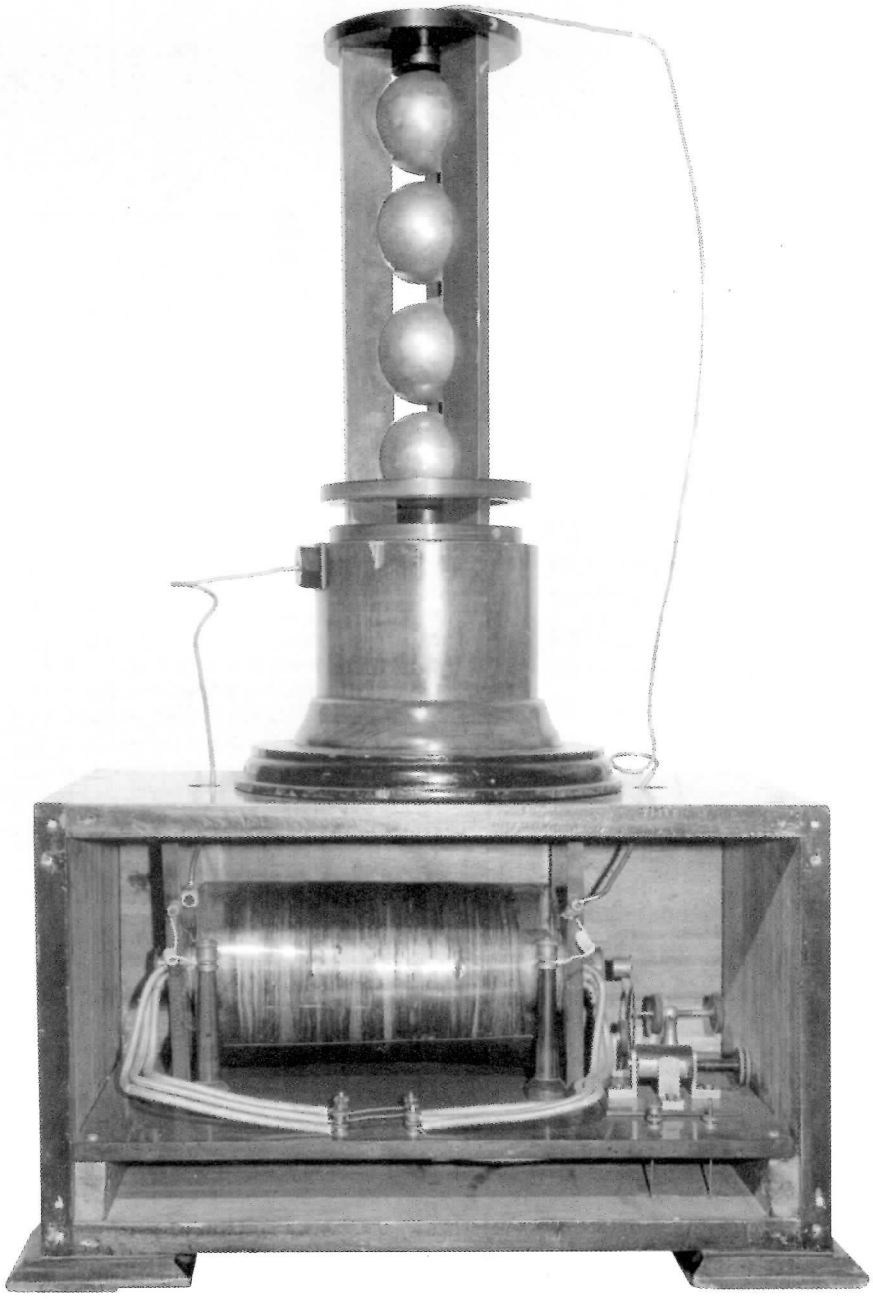
Fig.1 HMS Defiance moored at Devonport in 1897. Captain Henry Jackson carried out his original wireless telegraphy trials aboard this ship from December 1895 and developed useful signalling apparatus in the early months of 1896.

Fig.2 The transmitter used by Captain Jackson. This equipment is a 'model' of Jackson's original transmitter and is of unknown origin. It is presently at the Communications Museum at HMS Collingwood.

the whole problem of communication at sea was treated with the utmost seriousness. The officers on board HMS Vernon were dedicated to finding a solution to the problem of developing, "...a system of recognition signals between ships and boats"(3, p.35). In this energetic atmosphere and with this very problem in mind Jackson turned his attention to the recently discovered Hertzian waves.

It is not at all surprising that Hertzian waves should be looked at for a possible solution to the urgent problems of communication at sea. It is only surprising that others were so slow at making the connection. However, Jackson failed to take the bold initiative of setting up experimental test rigs, probably because naval duties kept him far too occupied in other matters. Pocock and Garratt, in their splendid booklet The Origins of Maritime Radio, point out that it might at first appear surprising that a young naval officer should have been sufficiently well informed about Hertz's experiments less than three years after their completion (4, p.3). It is true that the work of Hertz was mainly reported in learned publications and press coverage was infrequent and not very informative. However, one must suspect that Jackson as well as other Naval Officers in the Torpedo Branch would have read The Electrician in which G.F.FitzGerald's stimulating address to the 1888 meeting of the British Association (5) announcing Hertz's experimental success was reprinted in September1888 and in which frequent reference to the Hertz experiments appeared many times thereafter. Pocock (3, p.89) and Pocock and Garrett (4, p.4) point out the very interesting fact that Jackson married Florence Burbury, the daughter of Samuel Burbury, in 1889. Burbury was a competent mathematician and, with Henry Watson, had written a significant treatise on Maxwell's electromagnetic theory (6).

This treatise was in two parts and the authors claimed it would help students to understand Maxwell's theories better than Maxwell's own texts which were far too detailed. The first volume dealt essentially with static electricity and appeared in 1885 while the second, which dealt with currents, displacement currents and Maxwell's Equations, appeared in 1889. The date of appearance of the second volume is significant because it was less than a year after Hertz had completed his outstandingly successful series of experiments on electromagnetic radiation. Both authors of this new treatise were mathematicians and their approach was somewhat theoretical, but in the forword to the second volume as well as in two or three sections within the text, they refer to the new work of Hertz emphasising how, "...within the last two years"



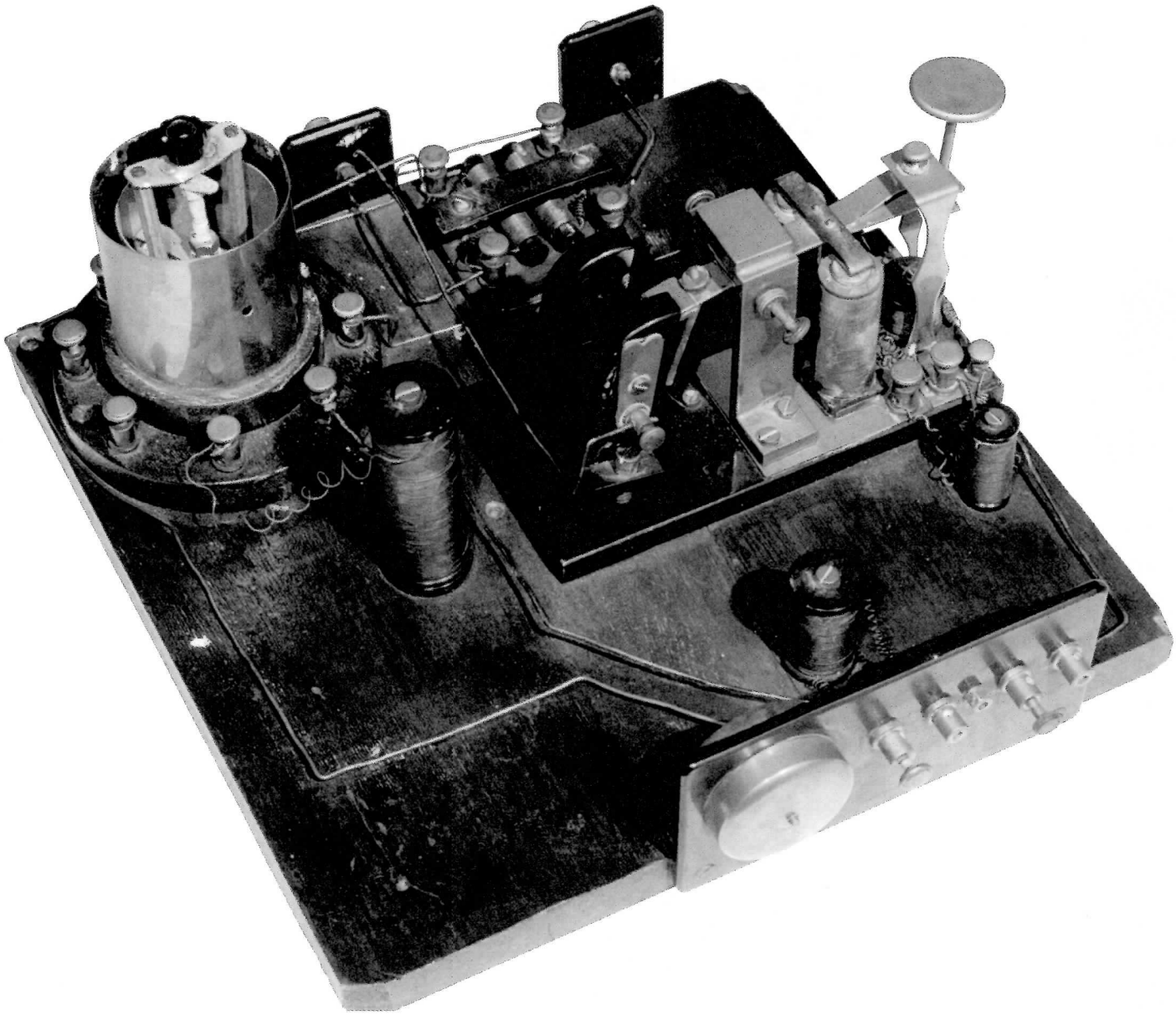


Fig.3: The receiver used by Captain Jackson. This equipment is also a non-working model of Jackson's original receiver. Its origin is unknown but it was obviously made as a careful reproduction of the original and almost certainly uses some of Jackson's original components. It is also at HMS Collingwood.

mere theory has now become a practical reality". They also noted that Hertz's findings had been completely verified by the work of Oliver Lodge and Gerald Francis FitzGerald. Thus it is well documented that Burbury, Jackson's father-in-law, was fully aware of current developments brought about by the central characters in the pre-history of radio.

When Jackson was not at sea, one can be fairly certain he would have had extensive discussions with his father-in-law on the subject of electromagnetism, on the experimental work of Hertz and Lodge and on the authoritative pronouncements of FitzGerald in September 1888 (5) on the work of Hertz. Jackson was close to the action. He was not only one of the few men of the time who was aware of the scientific significance of the Hertz experiments; he was, by virtue of his appointment to HMS Vernon, committed to looking for a solution to the problem of communications at sea. What a combination!

Despite this privileged position and his own very promising insight, Jackson seems to have missed a golden opportunity, largely due to his constantly changing naval postings. No immediate action was taken.

William Crookes wrote his famous article in the Fortnightly Review in1892 (7) outlining with remarkable prescience how Hertzian waves could be used for telegraphic communications and even how different stations might be selected with tuned circuits. In June 1894 Oliver Lodge delivered a much publicised commemorative lecture a few months after the death of Hertz in which he demonstrated a compact Hertzian transmitter and filings coherer receiver. Lodge's system could have provided a new starting point for Jackson, as it did for so many others, had he not been away on foreign service where it is highly unlikely that news of the demonstration would have reached him. Lodge's 1894 demonstration was fully reported at the time in the June and July issues of The Electrician (8) but Jackson stated at a later date (1) that he was totally unaware of this work until after his own initial attempts at wireless communication.

Early Experiments

Jackson eventually found an opportunity to carry out experimental work with Hertzian waves when, in 1895, he was given the command of HMS Defiance at Devonport, an old wooden hulk which had been re-commissioned in 1884 as a torpedo training ship. At this time Jackson became aware of the work of Jagadis Chunder Bose, an Indian physicist from Calcutta, who published his experiments in 1895 and described a multiple spring coherer for the detection of his very short Hertzian waves (9, 10). Bose repeated some of Hertz's observations using millimetre waves in an attempt to bridge the gap between Hertz's longer waves and the optical frequencies which were also believed to behave according to Maxwell's equations. While Bose was familiar with Lodge's 1894 demonstrations of the coherer, it seems that Jackson was completely unaware of them.

In his letter to Admiral Fisher (1), Jackson said he

became aware of Bose's coherer in 1895, "...through reading some of Dr. Bose's experiments..." He then began work at HMS Defiance straight away in December 1895. He used primitive equipment consisting of a 'toy' induction coil and a spring coherer of the type used by Bose. With such a humble start he was able to establish the feasibility of the method and proceeded to construct more elaborate equipment with which he carried out a series of important signalling tests on board the Defiance during the first few months of 1896. In March of 1896 he read the reprinted version of Lodge's 1894 commemorative lecture published in the form of a slim booklet by The Electrician with the title, "The Work of Hertz and Some of His Successors." This encouraged him to develop his apparatus further using some of Lodge's methods. It is possible that Lodge's suggestion of decohering by using the bell vibrations transmitted through the mounting board prompted him to develop his tapper decoherer which was very similar to those used by Popov and Marconi. Jackson stated that he got no impression at all from the written account that Lodge had the idea of signalling in mind. This is not at all surprising because the subject had not yet been mentioned in any of Lodge's publications relating to his 1894 demonstrations and it certainly did not appear in the reprinted version of Lodge's commemorative lecture.

By July 1896 Jackson had a simple but fully working system and on 20th August 1896 he successfully transmitted and received signals on board the Defiance and the initial attempt appears to have been across the after-cabin of the ship - a distance of just a few metres. Jackson used pitch lenses and he also used an aerial. About a week later Jackson extended his trials along the length of the Defiance over a distance of some 50 yards.

As we know, Marconi was busily developing his own apparatus at this time. Marconi arrived in England with a complete set of working equipment and acquired a letter of introduction (dated 30th March 1896) to William Preece, Engineer-in-Chief at the Post Office. He gave various informal demonstrations, took out a provisional patent on 2nd June 1896 and gave a first formal demonstration over a distance of several hundred metres to Post Office officials in July 1896.

Clearly, Jackson and Marconi were working simultaneously on the same problem - the application of Hertzian waves to telegraphic communication. Jackson's superiors were not much concerned with his work and chose to do nothing about it until later in the year after Jackson and Marconi had met each other at a conference held at the War Office on 31st August 1896 where Jackson was in attendance as the Admiralty observer. Thereafter, Jackson's work aboard the Defiance continued with the full support of the Royal Navy.

The ideas and work of Jackson are obviously of great historical importance. He fully appreciated how far Marconi had advanced, particularly in his use of a sensitive coherer and relay for signal detection. Jackson encouraged Marconi and went out of his way to bring him to the favourable attention of the Admiralty.

Jackson's Surviving Equipment

Many publications show illustrations of the equipment used by Henry Jackson and it is sometimes stated that it was used on board HMS Defiance (Fig.1.). We can still see this equipment in the Communications Museum at HMS Collingwood, Fareham, and it is illustrated again for this article. The design of the transmitter (Fig.2.) is certainly very impressive with its four vertically mounted spheres. The receiver (Fig.3.) consists of a coherer, tapper and relay exactly as shown in Jackson's drawings (Fig.4.) of 1897 (11).

But we should not be deceived. This equipment, impressive though it may seem in the photographs, does not stand up to scrutiny. On a recent visit to HMS Collingwood, I was able to get a very close look at both transmitter and receiver.

The transmitter is a moderately well made "model" of Jackson's equipment and shows signs of hasty construction as a demonstration set. Jackson's original transmitters used glass insulators to separate the copper spheres. The model shows no evidence of ever having been made in this way; the spheres rest in circular cut-outs in the three wooden supports. While Jackson's equipment went through various stages of development, I doubt that the spheres of a working transmitter would have been so casually mounted with no effort at insulation good enough for a marine environment. The large induction coil on which the spheres are mounted is an ordinary piece of commercial apparatus and this or a similar one could well have been used by Jackson on board the Defiance or some other vessel. In my view, it is highly unlikely that this transmitter was ever used in practice either on land or at sea. It can at best be described as a "model" - good for public demonstrations - and it photographs well.

The receiver also appears to be reconstructed to represent the general form of Jackson's instrument. It is possible that a few remaining bits and pieces from the workshops where Jackson's receivers were made were hastily assembled to give the overall general appearance of one of the original working instruments. The

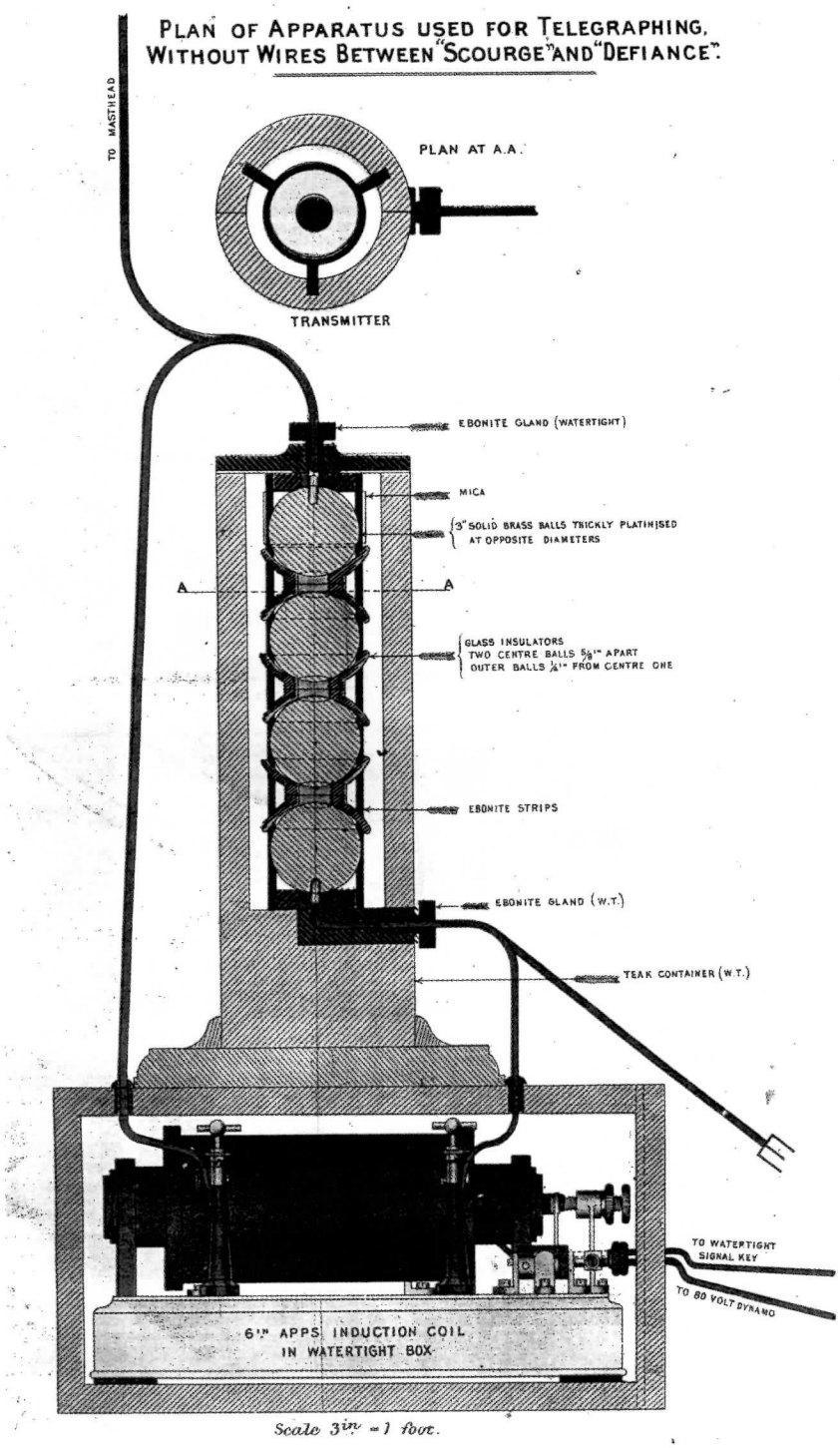
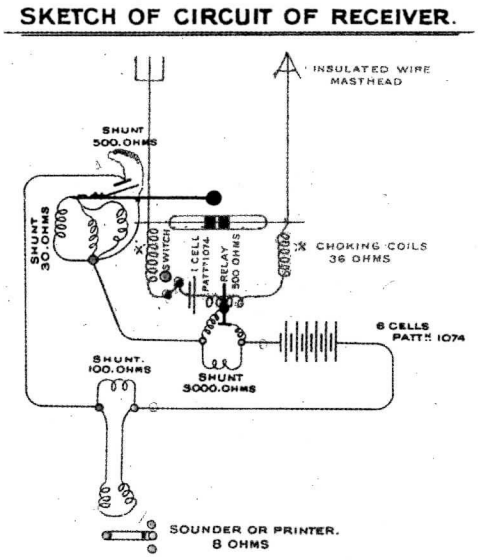
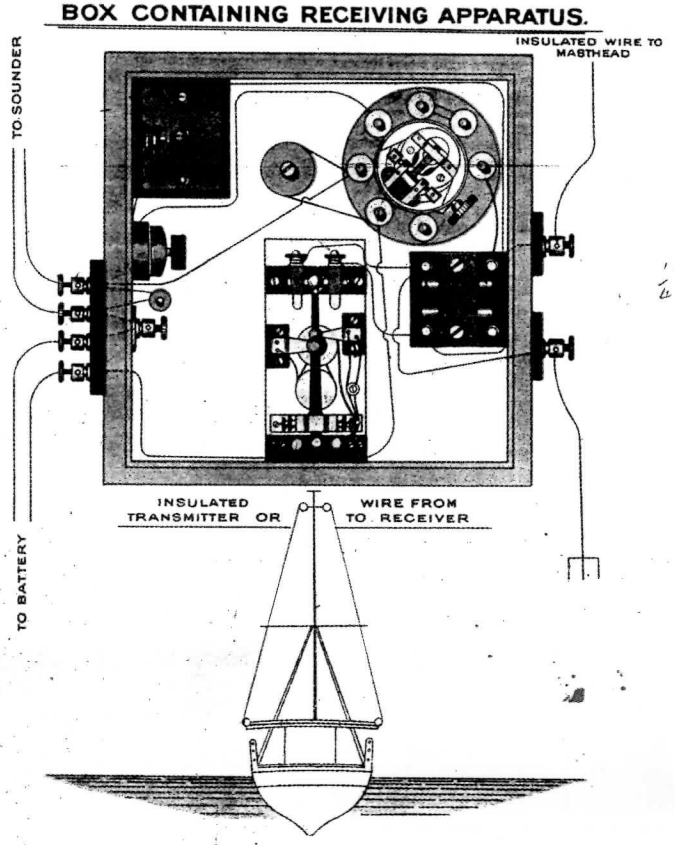


Fig.4: Above and on following page. These drawings of Captain Jackson's transmitter and receiver are reproduced from the Annual report of the Royal Naval Torpedo School for 1897. The diagrams appear at the end of Appendix C in which Jackson reports on "Experimental Telegraphy Without Wires".





coherer is housed inside an ebonite or composition cylinder and the filings tube itself, if it is there at all, is not visible. The adjacent tapper (or decoherer) is probably a true remnant from one of Jackson's receivers. The "relay" is not a relay at all. It is a roughly turned wooden base with an incongruous brass cylinder sitting on top. There are no relay components in the cylinder at all and I doubt that there ever were. Even the terminals around the base are not of the type expected for the style of relay the maker was trying to represent. The absence of a relay is surprising because, no matter when the model was made, it would have been a simple matter to find a suitable relay. I do not think the receiver ever functioned as such but was genuinely made to resemble an original Jackson receiver. There is no historical record of the origin of this equipment.

The Jackson apparatus now in the communications museum at HMS Collingwood has previously been on display at the Science Museum and HMS Mercury, Petersfield. Photographs have been published widely and often assumed to be original. But in Pocock and Garrett's Science Museum publication (4) the transmitter is referred to as "...believed to be a fairly accurate reproduction..." and the receiver is described as, "...incomplete, the working parts and the cover of the relay being missing. Its origin is unknown and it may also be a reproduction". To go a step further, I am quite confident that neither the transmitter nor the receiver were ever in use at sea and are unlikely to have been used on board the Defiance and I am sure the working parts of the relay are not only missing but have never been present in the poorly made housing that simply looks like a relay when seen on photographs.

However, it is remarkable that we have got anything at all of this important but fleeting event in wireless history. Jackson continued to develop his equipment for a few years after his initial trials and even redesigned it to resemble Marconi's apparatus more closely in order to avoid unnecessary complications when Royal Navy personnel switched between the two systems. By 1900 it was evident that Marconi sets were more reliable and capable of transmitting and receiving over greater distances than could be achieved with those sets designed and made to Jackson's specifications in the Royal Navy workshops. In October 1900 the Royal Navy formally adopted the Marconi system though it was some time before Marconi sets would outnumber Jackson's on board seagoing vessels. At the time there would have been no reason to keep a working model but, many years later, a model may have been required for an exhibition and would only then have prompted the re-make of the original Defiance version that is now all that exists.

The navy, through the work and stimulus of Jackson, played a very prominent part in the introduction of wireless telegraphy - an even more prominent one than the Post Office. In the very early days William Preece and the Post Office were not very interested in sponsoring Marconi's efforts as a means of communicating over long distances and thus competing with cable telegraphy. But the Royal Navy, through the efforts of Henry Jackson, was, from the outset, fully aware of the potential of wireless communication between ships of the fleet. It was largely Jackson's efforts which brought the Marconi Company into prominence as the provider of a fully working communications system, one which utilised the most reliable transmitters and receivers available.

He played a major role in bringing the idea of wireless telegraphy to the attention of the Royal Navy

The later years

Jackson continued to take an interest in radio communication for the rest of his life. He was elected a Fellow of the Royal Society in 1901 and was an active member of the Institution of Electrical Engineers. During the first world war, he was promoted to the highest naval offices; Admiral of the Fleet and First Sea Lord. He retired from active duty in 1919 and then became Chairman of the Radio Research Board of the Department of Scientific and Industrial Research.

Jackson was also President of the Wireless Society of London for 1922, the same year that the Society changed its name to the Radio Society of Great Britain (RSGB). Also in the same year the Marconi transmitter at Writtle, Chelmsford, began the all important speech and music transmissions for the benefit of amateurs, broadcasting from 2LO commenced and the British Broadcasting Company came into being. Jackson's presidency of the RSGB coincided with rapid changes in the history of radio in this country. He was thus, once again, at the very centre of pioneering radio developments.

Jackson died on 14th December 1929 at his home on Hayling Island. His role in the early days of wireless communication is now fully established and, although Marconi is rightly considered the inventor of Hertzian wave wireless telegraphy, Henry Jackson made his own independent start along an identical pathway with the specific objective of establishing a means of telegraphic communication at sea. He played a major role in bringing the idea of wireless telegraphy to the attention of the Royal Navy and an equally important role in establishing the predominance of the Marconi system

primarily for naval use but which quickly progressed into general commercial applications. His place in radio history ranks far higher than is generally acknowledged.

Acknowledgements
First and foremost I want to thank Rowland Pocock whose long years of research into the history of Naval communications has provided a wealth of easily accessible information on the subject of Jackson's life and work. He has brought the work of Henry Jackson to the attention of historians with his well known publications and lectures on the subject. I must also thank Lt Commander William E. Legg who, as curator of the communications museum at HMS Collingwood, permitted me to examine the models of Jackson's equipment and the Annual Reports which included Jackson's original drawings.

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Repair of an Aerodyne 302

by Gary Tempest

This radio, which is actually nicer than it looks in Fig. 650 of R.R, came my way, as a gift, after spending years in a garage. I was pleased to have it, as it would seem to be quite rare, leastwise I have yet to see another one. It must have been a damp free garage as the condition was not too bad. The cabinet needed refinishing but no delamination had occurred and there was no sign of worm. The chassis also was free of rust and has cleaned up very well.

The set dates from around 1945 and is a conventional AC/DC, 3 band superhet using a resistive line cord. I was a little suspicious when the previous owner remarked that it had one of these; not that he described it in exactly those terms. What had caused this single fact to be lodged in memory? BANG! perhaps. The cord was open circuit but the series valve heaters were still continuous. However, the dial lamps weren't and their shunt wirewound resistor was charred black and open. Repair proceeded with replacing this and the usual capacitors.

Finally what to do about the missing line cord. An ordinary mains dropper, inside the cabinet, would dissipate too much power. In Volume 22 number 3, Autumn 1997 of the Bulletin John Ounsted in his excellent article on repairing the Alba C112 had considered most of the options. His eventual solution was to use a series diode and resistor. The diode loses half of the AC cycle so the resistor only has to drop a smaller voltage and thus dissipate less power. To a simple man cutting out half cycles of a 240 v R.M.S. waveform would give 120 v R.M.S! Clearly this can't be right as the valve heaters, in John's case add up to 145 v R.M.S. The article did not address this conundrum only giving the resistor value to use for his specific case. With a little searching I found that the actual R.M.S. value is 240 v divided by the square root of 2 which equals 170 v. But where does this come from I hear you ask? Well at least I did. Unfortunately, I could not find a simple way of proving this (see next column). I had to resort to getting out an old college maths book and dwell on stuff not looked at for over thirty years. Basically, it entailed learning again how the R.M.S. value of an AC waveform is derived and then modifying the solution to suit the half wave case. For those of you who have been this way before and are interested I offer an explanation: see the Appendix.

Well at that time, as said, I couldnít think of a simple way of proving this. However, I just happened to mention this article to Jeff Borinsky, at the last Harpenden, who could. What is true is that the rectified half wave generates half the power that the full wave does into the same load.

So 240 squared / R = P and Vrect.(RMS) squared / R = P/2

Equating these gives 240 squared / R = 2 x Vrect.(RMS) squared / R

Thus 240 squared / 2 = Vrect.(RMS) squared and taking square roots gives

240 / square root of 2 = Vrect.(RMS) = 170 v.

Back to practicalities. For the Aerodyne, the valve heaters and dial lamps add up to about 100 v R.M.S. and at a current of 0.2 A this would mean the resistor in series with the diode would still soak up 14 W. A possibility not considered by John Ounsted was the use of a series capacitor instead of a diode and resistor. It has the advantage that the capacitor consumes no power. I had read about this in the Radiophile Magazine. Motor start capacitors were recommended, as they are non-polarised, cheap and easy to obtain. I still needed to calculate a value but at least this time I did not need to use integral calculus. The final circuit and calculation are shown below.

Maplin Electronics has a motor start capacitor of 3 micro Farads +/- 10% rated for 240 v use.

The capacitor value was likely to be larger than the optimum value (2.92 micro Farads). Thus some additional series resistance R1 may have been required to get the total voltage across all valve heaters correct. R2 is simply a safety resistor to ensure C cannot be left charged if the radio is unplugged.

If I had had a Variac I would have applied power using this. Without it, I put R1 at 150 ohms 7 W with a meter reading the total heater voltage. In the event I was able to reduce R1 to 100 ohms, which wastes only 4 W. Note that the voltage across C and that across R1 and the valves will not add up to the mains input voltage. The voltage across C lags by 90 degrees and so the vector sum is required. It's that square on the hypotenuse stuff again. Take the square of the voltage across C, add it to the square of the voltage across the resistive elements and then take the square root of this: it should equal 240 v.

I replaced the volume control with its single pole switch with a double pole version for safety. The motor start capacitor is mounted alongside it. I always use a 1A fuse in the mains plug. The radio works with typical performance on all three wavebands. All I needed to do now was to re-finish the cabinet (and find a missing knob) but that is another story (or article) as they say. Since writing this article and it's appearance in print, Gerry has kindly found me a replacement knob.

Many BVWS members will have been re-finishing radio cabinets for years and have their own method of doing it. I'm sure there are lots of these but not much, without buying books, seems to be written down in the form of detailed instructions to help the beginner. And then what books do you buy and do they describe it blow for blow, warts and all?

Some publications generalise on the materials to use; perhaps they can't be seen to be making a recommendation of one manufacturer's products over another or maybe they think the items may not be available by the time they get to print. Here for me is the beginner's first problem: there are lots of products out there; which to use and will one work with another? In this article I'm not making recommendations, there may indeed be equivalents to the ones quoted by me, which are equally good or better. Similarly, other long-term members may have other methods of finishing which are easier and as good or better than the ones written about here.

Refinishing Wooden Radio Cabinets

by Gary Tempest

For those of you who have access to the Internet a really useful site is the Antique Radio Forum (HYPERLINK http://www.antiqueradios.com/forum) (www.antiqueradios.com/forum). This is an American site but members participate from all over the globe. The Forum has a section on Cabinet Restoration and here I found an article on "Recreating a 1930's Lacquer Finish". The lacquer here would have been cellulose but I have also tried acrylic and give details of this. Cellulose lacquer would be the finish on almost all radios during the 30's and later. I have tried the method and offer here an anglicised version of the recipe along with my experience. As an alternative to this finish I've also tried Brushing French Polish which is a sort of cross between lacquer and shellac. Details of this are given later in this article. I hope the 'how to' style of writing is not too irritating, it just seemed to come naturally and is in keeping with the style of the article from which my experiments started.

Before contemplating a total strip and refinish it's worth considering carefully whether something less drastic will be enough. It's possible to fill many scratches and dents and then give the whole cabinet a rub over with stain and polish and it can look quite good enough. However, If a lot of the finish is not there or flaking off then you don't have much choice. My first suggestion, if you haven't done a refinish before, is to buy a couple of cheap radios and practice on these first. My start was on three radios, one a gift and the other two bought for less than £10 each. Strangely to some, I like them all very much. The gift was an Aerodyne 302 and the others a Defiant MSH 452 and a National table battery set. I also had a nice but sad speaker cabinet (Stork design R.R Fig. 890) to do something with.

The Defiant has a nice curvaceous cabinet and works after restoring the electronics (including a complete set of new valves!) with greater sensitivity than any radio I have. The National is 60's and has a somewhat brash OTT look. The Aerodyne has areas of different veneers and stain colours. So don't just buy any old cheap radios: buy something that has a character and you like. Doing this for me made the work enjoyable and not a chore. It will hopefully give me the experience to tackle more expensive and, some would say, important items. All materials needed (unless otherwise quoted) are obtainable from Restoration Materials, catalogue free on request, (Reference 1). What to use can be a problem and compatibility between them probably only gained by trial and error. Unless that is you only use one manufacturers products when normally they will inform you. I tried to do this but because of sizes and so on it is not always possible. Initial outlay on materials can be quite high: it's a bit like setting up a kitchen, but you will have a lot of items that will probably last for more radios than you will ever do, alas!

Initial outlay on materials can be quite high, it's a bit like setting up a kitchen, but you will have a lot of items that will probably last for more radios than you will ever do, alas!

Materials list, as used by me
Gel type paint remover – Nitromors works well
00000 Steel wool
Disposable brush
Old rags
Cellulose thinners
Methylated spirits (called Denatured alcohol in the US: denatured by adding blue dye! Thank you Forum)
White spirit (called Mineral spirits in the US)
Rustins Wood Stopping (this is available in a small range of colours but I bought Natural, (cream) as I was doing several items; I reckoned to colour it to suit as needed)
Rustins Grain Filler
Coarse rags

Lint free rags (cotton sheet is good and best cut up rather than torn)
#220 silicon carbide sandpaper
#400 wet/dry sandpaper
#1000 wet/dry sandpaper
Tack rags (wonderful and a must have)
Mylands oil-based wood stain(s) The most useful shades are probably Walnut, Teak, Black and Dark Oak.
Aerosol Cellulose Lacquer Clear Gloss. Have two 400g cans available for 1 mid-sized tabletop cabinet. Morrells, from Restoration Supplies or branches of Morrells, work well. I also tried Simonize from a factor that sells to the Auto repair trade. I would not recommend this; although it's 40% cheaper, the result had far too much orange-peel. I put this down to the can having a very simple nozzle whereas that on the Morrells looks more sophisticated and has a can ball bearing to achieve better mixing of the constituents.

Acrylic Lacquer Clear Gloss if using this instead of the cellulose lacquer listed above. At this time, Halfords do two: Acrylic Lacquer in silver cans (400 ml) and Universal Lacquer in darker silver grey cans (400 ml). The two work equally well.

Morrells Aerosol Cellulose toner sprays. Restoration Supplies have a range of shades even though they may not be listed in the catalogue! (Morrells are the only source in the UK that I have found for these).

2 Blocks of wood wrapped with firm soft cloth (felt or old blanket is fine).
Pumice powder
Lemon Oil
Rottenstone
Rustins Liquid Wax (NO SILICONES)
Shellac or Briwax Shellac Sanding Sealer (see text)
Evo Stick W PVA adhesive
Superglue
Masking tape
Spring clothes peg!
Plenty of old newspapers

Safety

Read instructions on all products first. Remember it's not worth damaging yourself, or someone else, however wonderful the radio and final finish that you achieve.

Wherever possible work outdoors. Stripping, sanding, staining and even lacquering can be done outside. For lacquer work you will need a warm, completely still day. If you're an early riser this time is often ideal. For stripping wear rubber gloves and some sort of eye protection. I use 'specs' for close up work and being careful, found those adequate.

For sanding a dust mask is a good idea but It's of no use with aerosols though. The original Lacquer article said use a "respirator with replaceable filter cartridges". However, over here they are not easy to come by and are quite expensive. When I sprayed inside, on a bench in the garage, I left the adjacent rear door open. You want a fairly still day to allow this and the breeze must obviously be blowing away from the opening. It's possible to get enough spraying done, in one session, whilst holding your breath (assuming you are reasonably fit). A spring clothes peg on the nose makes it harder to cheat but don't let the neighbours see you with it on! When I was gasping for air it was bolt outside taking the aerosol with me. Now I had to remember to clear the nozzle by inverting the can and spraying a couple of quick blasts. After a short while I opened both garage doors and allowed the place to ventilate before another spraying session.
Take care how you dispose of solvent laden cloths; either drop them in water or allow the solvent to evaporate outside before putting in the bin.

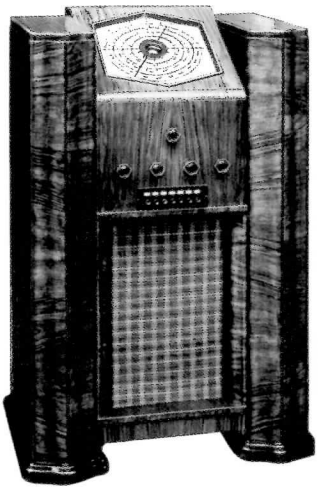
The Lacquer finish method

Stripping the finish off an old set is straightforward. I found it best to work on one face at a time with it horizontal. Use the disposable brush (old toothbrushes are useful for fiddly bits) to spread the stripper. Allow it to work and gently collect it up using an old blunt wallpaper scraper or similar. Clean up with old rag. Once you have done the whole radio it needs washing

off. Make a mix of 50/50 methylated spirits and cellulose thinner and use this with rags and 00000 steel wool. I washed off three times to make sure I got rid of all stripper residues. Now leave the cabinet overnight.

At the next session the first thing is to attend to any loose joints or loose or broken away veneer. Superglue seems to work very well for veneer, which is just loose. Lift it up with a trimming knife and with gravity giving you a hand dribble the glue into the wound. Press the veneer down using a piece of paper which will stick but can easily be sanded away. For broken away veneer clean up the glue surfaces by just gently scraping them with a blade from a trimming knife. Then use PVA adhesive, holding the veneer in place until the glue sets, with several layers of masking tape. Where small pieces of veneer (no bigger than fingernail say) are missing, as in the case of my Defiant, these can be filled with stopping. If the missing pieces are in a prominent place, or larger, then iron on veneer strip can be used. This strip is sold for edging mahogany faced chipboard. I found that I had to use two layers to get the right thickness. However, if cut in accurately and once sanded and stained up with the rest of the cabinet, unless you know where it is, it's quite hard to find! Bad joints can be fixed with Superglue, being most useful for joints that are only partially coming apart. These where possible can be reinforced with additional wood blocks, glued with PVA adhesive, after

Wherever possible work outdoors. Stripping, sanding, staining and even lacquering can be done outside. For stripping wear rubber gloves and some sort of eye protection.



Cabinet refinishing with spray cans is strictly for warm, dry and reasonably still summer days.

cleaning the inside surfaces.

Mix some Rustin's Grainfiller into a thin paste with white spirit and rub into the wood pores. Leave it for a while and then rub off any excess with a coarse cloth. Note that you can add stain to the paste but as it takes up stain readily when dry it's easier to do this. Fill any nicks and scratches with Rustin's Wood Stopping. Again, with this you can add stain but it makes the filler weaker and more likely to chip away particularly on edges. It's better to let it absorb stain, which it does readily, after it's sanded down. Because so much stain is taken up these areas do show (darker) but don't detract too much. If the area has grain you can take a small artists brush and using stain blend in the area with this. Alternatively you can lighten the areas with acrylic paint before lacquering. For the Defiant, which is stained walnut, I used Halfords Rover Maple, just spraying a little into the aerosol can lid, and applying with a small brush.

After grain filling and stopping, again leave the cabinet overnight and then sand lightly with #220 silicone carbide sandpaper until the surface is quite smooth. Wipe down and finally tack rag to remove stray dust particles.

Now apply as close a match of stain, to the original cabinet colour, as you can mix (Mylands oil based stains can be blended) directly into the wood. It's a good idea to test a small area on a side first. Colour matching is difficult so do take photographs of the original finish before stripping or use colour charts matched to it that you can refer to: don't just trust your memory!

I was not aiming to get an exact match, just a pleasing approximation. The stain can be applied by brush but it's better to use a lint free cloth, which gives a more uniform appearance.

The original Lacquer article said make a thin sealer coat of one part shellac and 5 parts of methylated spirit. (I was unable to obtain shellac and used Shellac Sanding Sealer instead). Then paint the surface of the cabinet with this sealer coat, which dries very quickly. Now if needed another coat of stain can be applied if the correct colour was not achieved at the first attempt. Different colour stains can be used sandwiched between sealer coats. If you don't seal them the solvent in the fresh stain will start to dissolve the previous coat and rub it up. I had problems here as the sealer coat rubbed up the stain slightly anyway (methylated spirit will dissolve Mylands Stain) and gave a somewhat streaky finish. I asked the Forum about this and they thought it might be because I used Sanding Sealer rather than shellac.

I talked to a local refinisher who said that he did not like this stain build up method. He was old fashioned and reckoned that stain should go into the wood. Also, that by layering stain and sealer and lacquer you were mixing coatings of various hardness. What this exactly has to do with it I'm not sure but it's probably part of the folk lore handed down by re-finishers. Anyway, I like to keep things simple and, to me, what he said made sense.

Now I have a confession to make as I have already deviated from the original Lacquer article by not applying a sealer coat before the stain. The method considered that this was desirable, as with some woods this was the only way to achieve a uniform appearance. I did try this but it has the disadvantage that now stain will not be absorbed by the grain filler or stopping. So if you think you have a veneer where you must apply a sealer coat, then it will be necessary to mix stain with the grain filler first. I would still use the stopping as it is, because it's definitely stronger and also it's hard to mix in enough stain to get a correct colour anyway. The stopped areas can be painted to match the stain colour later. I read that veneers where the grain pattern is large, or it's just a cheap veneer, are the ones most likely to give problems. Personally I would accept this hazard and reckon to correct it, should it occur, with toner spray (see below).

Cutting out the layering of stains leaves two choices, either accept the stain colour or modify it with an aerosol toner spray. These work very well and build up more colour with successive coats which I had no problem applying every 30 minutes or so. Do sand any 'nibs' (small specks) lightly with #400 grade sandpaper and tack rag before each new coat. Apply the first coat thinly spraying from a distance of about 12 inches the aim being to just wet the surface uniformly. Don't get any runs but if you do DON'T try to wipe them off as the cellulose will rub up the stain. If you have made a run you're working too close or not keeping the aerosol moving. The best way to deal with a run is to immediately get the surface horizontal; some of it may flow out. Then put the item to one side for several days and then gently flat out the remainder with # 400 sandpaper and 00000 steel wool. Now apply another toner spray coat over that whole surface. Another use of toner spray is to colour up cheap strips of wood sometimes used on cabinets, or corners where the exposed plywood was simply filled and flashed over. It can also be used on plinths, which have been so abused, that a lot of filler has to be used. Stain will not hide this whereas a build up of toner can completely mask it. Be sure to do the toner or flashcoats before the lacquering. The reason for this is that you don't want to remove pigment at the final rubbing out and polishing stage and the toner is quite soft and rubs away easily. When you are happy with the toning then you can move onto lacquering, I like to leave the cabinet for several days first. You will probably need 3 to 4 coats of lacquer. I prefer to spray a vertical surface with one coat and then take a breather. I come back after ventilating, rotate the cabinet and do another surface. When the whole cabinet has had one coat, leave for 30 minutes then sand any nibs ever so lightly, tack rag and go round again.

After the last coat leave the cabinet for a minimum of a week and preferably two weeks and then sand gently with the #1000 paper and a little water. Finish

off by polishing lightly, in the direction of the grain, with the 00000 steel wool. The surface wants to look just uniformly dull. Now for the alchemy: these steps are quite magical. Wet the surface with soapy water and sprinkle on some pumice powder (an abrasive). Now use a piece of lint free cloth over the top of a block of wood covered with soft material to burnish up the whole surface. As always work in the direction of any grain. The lacquer should end up with a semi-gloss finish. For a glossier finish, repeat the process using lemon oil and rottenstone (decomposed limestone which is a really fine abrasive) and another soft covered block, covered in turn with lint free cloth. Because rottenstone is so fine you can, if it can't be avoided, work lightly across the grain which is helpful on intricate cabinets.

Lastly, wipe down with white spirit and then apply a thin coat of Rustin's Liquid Wax. Leave a few minutes and buff up.

The Brushing French Polish Method
Extra Materials

Mylands Brushing French Polish
Mylands Brushing French Polish Thinners
Flat Lacquer Brush – mixed hair (quite expensive but essential; don't try just using an ordinary brush)

Note: The French polish and the toner spray are incompatible and the former will eat into the later. So this method is only applicable to cabinets where stain alone has been used or where the toner is confined to clearly defined areas, which can be left without covering.

All processes are the same until you get to the lacquering. Apply the French polish in quick even strokes. Try not to get it on any areas where you have used toner spray and if you do don't wipe it: It can easily be rubbed down later and touched up if need be. It's quite compatible with the Mylands wood stain by the way. You need 3-4 coats of French polish, to achieve a result similar to that which would have been obtained if lacquer had been used. Leave each coat for about 20 minutes and during this time wrap the brush tightly in a polythene bag. Be sure to stir the polish well before re-application, working some well into the brush first. As with the lacquer, leave the cabinet for one to two weeks before the final burnishing stage.

Using Masking Tape
On radios with two or more tones, it is necessary to use masking tape. This is seductively easy to apply but problems can arise when you try to remove it: it's prone to pulling up previously applied finish as well. This is more likely to happen if it's applied to finish that has not been given enough time to get really hard. Most aerosols and manufactures web sites say "allow two weeks to fully dry out". The web sites emphasise that paints and lacquers dry out from the top layers first and the coats first applied have to cure through these drier layers. So be patient, as in the long run you will save time by waiting because you won't need to keep going back trying to touch up and correct work already done. On well-cured finish a little liquid wax can be applied, making sure none gets on other areas, then polish off. This stops the masking tape sticking quite so well. If these areas are complete nothing else need be done. If they still need lacquer for example, then they will need cleaning several times with White spirit, to remove all traces of polish.

Problems
Cabinet refinishing with spray cans is strictly for warm, dry and reasonably still summer days. I did try using both cellulose and acrylic as we moved towards autumn. One problem that occurred was an opaque white clouding of the finish. The Americans who seem to have a term for everything call this "Blush". It is caused by water vapour being drawn into the spray stream and then the surface finish skinning over before the moisture trapped beneath can escape. The first thing to do is to stop spraying immediately! Go away and leave the piece alone for up to a day; for me on one occasion it cleared. On the Forum they have written about using "Blush Eliminator". This is an aerosol that contains a mix of cellulose thinners and cellulose retarder and when sprayed on re-flows the finish to release the vapour. Now because of the retarder it dries slower so that any new water vapour drawn in does not cause the same result. So far, I have not found anywhere in the UK that sells such an aerosol. If you have spray gun equipment then apparently it's easy because you can simply add retarder to the cellulose lacquer mix. You could ask why don't they put it into the aerosol mix ? Perhaps some is included but why not more? The downside of a slower drying finish is that it's vulnerable longer to falling dust and insects etc.

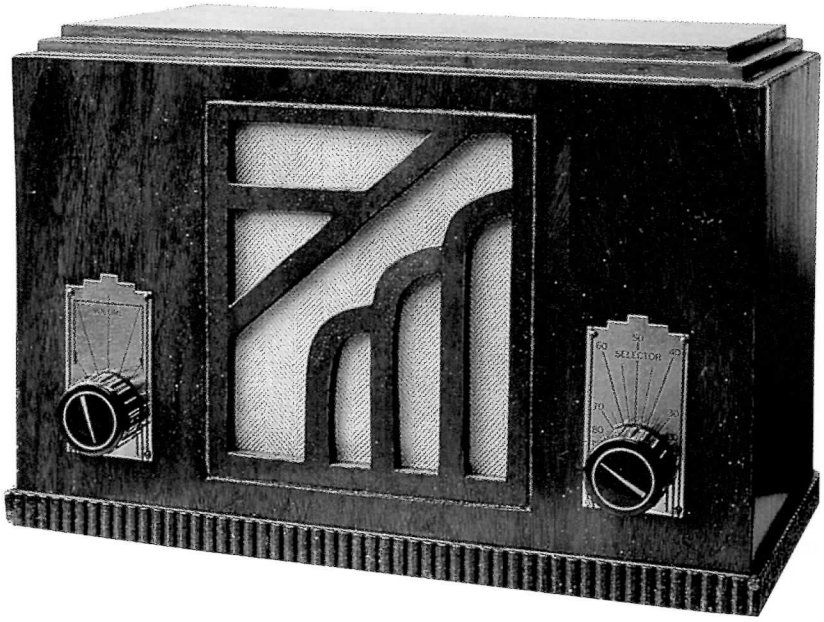
Drying conditions are said to also cause orange peel, where the surface does not flow properly to merge the individual spray droplets.

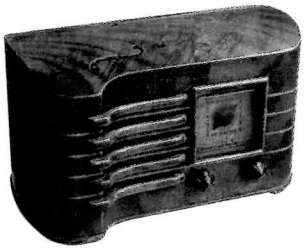
Another problem that I've seen is 'blow holes'. These are small eruptions in the finish that are caused by grease and in particular silicones. These according to the Forum can lurk in the pores of the wood and even some strippers contain them. The answer is lots of washing off after stripping with the cellulose thinner and methylated spirit mix.

As an alternative to the Rustins Wood Stopping, Restoration Supplies sell a Cellulose Wood Stopping ("...especially for cellulose lacquer work"). I have not used their particular product but others, I've used in the past, have had to be used very thinly. When used to fill deeper holes, in one go, then shrinkage occurred so you had to fill the holes a little at a time. As it dries quickly this is not too bad but I prefer the Rustins which does not shrink as it dries slower. Another thing I dislike about the cellulose stoppers is that no matter how tightly you put the lid on the can, they go hard very quickly.

Other types of wood stains are available including

Another thing I dislike about the cellulose stoppers is that no matter how tightly you put the lid on the can, they go hard very quickly.





water based. These are really only recommended for new wood where they can totally penetrate. For stripped wood where this can't be guaranteed, then the oil-based stains are better, and the base means that they don't react with the lacquers.

Insides of Cabinets

I did ask the Forum what was best for the insides of cabinets but I did not get a reply. I have read about painting with matt black paint but unless the radio was originally like that I don't see the point. What I have done is to clean with white spirit and then rub in a good helping of Rustins Liquid Wax to feed something back into the wood.

Conclusions

Cellulose finish

This worked well and the results were good; even from a few inches away the finish is quite acceptable. The toner sprays are excellent. On the National I had actually finished the cabinet but was unhappy with its shade. So, I washed it down several times with white spirit, to remove any liquid wax, then flatted it with #1000 paper used wet and re-toned it. After re-lacquering and final buffing I was happy.

Acrylic finish

Again excellent results were obtained. Acrylic is quite compatible with toner and stain. The Defiant, shown in the picture, is finished with this. The scale 'mouth' and the bar across the front were toned with walnut spray. They were made from solid hardwood, probably beech and did not take stain in the same way as the rest of the cabinet. The speaker grill edges and the rebated corners were masked off, after staining the rest of the cabinet, and sprayed with Rover Maple acrylic. I did this because they both were raw plywood edges and I wanted to obliterate these completely. It would be possible with toner but would take a lot of coats because of the slow pigment build-up.

To me, the acrylic finish does not seem to need the sanding with the wet paper prior to the other rubbing out stages. Next time I will try just using the 00000 steel wool or may be go direct to the pumice. During these rubbing out stages I know I have used the word "lightly" a lot. It's very easy to oscillate between too bright and too dull. My advice would be not only go easy but check repeatedly. It's a bit of a bind to keep having to clean off deposits but it's still better than having to go round again. Also, it's possible to go right through the finish, you'll know because it will suddenly have matt patches: Yes! I've been there.

I will use acrylic again: it's easy to obtain, cheaper than the cellulose, seems to work better if it's a little cold and the end result is the same.

Tip: If a can has been left in a cold garage put it in a bowl of fairly warm water, for a while, before use.

I know I have used the word "lightly" a lot. It's very easy to oscillate between too bright and too dull. My advice would be not only go easy but check repeatedly.

Brushing French Polish

I have reservations about this finish. It does not come out like real French polish and even with the right brush and after using it several times I was unable to get a result that didn't look brushed. Albeit this was only when viewed very close. It's difficult to get it on quickly enough so as not to get a drying edge and at the same time avoid runs. It would work best on simple box type cabinets and not something complex like the Defiant. I did try it on this and took it all the way to a finished item before starting again!

It did work well on the Stork (GecoPhone) Speaker cabinet. This is made out of solid oak and needed a complete strip and replacement of missing beading. After this, I only gave it a light rub over with oak stain, filled the battered plinth and flashed it with toner and then gave the rest of it a single coat of polish. The result is a dull, low gloss finish that to me looks right and is acceptable. I had noticed that the first coat of this polish goes on freely and with very few or only small brush evidence. Subsequent coats pull against the previous; maybe adding thinners would have helped but I didn't try this.

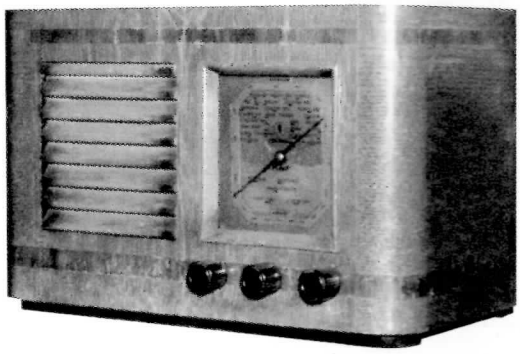
Things still to try

I want to try some of the Mohawk lacquers and toners sold by Antique Electronic Supply. (A.E.S). Their prices for these are not much more in dollars than we pay for similar items in pounds! So even with shipping, which has to be surface for aerosols, and customs duty the cost is not too bad. It does mean that I must get my order off soon to allow the winter (which is when I'm writing this) for it to get here (UK Customs can be painfully slow!). A.E.S are based in Arizona and are happy to ship items anywhere and accept major credit cards or money orders. They do a free catalogue which has lots of radio related items.

The Mohawk sprays are said to be very good and they do a satin lacquer finish as well as the gloss. The Forum recommends the gloss because it is harder. However, on some intricate cabinets, it's not easy to reduce the shine in those places having poor access, whilst working with the grain. I have such a cabinet, for a Model 118 Philco, which is all done apart from the lacquer and I intend to try the satin finish on this.

I will write another (hopefully shorter) piece on this and the other Mohawk toners and lacquers after next summer.

Reference 1
Restoration Materials, Proctor Street, Bury Lancs, BL8 2NY. Tel: 0161 764 2741



Yours truly recently paid a visit to an antique centre, where a trader I know has a superb array of glossy Bakelite telephones. Keeping the shine on Bakelite is a subject that exercises the minds of many collectors and we started to discuss the best way of keeping Bakelite objects shiny without colour fading.

It transpires that Bakelite deteriorates easily, especially in sunlight so the best ways of keeping the gloss are (a) keep the object out of sunlight and (b) protect the surface layer (the resin that gives the gloss) by applying a coat of hard beeswax polish. Beeswax responds well to polishing with a duster. Silicone polishes leave a very slippery surface, so slippery in fact that you might drop your treasure when picking it up!

Buffing up the Bakelite

by Andy Emmerson

Afterwards I asked a friend who's an expert in chemistry what he could add and he told me the following: Bakelite is a cross-linked polymer of phenol and formaldehyde. Neglecting the filler material for the moment, a Bakelite object is actually just one big molecule. There are no polymer chain ends to be attacked so the material is quite resistant to all solvents. But unfortunately, getting the exact proportions of the materials right is difficult. The formaldehyde boils off at lower temperatures and can be absorbed into the filler easily.

Once Bakelite has started to deteriorate you will notice a roughness of the surface, where the top layer of phenolic resin has been rubbed away, exposing the coarser filler material (wood flour or asbestos dust). These waxes tend to fill in the surface pits and micro-cracks and make the surface look better. But they can only slow the breakdown; they cannot stop it.

You can try and flatten this rough surface to make it smooth again; sometimes you'll be lucky. The recommended product is automobile rubbing compound, which you can buy at car accessory shops (retail) or motor factors (trade). It's a paste the consistency of warm butter, smelling of ammonia and tan or ochre in colour. Rub heavily with a hard cloth, then remove the residue with a clean cloth and buff with a duster. It's certainly effective, although you'll have to rub long and hard to disguise badly pitted surfaces.

Buffing with an extremely fine abrasive can sometimes help bring back a shine. I like to use what is called "automobile rubbing compound". This is diatomaceous earth or fumed silica in a solvent and wax base. A buffing wheel will speed things up but watch out for the polishing to go too deep.

You may find the Bakelite has faded badly; your options are to dye or paint. Shoe polish of the appropriate colour can be quite effective to fill the minute pits; let it harden for ten minutes, then wipe off the remainder with a kitchen paper towel and buff with a duster.

For black Bakelite there are two other automotive products you can try, with confusingly similar names- Back-to-Black and Black Bright. The former comes in an aerosol spray can and is a clear silicone varnish intended for rejuvenating black vinyl trim on cars; although being clear, it will work on other coloured surfaces as well. Black Bright is an intensely deep black (mauve-blue-black in fact) dye or liquid pigment that you 'paint' on with a felt applicator. Because Bakelite is non-porous, it takes a while to dry (leave it for an couple of hours, then dry off the surplus with a paper towel); for a consistent finish you really do need to cover all surfaces of the object in order to make all the parts match. This finish benefits from a coat of polish afterwards and do take great care not to get any of the dye on your skin or clothes; it's extremely permanent!

Shoe polish, mentioned earlier, is not a perfect solution; it's basically wax and pigment. The dyes do not work on Bakelite, as their solvent cannot swell the Bakelite for them to penetrate. Even though the surface may now be roughened, the Bakelite is still chemically resistant.

I have sometimes found that repainting was a last resort. Unfortunately paint does not stick well to the Bakelite. You will have to roughen up the surface first to get mechanical adhesion. This is also where you do not want any silicones present so if you use silicone waxes, forget about painting. If you use a slow-drying paint like epoxy, you can often get a good finish over fairly deep scratches. This is good, as the deeper scratches will make the paint adhere more. Lacquer coatings tend to be thinner and dry fast, so the Bakelite cannot be roughened up as much. They have the advantage that a soak in solvent will remove them and allow you to repaint easily. Like everything we do in restoration, some experimentation is necessary to get things as we like.

Since Bakelite is pretty inert, silicone wax can be cleaned off by soaking in dilute sodium hydroxide (lye) for a few hours (note that the hydroxide will attack metals such as aluminium). This will roughen the surface somewhat, but normally cleaning off silicone is preparation for painting anyway. A silicone wax on phenolic will last longer than any other wax and give the best protection. I hesitate to suggest this to too many people since if you do get it on other surfaces (such as a painted panel) it is very difficult to remove. One additional thing about repainting is that if the Bakelite has a fabric or cellulose filler, the paint will seal this, keeping moisture out and allowing you to retain the finish longer. I hope this helped a little. Unfortunately there are no easy fixes (and few not-so-easy ones either).

As the surface of even reasonably well preserved Bakelite contains deteriorated phenol, washing with a strong cleaner will wash away the deteriorated phenol leaving a roughened surface. That is the first step to getting the mechanical adhesion you need. Depending on how rough the surface is before painting, one or more coats of paint or clear coating (like polyurethane) will fill the opened pores and some rubbing down between coats will restore a smooth finish. If using a rubbing compound before applying a clear coat be aware that all of the rubbing compound may not wash out of the pores, leaving a speckled appearance. It's better to varnish first and then polish the varnish.

Fired with enthusiasm, I bought some rubbing compound to see what it could do on my own treasures. In a nutshell, it's rather like T-Cut, with the same ammonia smell, but with a much thicker consistency. You rub on this paste with a damp cloth, then remove the residue with a dry cloth. It's certainly effective, although you'll have to rub long and hard to disguise badly pitted surfaces.

There must be other secret remedies for putting the gloss back into Bakelite, so if you have one, please share it with us!

Bakelite is a cross-linked polymer of phenol and formaldehyde. Neglecting the filler material for the moment, a Bakelite object is actually just one big molecule. There are no polymer chain ends to be attacked so the material is quite resistant to all solvents.

Minutes

Minutes of BVWS committee meeting held on Thursday 25 November 1999 at the Vintage Wireless Museum, 23 Rosendale Road, Dulwich

Present: Carl Glover, Jeff Borinsky, Mike Barker (chair), Guy Peskett. Present by invitation: Terry Martini, Robert Chesters

1. Apologies for absence: Ian Higginbottom, Steve Sidaway
2. Minutes of meeting held on 2 September 1999 Matters arising: none. The minutes were approved
3. MB reported that the membership stood at 1308 and that enquiries were running at more than one a day.
4. CG reported that the Christmas Bulletin had been printed and delivered to the mailing team.
5. JB reported that despite the exceptional items of expenditure good stall receipts at Harpenden and the NEC meant that the Society's balance would not fall below £1000 at the end of this year
6. Proposed by MB and seconded by JB, Robert Chesters was co-opted onto the committee to serve as Bulletin Editor until AGM 2000. [Clarification note added: CG remains in charge of Bulletin design and production, see AOB item (ii).]

7. Status of items for distribution with Christmas Bulletin

(i) CD rom of Electrical and Radio Trader sheets numbers 1-800 produced with the permission of the copyright holder (ERT Magazine). Production of 3000 has been ordered from Universal Mastering, delivery expected first week in December. (ii) Marconi Centenaries brochure donated to the Society by GEC-Marconi Ltd. And arranged by Gordon Bussey, delivered to the mailing team (iii) "Call for Nominations" form, delivered to the mailing team

8. Arrangements for Harpenden

Following Steve Sidaway's withdrawal from organising the Harpenden meetings, which he had been doing as well as being Events Coordinator, Terry Martini has volonteered to take on the task. This offer has been accepted by the committee and Terry has been co-opted onto the committee to serve until AGM 2000. [Note added: see item 10.]

9. Pat Leggatt awards

The following arrangements proposed by GP were discussed and approved

(i) The award will be made annually to the Author of the 'voted' outstanding Bulletin article of the year. (ii) Selection of the article will be made by members voting on their subscription renewal forms (iii) Announcement of the winner will be made at the AGM following the year being considered. A prize of one year's free subscription and a memento will be awarded.

10, Constitutional matters

MB expressed the view that it would be an advantage if the committee structure could be adapted to changing circumstances (e.g. the need to spread the work of producing the Bulletin by separating the responsibilities for design and printing from those of editing) without the need for amendments to the Constitution or resorts to co-option. The discussion centred around two ideas, (i) that the committee in being should have placed upon it the duty to specify each year the structure it deemed to be required for the coming year, the new structure being made clear to members from the posts required to be filled appearing on the Call for Nominations form. (ii) that in view of the reluctance of members of the Society to put themselves forward to serve (despite many appeals) the Committee itself be required to put forward nominations as a fall back in case no others are received. These ideas were approved in principle and GP was asked to produce draft amendments for iteration with MB.

11. AOB

(i) It was agreed that members be invited to observe committee meetings, subject to informing the Chairman beforehand. (ii) The possibility of unauthorised exploitation of Society publications was discussed. A watching brief will be maintained. A number of suggestions were made of material which might be transferred to CD and issued to members if copyright clearances can be obtained. (iii) It was agreed that subject to availbility copies of Society publications could be released for sale by reputable museums and organisations at average cost less 33% for quantities of 10 or less and average cost less 50% for more than 10.

(iv) MB will write a formal letter of thanks to those involved in the production of the first CD. Free advertising space in the year 2000 handbook will be offered to them.

(v) It was agreed that the Society's auditors will be offered free advertising space in the year 2000 handbook and their contact details included on the published accounts.

The meeting closed at 10.40pm, the next meeting will be on 27 January 2000 at Templewood.

Proposed amendments to the Constitution

Replace 4.1 with 'The affairs of the Society shall be managed by an elected committee consisting of Chairman and Treasurer and such other members as are needed to carry out the work involved. The Committee in being shall each year specify in the call for nominations the positions to be filled for the coming year' .4.2.1 delete 'Secretary and Bulletin Editor' 4.3 delete 'Officers and' Add to 4.3.1 'The Committee shall also make nominations for all positions up for election' 4.4 delete 'secretary'.

405-line television goes North

By Terry Martini

I was asked to mount a working display of vintage television and video recorders at the Kaleidoscope 'Main Event' on 20 November 1999 at the United Services Club, Birmingham. The 'Event' is effectively an all day screening of television programming, vintage, modern and everything in between. The bulk of the programming has not been seen on our TV screens since the original transmission date and special clearance is needed to be able to screen it. Additionally, programming previously thought missing or deleted from television company archives also made a debut. Guests on the day included the Broadcaster Tony Currie, who did a presentation entitled 'branding the sixties' which looked at the way the ITV regions created their onscreen identities, through animation, music and announcers. Also, a guest appearance was made by Alfred Burke, probably best remembered as Frank Marker the shabby antihero of Public Eye, who went on to introduce an episode entitled 'A fixed address' an early colour episode which had not been widely seen for over thirty years.

A great deal of interest was shown at the display. Many people were interested at the vintage programme material showing on the sets throughout the day and wanted to know how I did it! Hopefully more new recruits to the growing 405 Alive circle. The TV sets displayed were Ferguson 968T, Ekco TMB272 and Ekco TP309 all chosen for size or portability! A lot of interest was also shown at the early video gear with demos galore. Organising a working exhibition gives me the chance to put the gear through its paces. No time for "Temporary Faults". I enjoy answering the questions, technical and non-technical, letting the visitors get a feel for the equipment and getting their reactions. A number of visitors remarked at how good a 405-line TV picture could be. Although in fairness, each set was receiving an optimum signal from videotape. I met at least two BVWS members on the day, one of which had travelled down from Blackpool. All proceeds from the day were given to charity. For further information, the organisers can be contacted at:

Kaleidoscope Events, 93 Old Park Road, Dudley, West Midlands DY 3NE.

Kaleidoscope also has an informative web site, which is well worth a visit. You can find them at HYPERLINK http://www.kaleidoscope.org.uk

Many people were interested at the vintage programme material showing on the sets throughout the day and wanted to know how I did it!

The History of GEC and the Marconi Osram Valve. By Fin Stewart

Reviewed by Tony Constable

Wireless historians and collectors always welcome new aspects of their subject. For many members of BVWS, the early valves they possess constitute the most precious, and certainly the most vulnerable, part of their collections. Such collectors aim to know as much as possible about the valves themselves and also about the companies which produced them. From Fin Stewart's book we learn that the GEC Osram valve has been with us since 1917 when, during WWI, the company produced an improved version of the R2 valve.

GEC was a well established company long before it began making and marketing radio valves. The company was founded in 1889 by the Binswanger Brothers (Gustaf and Max Byng following a change of name) and Hugo Hirst and was called the General Electric Company Limited. This company has nothing whatsoever to do with GE (USA) which developed from the Edison General Electric Company three years after GEC was formed. The early history of GEC is well described in this book by Fin Stewart and from his study we see clearly how the company grew from its small beginnings to the colossal giant we know today.

In 1893 C.J.Robertson sought Hirst's support in setting up the Robertson Electric Lamp Company at Brook Green, Hammersmith. This factory was half owned by GEC and, although it began manufacturing electric lamps (Robertson lamps) in 1893, the lamps made there were not of a sufficiently high calibre for marketing until 1896. At that time lamps all had carbon filaments and Robertson's scientific and technical expertise ensured the highest quality product.

Metal filaments using Osmium were developed in Austria by the Welsbach Co from about 1899 but achieved little success owing to the extreme fragility of the material. Hirst acquired the rights of the Welsbach patents for GEC in 1905/06 as well as those of Alexander Just and Franz Haneman who were making advances in Germany using tungsten, initially in a powder form. More robust filaments were developed by Welsbach and further developed at Hammersmith by combining tungsten (wolfram) with osmium, which gave birth to the word "Osram" as the trade name for the lamps marketed by GEC. At first the GEC Osram lamps were manufactured in Germany but the factory at Hammersmith began making successful Osram lamps in 1909. Even though osmium as a filament material was soon discontinued the name Osram remained.

The Osram lamp works began producing radio valves in 1917, says Fin Stewart, and, in the first half of the year the T3, T1, R2 and R4 appeared. The first receiving valve, the R2, was an improved version of the original triode valves initially developed at BTH and Edison Swan from de Forest's Audion and from the well known wartime French triode which itself arose from the batch of Audions brought to France by Paul Pichon and acquired by Col Gustav Ferrié in 1914.

At the end of WWI an agreement was signed between the Marconi Company and GEC which resulted in the formation of the Marconi Osram Valve Company Ltd on 26th November 1919. The following year the name was changed to the M.O.Valve Company. The valves manufactured by MOV at Hammersmith were marketed variously with the labels: Marconi-Osram, GEC, Marconi, Osram or Gecovalve.

Fin Stewart's book is produced in spiral bound form with photocopied typewritten pages and, while this neither detracts from the readability of the book nor from its worth as a source on information, the quality of the illustrations leaves a lot to be desired. The author tells me he is producing the book in limited quantities while it is undergoing corrections passed on from readers. It is available directly from the author at "Cockerdale", 380, Bulga Road, Wingham, N.S.W. 2429, Australia for $A 25.00 (banker's draft) which includes postage. This is a worthwhile outlay at approximately £10.00.

The first part of the book which describes the formation and growth of GEC is very informative and readable for those of us who like to know more about the origins of those companies we think we know so well. The second part of the book deals with the emergence of MOV, a most important subject for radio historians and collectors. The whole content of the book adds up to a worthwhile project and a copious supply of information about the full range of valves manufactured by MOV throughout their history. There are many illustrations of valves, sets, components, personalities and advertisements and there is a full set of MOV valve tables including a table of equivalents. Unfortunately there is no index, but the arrangement of the book makes it fairly easy to find one's way about the contents.

I take the view that Fin Stewart's book is still under development and sincerely hope that, in time, it will be properly produced with good photographic illustrations. It still contains errors, but most of those I spotted were typographical or those "errors" which are not errors at all but merely matters of opinion which inevitably arise from variations of linguistic style and other minor matters. Errors of substance seem few and readers will no doubt pass on their corrections to the author.

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Dr Ralph Muchow, owner of world's largest private radio collection passes away

The owner of what is said to be the largest private collection of antique radios in the world, Dr. Ralph Muchow of Elgin, IL, died on March 4 at the age of 83. Words are inadaquate to describe this collection of 3,400 working radios and the man behind the it, except to note that "Doc" was a really great guy. The obituary from the Chicago Tribune can be found at the ARCI website:
http://members.aol.com/arci31280/muchow.htm

Letters

Dear Editor
With reference to Graham Dawson's letter in the last Bulletin on Battery Eliminators. I would quite agree with him that if you want a converter to work free from a mains supply then his design is the only option. However, I did not 'decry' (O.E.D disparage, belittle) Andrew Zimmer's design for needing a home wound transformer. I merely said that it was a 'disadvantage' which is true if you don't have a coil winder. My design just added a couple of low voltage windings to an existing device. As the turns are few this can be done, by hand, in no time at all. Also, it's using a toroid that's a significant advantage as there is virtually no stray magnetic field, to interfere with the radio being powered.

Yours Sincerely
Gary Tempest

Dear Editor
Thank you for the present of the record. Unfortunately it won't go on my gramophone, as the hole is the wrong size. However, as they keep on telling me, it's the thought that counts!

I assume that as well as the 'trader' sheets it contains the index. If so, now is the time to publish a list of errors, before the next instalment. This is as far as I have got:-

Errors

Ekco A22	768, not 786
GEC 3440 (not 3340)	
HMV 485A	619, not 610
Philips 716B (not 716N)	294

Omissions

Barker 88	747
Burrell 4V superhet	9
Climax S5	16
Climax TC111	103
Drummer M45	18
Philips 855X	465
Romac personal sets	940
Wartime Civilian set	688
Zetavox 'S'	727

While we are on the subject the following are missing from the TV sheets:

Plessey chassis	984
Pye D16T	894
Pye D18T	946

That is all I have found, but somebody else may know more.

Yours truly,
Geoffrey Dixon-Nuttall

Dear Editor
Regarding nominations for the article in 1999 of most interest, I have marked the one on MOV. This is because I worked for many years in the Osram company, although I don't personally go back as far as the article does. My involvement was not with valves or lamps but with control gear for discharge lamps, involving, in the latter years, semiconductors. I never worked on the Hammersmith site but at Wembley and Erith. I was development manager for control gear with a staff of 20.

There are a number of people still alive who do remember and had connections with some of the names in that article. I am still in touch with some of them as although we may not have worked in the same area we did liase together to use each others experience in solving problems. No doubt part two of that article will bring us more into the post-war era and may even mention folk I know/knew.

One ex-colleague writes to me that it was most certainly Hirst who foresaw that under British conditions with the high price of copper, the high voltage lamp (200-240V) would become paramount, whereas as I expect you know the USA stayed on 110V. Lamps are easier to make for the lower voltage. He also writes that it was Robertson's genius that solved the problems of making reliable lamps for 240V and that enabled them to take business away from Swan and, subsequently, Ediswan group.

I did some 42 years continuous service in GEC, joining them as an apprentice in 1945 and leaving as redundant in 1988. Osram joined forces with the Lighting group of which I was a member in 1964, upon our leaving Magnet House, Kingsway and ceased to manufacture control gear for lamps in 1981 when they closed down my department and the Erith factory. What was left was transferred to Shaw near Manchester and now I hear that Siemens who bought out the British Osram from GEC are to close Shaw by the end of this year. There is virtually no manufacturer of lamps in the UK any more. What a heritage we continue to throw away. All very sad.

Yours sincerely
Peter D Parker

Dear Editor
Regarding Gary Tempest's query regarding the Marconi magnetic detector; I always look at it as a rather simple form of wire-recorder.

The permanet magnets provide erasure of previous signals and pre-biasing of wire to optimum sensitivity.

The currents are fed to the drive coil by the multiple-tuner 'chopping' the residual magnetism in wire at spark-repetition rate. From then on a direct family tree to Poulson telegraphon and Ferrograph/Uher.

Yours sincerely
John R Gomer

Dear Editor
I just wanted to send a note to say how much I enjoyed reading your most recent BVWS Bulletin. Each article was keen in content and delightful to read, but I especially liked the Wichety Grubs bit, the Wonderful Marconi Osram Valve story (looking forward to part 2) and the wonderful collection of Scott receivers.

To that end, you mentioned that you thought it a bit of a surprise that these sets rarely appear in world wide press. Problem solved. Please be aware that a wonderful 100 page detailed account of Scott appears in Review #11, printed by the Antique Wireless Association.

My compliments again on a wonderful publication.

Warm Regards,
Edward Gable K2MP
Curator, A.W.A. Electronic Communication Museum
Bloomfield, NY, USA

Ordering information for Review #11 is
US $22.00, postage paid, to
A.W.A. Electronic Communication Museum
187 Lighthouse Rd
Hilton, NY 14468 USA

Dear Editor
Please find enclosed a list of items stolen from my home a few weeks ago. If any collectors (or dealers) should be offered these items individually or as a lot please contact the phone number supplied.

SUBSTANTIAL REWARD OFFERED FOR INFORMATION TO RECOVERY OF Items stolen from Lambert Way. Hartford. Cheshire PHONE 07802 470122 or 01606 872 806 (Northwich Police)

1. Table stand for mic, brass octagonal frame for mic on column, circular base. Ex BBC c. 1927.
2. Chrome plated door "Porthole" with glass. Approx 6" dia. BBC c1930.
3. Bronze rectangular plate with three coloured lamp fittings with Red/Green/White lenses. BBC c1940
4. Small BBC badge c1930 white letters on Brass (approx 2") with jubilee clip on back.
5. Black Bakelite "Brownie" crystal set c1940's
6. Black Bakelite ashtray with chrome top "BBC" engraved on front.
7. Several books on BBC history including "Those Radio Times" and "The ITMA Years"
8. Several Flexible bronze mic stand extensions.
9. Wooden Board with 4 "knife switches BBC c1930.
10. Various old microphone Cables, plugs and sockets.
11. Chrome plated Headphones c1940 (new condition) BBC label on headband.

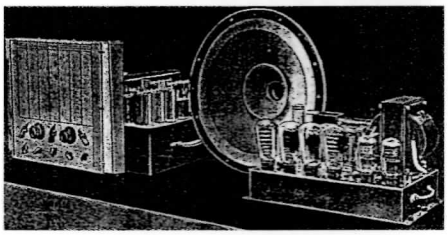
These are all specialist collectors items and in many cases it is hard to imagine a petty thief understanding at all what they are. Its a long shot I know but should anyone see these things don't hesitate to contact me.

Yours sincerely
Chris Owens
Lambert Way

Dear Editor
This is an appeal to help me trace the wherabouts of a special wireless of exceptional specifications.

Some radios are known to a few people. Some are never seen. Others appear to have no printed record or service data anywhere at all. These sets are sometimes mentioned in hushed tones in quiet corners of swapmeets. The KH Commander (see below) fits neatly into all these categories, never having been seen by any collectors to my knowledge. The set was marketed from Aug/Sept 1939 to July/Aug 1940 - just under a year. It was the brainchild of Mr A.G. Hacker of Dynatron of Maidenhead. This company were co-owners of the Keates-Hacker Co. along with Keates and Co. who marketed these sets. The commander was the forth and last model made after which the company co longer sold sets. Until the 1960s, that was, when Dynatron resurrected the Hacker name once again.

Of the brothers Hacker, Mr A. G. Hacker was the designer of the circuits etc. and it was he who stuck to the TRF or straight principle



Page 34: The Keates - Hacker " Commander " receiver employs a ''straight " circuit for high-quality reproduction, a superheterodyne for normal reception on medium and long waves and a double superheterodyne circuit for short waves.

The Dynatron "Commander" chassis shown on the Keates-Hacker stand is virtually three receivers in one. A straight circuit is provided for local station reception, a " normal " superheterodyne with a redesigned variable selectivity system giving true band pass characteristics even at 4 kc/s band width is employed for general reception, and on short waves a double superhet circuit with two RF stages brought into operation. There are twenty-five valves in the circuit, four of which are triodes working in push-pull to give an undistorted output of 20 watts. Refinements; include noise suppression circuits, a manually operated adjustable whistle filter and a cathode ray indicator for grid current in the output valves. The chassis is built on a machined aluminium casting and costs £165"

This page: more pictures from Frank Hawkins illustrating his Swindon shop in 1951 and later in the early 1960's.

long after others dropped it. The tuner of the Commander was different to the previous series (all KH instruments were chromium plated). The complete set itself was a 25 valve TRF/Superhet and double superhet on short wave with separate gang condensers, for LW/MW 6 gang and short wave 4 gang, with two RF stages on Short Wave. The coil formers for all RF coils were imported from Germany. There were many refinements such as noise suppression, whistle filter, parallel push-pull triode output, 18" Celestion twin cone speaker, two cathode ray indicators - one for tuning and a second fordistortion in the AF stage. The tuner section was an aluminium casting which unfortunately was badly struck and had to be overlaid with a sheet steel chromium cover which was screwed to the moulded alloy. In terms of performance it was everything that could be expected from such a large set.

In all my research no one can actually say how many were made, but the 15 year old apprentice of 1939 who dressed the alloy chassis with a file well remembers doing a few and he reckoned he did around twenty but no more than fifty in total were made. The filing must have left a lasting impression upon him to still recall it so many years later. Mr. Hacker's assistant designer thought it too large for ordinary use and when offered one as a leaving present declined the offer (I wish he'd taken it). Keates Hacker had stand No. 1 at the 1938 and '39 Radiolympia shows and the Commander was on show with various pieces cut out of the cabinet so that visitors could see the insides.

This is as far as I have got and that leaves the story unfinished as I have as yet not turned up a single example. So can anyone add anything; have you seen one ? Have you got one lurking in your home? If so get in touch, I'd be delighted to hear.

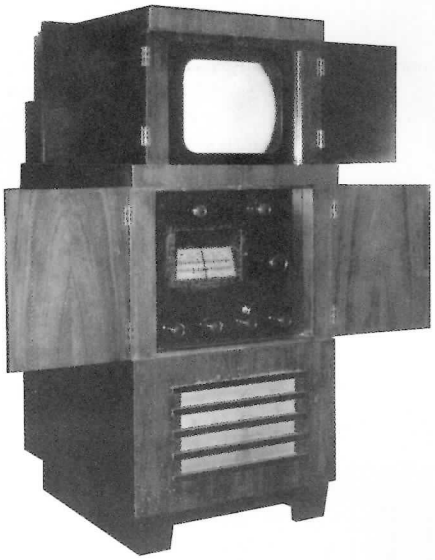
Yours sincerely
Andrew Denton

Many of you who have perhaps been in the radio and TV trade will no doubt recall those manufacturers courses in the '50's and '60's which we were invited to attend in an effort to familiarise us with the latest models. They were mostly of short duration; a day perhaps, or two days at most, and were held in the nearest central town or city to cater for engineers in the surrounding area. The majority of the courses were very informative but some were purely and simply a propaganda exercise on the manufacturers part. I recall one such given by Ferguson on the inauguration of their latest portable television and how my employer, who had come along with me was completely 'brainwashed' by the lecturer's hype. On the way homewards he would say things like "You won't have to worry about repairs now Bill... you'll have no trouble with this model... It's a winner!" I, of course, had heard it all before and was not quite so gullible as my boss, and as time went by the 'winner' presented us with the usual spate of problems.

Some courses I have attended

by Bill Smith

The very first course that I attended was a Philips one in the early fifties. Philips latest brainchild at that time was 'projection' television where a large picture could be obtained by projecting the image onto an internal or external screen. EHT voltages as you would expect, were high and we were warned not to view the brilliantly lit small CRT which fitted into the Shmidt Optical Unit. As a further warning it was pointed out to us that one of the instructors had not been taking precautions and now had leukaemia, and I must admit that he looked positively ghastly. The two-day course was all a bit over my head with its conglomeration of safety circuits involving a host of EB91 double-diode valves juggling with minute voltage changes. However the experience put me in good stead when I had to deal with many projection models when I moved to Peterhead. The local RAF station of RAF Buchan purchased a large 6x4 feet screen model from us and all went well for a while. Unfortunately the site was a radar one and all the 'experts' there seemed to want to have a go at improving the picture with disastrous results. The fact that they knew little if anything about the machine didn't stop them from opening up the console and interfering with the focusing of the optical unit. After spending a day in almost total darkness laboriously resetting the focus, I had the console boxed in by a joiner to avoid further trouble. Given the correct conditions i.e, a darkened room, a central position and a properly set brightness level, the picture quality received from the projection television set was quite pleasing. What you generally found to be the case in practice was that the customer tried to obtain more illumination on the screen and the picture would go out of focus; the line time base screaming in protest! The firms of Decca and Ferranti also produced projection models using the same Philips technology. I think that Ferranti had more success with their 20-inch screen model, one I must confess I rather liked. I recall later visiting one in a prefab where the man of the house was quite contentedly viewing the set placed in the corner of the living room from his vantage point in the kitchen! Thankfully for us the interest in projection receivers waned in the late fifties although there seems to be a resurgence of the concept.



Then there was the Baird course where we found that the company preferred the terms *light* and *shade* instead of the usual *brightness* and *contrast*. I remember that the instructor impressed upon us the need to keep one hand in your trouser pocket out of harm's way when delving into the innards of a television. To further convince us of this necessity he showed us the long angry scar on the top of his left hand; the consequence of him accidentally coming in cotact with EHT voltages whereby his reactions in smartly withdrawing his hand had resulted in it being badly torn on the interior of the cabinet.

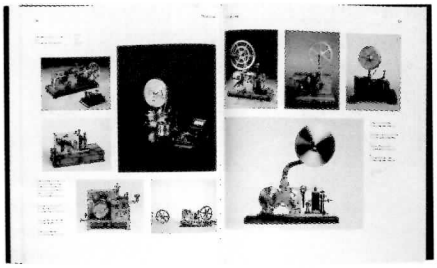
Of all the courses I attended, the Ferranti TV one was the most enjoyable by far as we also gained valuable 'hands on' experience. Benches were set up and the instructors simulated typical faults on some current models displayed there. We were split into groups of three and had to move around from one TV to the next locating the faults, taking notes and the returning the set to its original 'fault' condition. It was soon apparent that the trio immediatly behind us was superior in their ability to clear the faults as they were breathing down our necks and generally hustling us on. It was only when I had occasion to collect my notebook from my desk and had to pass by them that I heard one of them whisper "Look for the newly-soldered joints!" that the penny dropped. They were not really tracing for faults but merely looking for signs of recent soldering by us! Now Ferranti at this time, possibly as an aid to inpection, had each solder joint painted with a purplish ink or paint. I thought about this and had a flash of sheer inspiration. I happened to have one of those indelible pencils which when moistened produced a purplish hue, and from then on, after we had done our repair and had returned our chassis to its original state, we applied this with dramatic effect. Our three erstwhile geniuses, now looking somewhat puzzled and perplexed, gradually fell behind much to our delight... served them right! Actually I must admit that it became difficult not to copy their example, now that the notion had been revealed to us!

One of the Pye courses turned out to be a bit of a social occasion as, after the preliminaries we sat up for a slap-up dinner where the wine and speeches flowed and there was much bonhomie. The meal was exquisite and, being only a male only function, the jokes became more risqué by the minute. After coffee and liqueurs and not being accustomed to all this 'high living' I became decidedly bemused and concentrated on makig my way home. As I had come by bus I boarded one for Peterhead and promptly fell asleep. Next day I awoke with the mother of all hangovers and had good cause to remember Pye's excellent hospitality!

Although most of the courses were held in nearby Aberdeen, I recall going further afield to Edinburgh to attend a two-day colour course given by the firm GEC. I had just purchased a new car and thought it would be a good idea to 'run it in' by taking it on a trip to Edinburgh. My young apprentice Ben and I set off early and soon Ben, who was a bit of a car fanatic, was pleading with me to 'have a go' at the wheel. With some trepidation on my part, and having visions of us landing in a ditch, I gave in and let him take the wheel. However I need not have worried, as from then on Ben did all the driving, a situation that suited me very well as I was not too keen on driving. As colour was very new to us then, courses like these were very important to the service engineers who had to struggle to master yet another technical innovation. Indeed most of us had to go back to college to obtain our City and Guilds colour certificate to enable us to meet the criteria. On looking back it seems very sad to observe that all of those British manufacturers and their distinctive television models have disapeared and have been superseded by a selection of remarkably similar looking black or grey plastic boxes!

Classics of Communication by Fons Vanden Berghen

Book review by David Read.



BVWS member Fons Vanden Berghen is well known for his expertise in communications technologies from the most ancient to the most modern, as well as the remarkable exhibition of his collection of historic communications apparatus which was held in the *Galerie of the Credit Communal* in Brussels at the end of 1998. The original book to accompany the exhibition was written in Dutch and French and copies are no longer available. Fortunately for English speakers this important book has been reprinted in the English language to commemorate the 30th anniversary of *Telindus*, a leading European company in the business of integrating data and communications networks. As explained by Fons in his brief introduction, the book is aimed at a broad readership and is intended as a survey of the development of electrical telecommunications beginning with the discovery of electricity and concluding with the transmission of moving pictures. It is not, therefore, a textbook for specialists - though they will enjoy it and learn from it - but a comprehensive overview which is most sumptuously illustrated.

In the French manner, the contents are shown on the last page of the book and on first picking it up there is a moment or two of confusion as the English reader looks for an overview of the subject matter and where to find it. Once found however, the chapter headings are excellent, being to the point as well as providing a clear layout of the subject matter. If I have a quibble it is that that it could also be improved with the inclusion of an index.

The book's first two chapters deal with telecommunication before 1880 (touching briefly on signal towers and visual telegraphy with the aid of telescopes) and electricity before 1900. The latter is a fascinating synopsis of developments from static electricity, through electrical storage, electromagnetism and measuring instruments to light bulbs and radio tubes. Telegraphy is covered in detail in chapter three and might be considered to be the central core of the book. It begins with the importance of railways, the strategic requirements of the military, and, perhaps less well realised generally, newspapers and the stock market. The various types of telegraph (such as needle, dial ,the pivotal work and machines of Samuel Morse and the printing telegraph) are dealt with in a way which explains their origins, technology and chronology in an exemplary manner. The chapter also covers accessories such as keys, relays, indicating galvanometers and switches and finishes with an account of the development of telex and teletex. I doubt that a better historical account of this subject exists and the accompanying illustrations and photographs are superb.

Chapters four to seven are short and cover wireless telegraphy, radio, telephony and image transmission. These areas and their relevant subject matter will be more familiar to the mainstream of BVWS interest and knowledge and I will not go into detail. For collectors who have a special and narrow interest area, e.g. radios of a particular period, material or manufacturer, and there are many such collectors, these chapters will provide a useful overview of the broad subject of which their collecting areas form a part.

In summary, I thoroughly enjoyed this book and recommend it wholeheartedly. It reminds me that towards the end of 1997 I read a piece by the science correspondent of a national broadsheet in which Samuel Morse was referred to as the inventor of wireless telegraphy. Impossible of course, as Morse died in 1872 twenty-four years before the worlds first wireless patent in 1896, and surprising that such a howler should come from a person writing on science. He should have known better of course, and this excellent book would have been the perfect vehicle to put him right, but unfortunately it was then only a gleam in Fons' eye!

BVWS members can buy the book directly from Fons by sending a £20 note (which includes postage) in a sealed envelope to:
Fons M. Vanden Berghen
Lenniksesteenweg 462/22, B-1500 Halle, BELGIUM.

Back issues

Vol 10 Numbers 2, 3 & 4 Inc. The KB Masterpiece, Extinct Species "A Monster Defiant".

Vol 11 Numbers 1, 2, 3, 4 Inc. BTH VR3 (1924) receiver, Marconi's 1897 tests, Origin of the term 'Radio', Baird or Jenkins first with TV?

Vol 12 Numbers 1, 2, 3, 4 Inc. the Emor Globe, The Fultograph, Ekco Coloured Cabinets.

Vol 13 Numbers 1, 2, 3 Inc. Direct action tuning, The Philips 2514, Noctovision.

Vol 14 Numbers 1, 2, 3, 4 Inc. Cable broadcasting in the 1930's, The story of the Screen Grid.

Vol 15 Numbers 2, 3, 4 Inc. The wartime Civilian Receiver, Coherers in action, Vintage Vision.

Vol 16 Numbers 1, 2, 3, 4 Inc. The Stenode, The Philips 2511, Inside the Round Ekco's.

Vol 17 Numbers 1, 3, 4, 5, 6 Inc. Wattless Mains Droppers, The First Philips set, Receiver Techniques.

Vol 18 Numbers 3, 4, 5 Inc. The First Transistor radio, The AVO Valve tester, The way it was.

Vol 19 Numbers 1, 2, 3, 4, 5, 6 Inc. The Birth of the Transistor, Super Inductance and all that, reflex circuits, A Murphy Radio display, restoration.

Vol 20 Numbers 1, 2, 4, 5, 6 Inc. Radio Instruments Ltd., Japanese shirt pocket radios, Philco 'peoples set', notes on piano-keys, the story of Pilot Radio, the Ever Ready company from the inside, the Cambridge international, the AWA Radiolette, this Murphy tunes itself!

Vol 21 Numbers 1, 2, 3, 4 Inc. Marconi in postcards, the Defiant M900, GPO registration No.s, Personal portables, the transmission of time signals by wireless, the Ekco A23, historic equipment from the early marine era, the birth pains of radio, inside the BM20, plastics, Ferdinand Braun, pioneer of wireless telegraphy, that was the weekend that was, the first bakelite radios, BVWS - the first five years, the world of cathedrals, Pam 710.

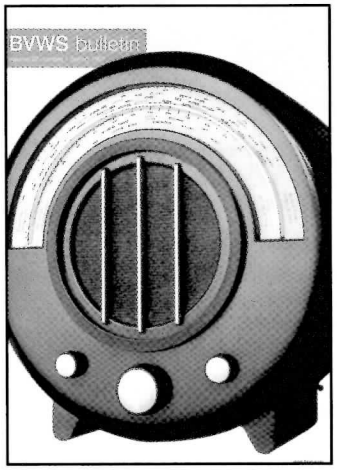
Vol 22 Numbers 1, 2, 3, 4 inc. Another AD65 story, the Marconiphone P20B & P17B, listening in, communication *with* wires, the story of Sudbury radio supply, French collection, Zenith Trans-oceanics, Farnham show, Alba's baby, the first Murphy television receiver, AJS receivers, Fellows magneto Company, Ekco RS3, Black Propaganda.

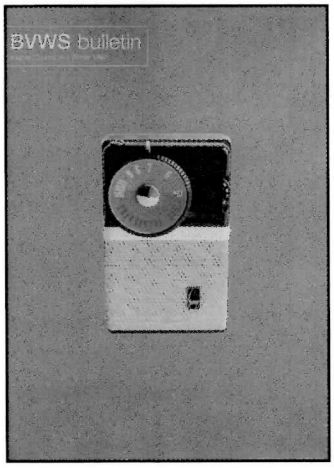
Vol 23 Number 1 inc. Sonora Sonorette, Bush SUG3, RNAS Transmitter type 52b, North American 'Woodies'.

Supplements:
1 'The story of Burndept'.
2 'WW 1927 data sheet'
3 'Seeing by wireless' the story of Baird Television
4 reproduction Marconi catalogue

Earlier Bulletins and supplements are priced at £2:00 each + postage. Bulletins from volume 21 onwards are priced at £2.50 each. + postage.

Postage:
for individual bulletins add 50p, for 2-5 bulletins add £1, for 6 or more add an extra 20p each. 23 Rosendale Road, West Dulwich London SE21 8DS Telephone 0181 670 3667. Cheques to be made payable to 'The Vintage Wireless Museum'.





News and Meetings

Blackpool meeting
A brand-new meeting for the north of England will be held in Blackpool on **26th March 2000** at the De Vere hotel, on the A587. There will be free parking, roughly 80 stalls and entry will be from 9.00 am to 4.30 pm. For further details, please refer to advertisement on the opposite page.

NEC Meeting
Jonathan Hill's 'National Vintage Communication Fair' meeting will occur on **April 30th**. For further details on the NVCF please refer to the advertisement on page 2.

NEC Coach Trip
A coach is being arranged for an excursion to the NVCF on **April 30th**. A succesful coach trip was arranged two years ago and it is hoped to repeat this. The coach picks up at Tonbridge in Kent and Leatherhead in Surrey. If you are interested please contact Ron Deeprose, 70 Hollington Old Lane, St. Leonards-on-Sea, East Sussex. TN38 9DP. Telephone: 01424 428428.

Harpenden meetings
Sunday the **11th June** hosts a swapmeet featuring a workshop with Gerry Wells. Autumn is heralded with a swapmeet on **3rd September** also featuring Gerry's workshop, and the year finishes with a swapmeet on the **26th of November**.

Harpenden meetings 2001
There will be an auction, a restoration contest and the AGM on Sunday **4th of March.** Sunday the **10th June** hosts a swapmeet. Autumn is heralded with a swapmeet on **2nd September**, and the year finishes with a swapmeet on the **25th of November**.

Gerald Wells' garden party
Gerry Wells will be having a garden party on Saturday **10th June** at the Vintage Wireless Museum, 23 Rosendale Road, West Dulwich, London SE21 8DS. Telephone 0181 670 3667.

Gerald Wells' garden party 2001
For those with busy calendars Gerry Wells will be having a garden party on Saturday **9th June 2001**

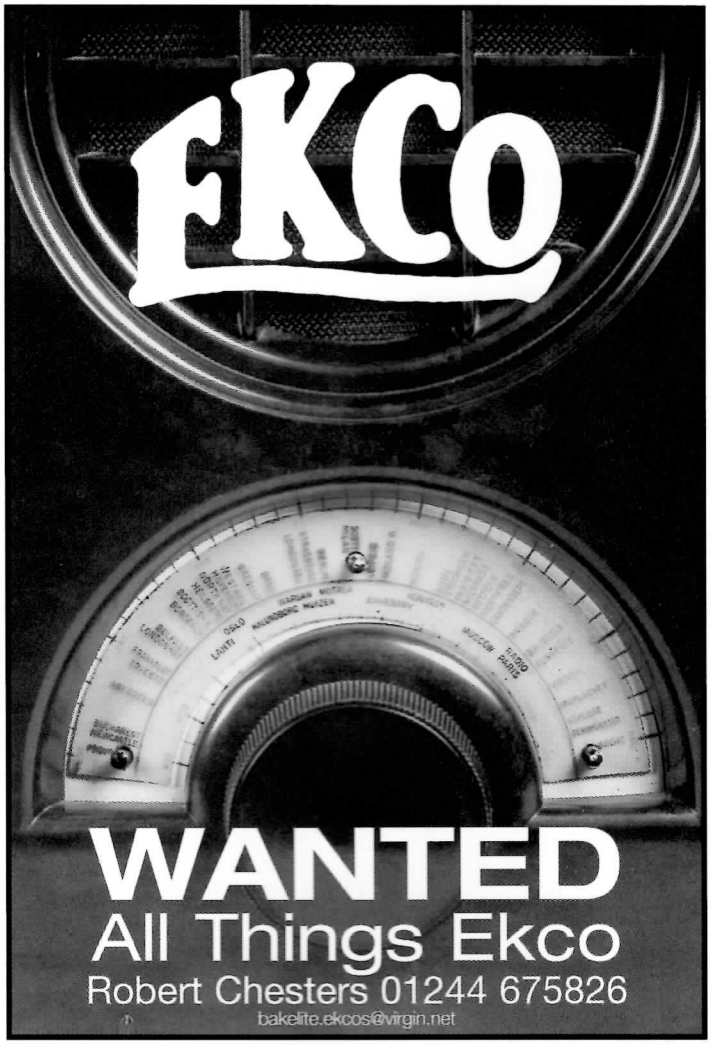
Portishead meeting 2000 and 2001
Alex Woolliams will be holding a swapmeet on Sunday the **17th of September**, and in 2001 on Sunday the **14th January**. For further details please contact Alex on 0117 9776576 or you could email him at: woolly@eggconnect.net. Details by post can be acquired by writing to him at: 11 Knowle Road, Bristol, BS4 2EZ.

Wootton Bassett meetings 2000
Mike Barker will be organising a swapmeet on Sunday **9th July** and Sunday **December 3rd.**

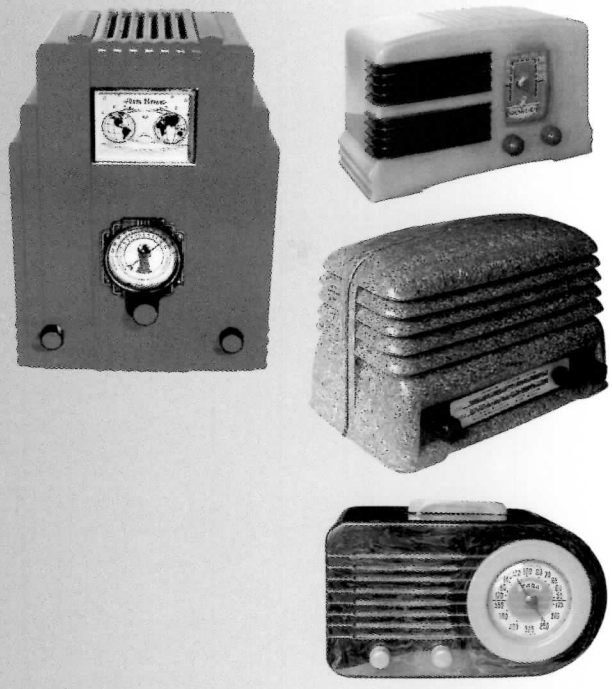
New Articles
If you have anything interesting to say concerning Wireless, Television, Broadcasting, Collecting etc. please send it to the Editor for future publication in the BVWS Bulletin. Your article can be just a few paragraphs long if you think it conveys its message to your fellow members.

Also if you have any photographic material that would look good in the Bulletin, don't hesitate to post it to the Editor. The chances are that I will definitely use it!

Please send to: Robert Chesters, 32 Eaton Road, Handbridge, Chester Cheshire CH4 7EN. Tel: 01244 675826
email: bakelite.ekcos@virgin.net



Wanted by collector



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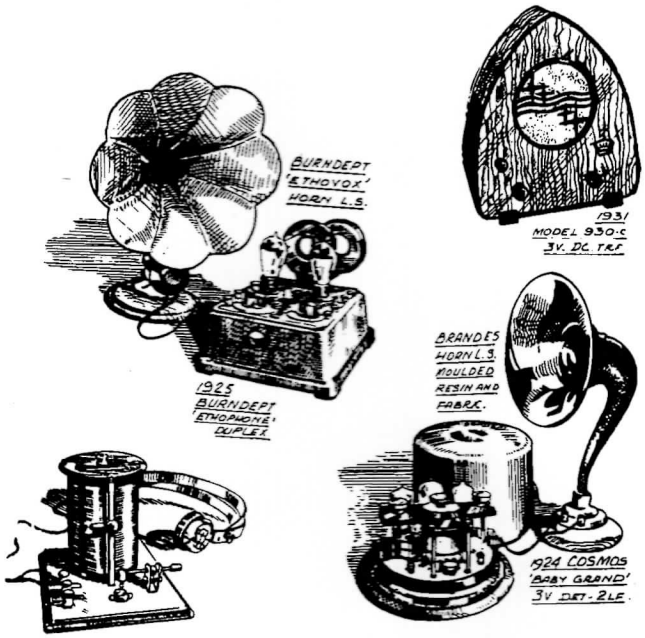
BVWS POSTERS

3 designs depicting wireless sets from the 1920's, 1930's and1940's onwards



£6 per set at BVWS meetings
£10 per set mail order including postage

Mike Barker: 59 Dunsford Close, Swindon. Wilts SN1 4PW.
Telephone 01793 541634

Important event in ***Blackpool***

Vintage Technology 2000

The world of old radios, gramophones, T.V.s music machines, telephones & scientific instruments comes to Blackpool

Sunday March 26th. 2000

Join us by the seaside at the De Vere Hotel, Leisure Centre and Golf Course on the A 587 just by the Park and Zoo in Blackpool. A short drive along the A 583 from the M55 Motorway. Acres of FREE parking, about 80 stalls, ideal venue for the family, entry from 9.00 a.m. to 4.30 p.m.

For a stall booking form contact John McGlynn or Brian Chesters at Vintage Technology:
e-mail: brian@blackpool.net
fax: 01253 300020
tel: 01253 300100 9.00 - 5.00

or write to:- **173 Newton Drive, Blackpool, Lancashire FY3 8ND**

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