The Bulletin

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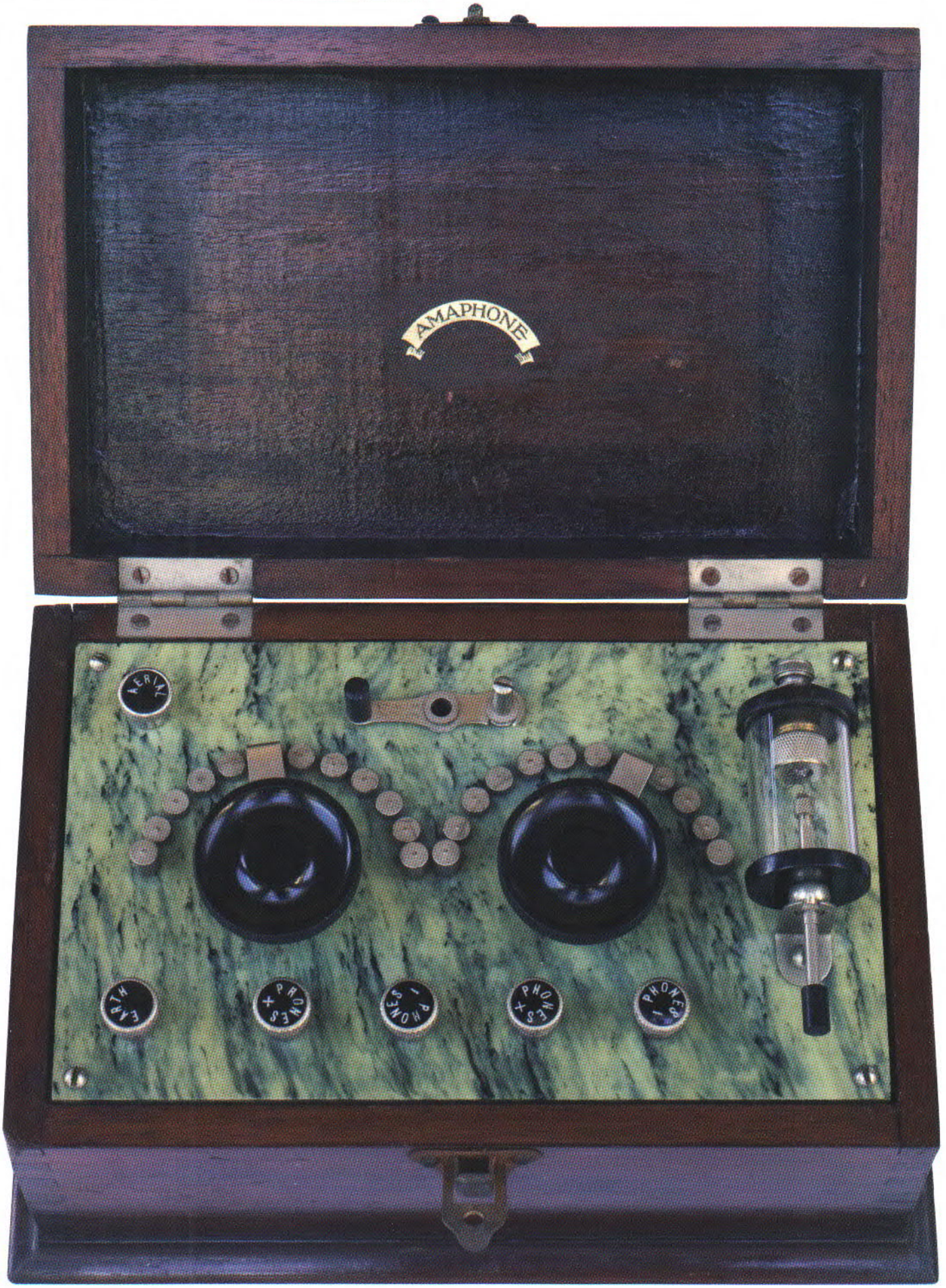

The Bulletin of the British Vintage Wireless Society £4.00 | free to members ISSN 0955-9345

11 May 2008

National Vintage Communications Fair

at The Warwickshire Exhibition Centre

Now in our 15th year!

10.30 to 4.00 **£5 admission** (under-14s Free),
early entry 9.00 at £20

300 Stallholders

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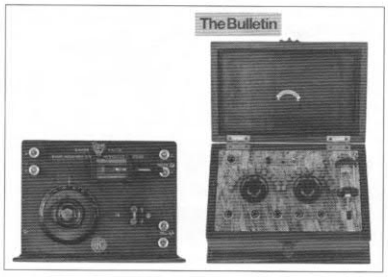
Bulletin of the British Vintage Wireless Society
Incorporating 405 Alive
Volume 32 No.3 Autumn 2007

www.bvws.org.uk

Separations and Printing by Hastings Print



Cover: front – Amaphone, 1920's, rear – Chase, 1920's
Photographed by Carl Glover

Graphic design by Carl Glover and Christine Bone

Edited by Carl Glover. Sub–Edited by Ian Higginbottom

Proof-reading by Mike Barker,
Ian Higginbottom and Peter Merriman

Contents

From the Chair

I'll keep this short and sweet, as space in this issue is at a premium.
Update on the BVWS parts Dept. The 0.1uF capacitors have sold in record time and we are now waiting for new stock, so if you have placed an order with Graham, and they have not yet arrived, please be patient, they will be with you just as soon as we have the new stock. The 0.01uF caps are in plentiful stock. The dual can Electrolytics will be available shortly in 16+16 32+32 and 50+50 versions so keep a look out for them in the next Bulletin and on the BVWS stall.
Murphy Day at the Mill Green Museum, with a display of Working radio and TV equipment, plus very nice cream teas will be on the 16th September, see Diary for full details at the back of the Bulletin.
The forthcoming 2nd BVWS Manchester Radio meeting will be held on the 28th October at Sale Moor Community Centre, Sale. Organised by John Marshman. The first event was very friendly with a good number of the usual faces and dealers and lots of odd bits and pieces to sort through to find treasures needed for those outstanding restorations. There is also light refreshments. Times are 2pm to 5pm so no early morning starts needed this time. I hope to see many members there. The BVWS stall plus a display stall of working 405 Line TV's will be there. See diary page for full details.
All for now, Mike...

Geoffrey Dixon–Nuttall 1927 – 2007

I first met Geoffrey in 1979 at a Boot Sale – where else? He was there with Desmond Thackeray, another close friend and long term member of the BVWS, who died in 2003. It was winter time and both were buried in heavy anoraks with hoods raised as though trying hard not to be recognised.

As usual, my Sunday morning had been spent cycling with friends. We had been out early and intended to finish the morning fishing amongst the junk for bargains – as you do!

I joined the two anorak clad characters who were peering into a large box with knobs on the front which I recognised as a home built receiver of 1920's vintage.

We soon struck up a conversation and it was not long before I realised that Geoffrey and Desmond had no intention in buying the set, but simply wanted to analyse the circuit which they thought was a Scott–Taggart.

The vendor was becoming irritated as it became clear that they were not going to buy the wireless but were simply examining it. To calm things down I said I was interested and promptly parted with a fiver. After the lads had another look at the set, I carried the thing home on the back of my bike.

That first meeting was repeated most Sunday mornings for many years as the three of us visited just about every boot sale venue in our patch, taking turns afterwards to provide coffee and a look round our collections at home. Latterly we settled for coffee and collections because boot sales are not what they were – all plastic toys and market traders now.

The three of us joined the BVWS in 1980 and within a year or so I regarded the other two to be amongst my best friends and I think the feeling was mutual.

Geoffrey was an exceptionally talented man. Very knowledgeable about clocks, tinplate toys, vintage cars, model steam engines and of course wireless sets.

He was a respected member of the Malden Model Engineering Society and had built three live steam locomotives which took hundreds of hours to complete. He often said that he would have a go at anything mechanical and he always succeeded.

This ability was recently demonstrated during a tussle with a grandfather clock. On Christmas Eve 2004, his four year old grandson knocked the clock over when playing hide–and–seek. It shattered into dozens of pieces of mechanism and case. After hours of painstaking work, the clock stood in the hall as good as new. His well known sense of humour was necessary on that occasion. And yet, he was also keen on the arts and music and was well–read. He could recognise

continued on page 43

Transistor Radios of the Soviet Union by Howard Craven

Since the end of the Cold War, the demise of the Soviet Union and the creation of the Internet, it has at last been possible to research the origins of the "Russian" transistor radios built in the USSR which were sold in the UK between the1960s and 1990s. Initially, these sets were often sold in the UK via small advertisements in publications such as Exchange & Mart and the Sunday newspapers, in specialist electronics retailers such as Proops and Laskys but in the 1970s they became more widely available and were sold in high street retailers. They were generally thought of as Russian built, but in fact most were built in huge factories in Riga in Latvia, and Minsk in Belarus, countries which were until 1991 part of the USSR. In the 1960s and 1970s, the export of technical goods built in the USSR which included transistor radios, telescopes and cameras was controlled by a Soviet Association called Mashpriborintorg (or "Mash") who were based in Moscow and their logo can usually be found stamped on the rear covers of the radios and on their packaging along with 'Made in USSR'. In the early 1960s, the UK importers of USSR built radios was a Company called Convair Electronics Ltd, Hatton Gardens, London EC1, and then Technical and Optical Equipment (London) Ltd (also known as "TOE"), London N7, who were wholly owned by Mashpriborintorg, was started in 1962.

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TOE was principally involved in the import and marketing of Russian built cameras (notably Zenit) and employed over one hundred Russian technicians who carefully checked and calibrated them on arrival from Russia before offered for sale in the UK and in Europe (and any rumours that they were associated with the KGB are totally unfounded!). They also imported and marketed transistor radios built in the USSR, often with the generic brand names 'Convair', 'Astrad' or 'Vega' (and 'Comix' in France). As all radio factories in the USSR were state owned, these were not Company brand names and were no indication of where the sets were built but somewhere on them a factory logo can usually be found. These factories included:

- RRR, Rigas Radio Rupnica in Riga, Latvia who also built the 'Rigonda' brand radios and radiograms
- VEF, Valsts Elektrotechniska Fabrika factory in Riga, Latvia
- Minsk Radio Works, Minsk, Belarus
- Sokol, Moscow Industrial Union "TEMP" factory, Moscow, Russia
- Leningrad Radio Devices Works, St. Petersburg, Russia
- Vega, Berdsk Radio Works, Berdsk in Siberia, Russia

Radios with the Vega factory/brand name sold in the USSR were exclusively built in the Berdsk Radio Works in Siberia, but in Western Europe and Scandinavia Vega brand radios

1: Mashpriborintorg logo
2: Soviet quality rosette
3: RRR logo
4: Tento logo
5: VEF factory logo
6: Vega logo
7: Spidola – VEF Riga, 1961
8: Convair 1 – VEF Riga, 1962

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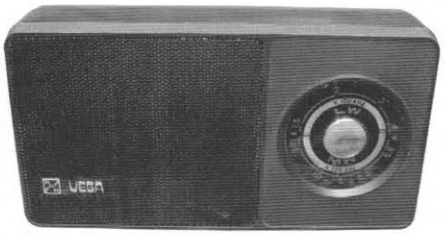

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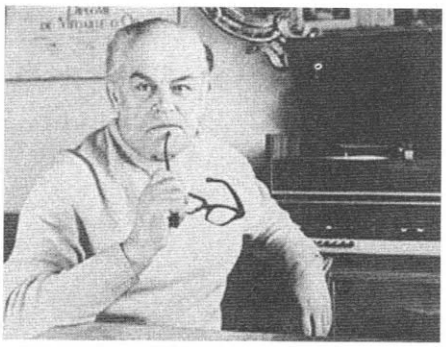
originated from factories all over the USSR.

In 1979, the Mashpriborintorg Association was replaced by 'Technointorg' (or 'TENTO'). This larger Moscow based Soviet Association controlled the export and import of technical goods and services between the USSR and the rest of the world and the 'TENTO' logo thereafter appeared on radios and packaging. This organisation continues to this day as an agency of the Russian Federation.

1960s USSR transistor radios.

Transistor radios were first built in the USSR in Russia in the late 1950s, in small numbers and only for the USSR market. Probably the best known of these were the 'Atmosfera' MW/LW sets built at the Grozny Radio Works in Grozny, Chechenia. The first mass produced transistor radio and the first to be exported from the USSR was the 'Spidola' MW/LW/SW 10 transistor set built in 1961 in the VEF factory in Riga, Latvia. The VEF Riga factory had a workforce of over 20,000 people and 40% of the radios built there were these 'class 2' Spidola transistor radios; over 1 million of them were built per year. The casework was designed by the famous Latvian technical designer Adolfs Irbite (1910-1983) who also designed many of the Rigonda radios and radiograms of the 1950s and 1960s and who continued to design many of the transistor radios built in Latvia until his retirement in 1973.

The Spidola radio set the trend in the design of multiband transistor radios built in the USSR for the next 30 years, with its familiar turret type waveband switch. Inside, the components are of Russian origin, with the familiar 'top hat' germanium transistors, and it's capacitors, loudspeaker etc all have 'CCCP' stamped on them. I have two 1961 Spidolas in my collection, one in black and white and another in pale blue and primrose yellow and they are both totally original and still work perfectly. In 1962 the second Spidola model was introduced, with a redesigned



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dial and these appeared in the UK and Western Europe with the 'VEF Transistor', 'VEF Tranzistors' or 'Convair 1' names on them and these are probably more familiar sets nowadays as they were imported in large numbers and continued in production for over three years.The third 'Spidola 10' model appeared in 1966, renamed the 'Convair 10' for the European market, and this had a square case but internally was much the same as the previous model. In 1969, the VEF 12 model was introduced, which came in a larger more robust case than the earlier VEF models, and was fitted with a tone control.

Also in Riga was the RRR factory, the oldest radio factory in Latvia (started in 1927) who were already well known in the UK in the 1950s for their 'Rigonda' brand valve radios and radiograms. This factory was originally known as Radio Popov Radiotehnika (RT) and changed its name to Rigas Radio Rupnica in 1951. The factory employed around 16,000 people and built a range of high quality valve radios, radiograms and transistor radios. The first transistor radio to be exported to the UK in 1963 was the 'Selga', a pretty little 7 transistor MW/LW pocket set, and this model, as many RRR products, was regarded a 'high class' product in the USSR as it had stamped on its case the coveted 'quality rosette' emblem, awarded to products built in the USSR considered the best quality. It is a nicely built little set in its black and white plastic case and gold grille with its superbly made Russian leather carry case and my original 1963 example still works

9: Selga RRR Riga, 1963
10: Convair 10 – VEF Riga, 1966
11: Selga RRR Riga, 1967
12: Astrad Solar – RRR Riga, 1967
13: VEF 206 Riga, 1976
14: Sokol 308 Moscow TEMP, 1976
15: Selena B215 Minsk, 1977
16: Selga 405 RRR Riga, 1977
17: Vega RP2411 Berdsk, 1991
18: Adolfs Irbite (1910 – 1983)
19: TOE Thane Villas, London N7

Signal 601 – Leningrad 1974

Sokol RP204 – Moscow TEMP, 1992

Sokol RP210 – Moscow TEMP, 1992

perfectly. The case was redesigned in the mid 1960s and was then available in several different colours. In 1967, the RRR Astrad Solar (known as the Riga 103 in the USSR) 17 transistor radio was released and this model designed by Adolfs Irbite was a very fine quality AM/FM radio, with 12 push buttons, tone controls, two loudspeakers and was housed in a very robust wooden case. In the USSR some of these large sets appeared with stunning marquetry work on the front of their wooden cases, depicting rural or industrial scenes and some even had bold CCCP, hammer and sickle emblems.

The diminutive 'Micro' MW/LW 6 transistor radio with its tiny rechargeable batteries built in the Minsk Radio Works in Belarus appeared in the UK in 1966. One or two Russian built radios appeared in the UK in the 1960s; the Convair 7 transistor pocket radio built in the Sokol factory in Moscow is a model which occasionally turns up nowadays.

1970s USSR transistor radios.

In 1970, VEF released the VEF 201 model in Europe which was similar in appearance to the VEF 12 with MW/LW and 6 shortwave bands. This design remained in production into the 1980s, appearing later as the VEF 202, VEF 204 and in 1976 the VEF 206, each with slightly modified casework, and acquiring an external PSU and silicon transistors. These are all well built radios and attained almost cult status in the 1970s by virtue of their excellent shortwave performance. I have a couple of original VEF 206 sets and they both work perfectly and are indeed exceptionally sensitive on shortwave. The Spidola name continued to appear on 1970s VEF MW/LW/SW sets in more up to date looking cases, examples being the Spidola 250 (1976) and Spidola 232 (1979).

RRR continued to export their Selga models into Europe during the1970s, the Selga 402 (1971), Selga 403 (1972), Selga 404 (1974) and Selga 405 (1977). The Selga 403 was RRR's first model incorporating an integrated circuit but that innovation was dropped in the later Selgas which returned to all discrete components. Between 1970 and 1974, RRR built the Astrad 302 (also known as the Riga 302 and Vega 302), a small LW/MW/VHF set. I have an example of this model and it works very well, with very good sensitivity, and good sound quality too, considering its modest size.

In 1970, the 'Selena' MW/LW/SW/VHF mains/battery AM/FM radios built in the Minsk Radio Works in Minsk, Belarus started to appear in Western Europe and Scandinavia. These high quality 17 transistor radios were known in the USSR as Okeans where all had the 'quality rosette' stamped on their dials. They appeared in the UK initially with the 'Astrad' brand name, the Astrad 203 in 1972 and the Astrad 205 (also named the Mikado) in 1974. In 1975 the Selena B212 appeared, with its rather cluttered black dial and in 1977, the best selling Selena of all, the B215, was released. These radios attained cult status in Scandinavia, due to their excellent sensitivity on SW, and their top notch sound quality on FM. In the UK they received Which? magazine Best Buy awards. I have several Selena models and they are generally well built and all continue to work well.

The Vega 402 MW/LW 7 transistor radio was built from around 1971 and this is a genuine Vega set as it was built in the Berdsk Radio Works in Berdsk, Siberia. Unusually, Mashpriborintorg had their own logo placed on the front of this set rather than the Vega brand name. This little radio works OK, it's a bit lightweight in construction but it has a little button on the front which when pressed lights up the dial. The Vega 402 name was also assigned to a small portable television set imported into the UK but that had nothing to do with the Berdsk factory as it was built in the KRG factory in Kaunas Lithuania.

Around 1974, two little MW/LW 7 transistor pocket clock radios appeared here, the Ruby and the Signal 601. These were built at the Leningrad Radio Devices Works in Leningrad (now St. Petersburg) in Russia. These are very cute little sets with their Sekonda built alarm clocks and came with superb Russian made leather cases. I have examples of both of these, they both work well but are best kept in their leather carry cases as their plastic cases are rather fragile !

In 1976, the Sokol 308 built in the Moscow Industrial Union "TEMP" factory appeared on the Western European market. These are small MW/SW/VHF sets with a complement of 9 germanium transistors, 1 silicon transistor and two integrated circuits. I have one of these and it works well, but its build quality is a bit lightweight, and its box as usual with Sokol radios, is handmade from recycled paper - what an awful job that must have been for some Russian ladies pasting those together all day long!

1980s USSR transistor radios.

Production of the VEF 206 continued into the 1980s. Production of the Selena B215 continued throughout the 1980s and remained a popular transistor radio in the UK.

The Vega 404 MW/LW set appeared here around the mid 1980s, with much the same appearance as the 1970s model 402 but with a brightly coloured plastic case. The Vega Sapphire 303 Mk 2 LW/MW/SW 8 transistor set (known as the Russia-303 and Dombay- 303 in the USSR) appeared here around 1982 but I have not as yet been able to determine which factory it was built in.

The 1990s and the demise of the Soviet radio industry.

The Selena B215 continued in production until 1993. The last of these sets did not have a tuning indicator fitted as the factory ran out of them. I have a couple of Sokol radios built in the early 1990s, an RP210 pocket 10 transistor set, and a Sokol RP204 9 transistor portable which is spitting image of the Sokol 304 and 404 models sold in the USSR 10-15 years earlier.

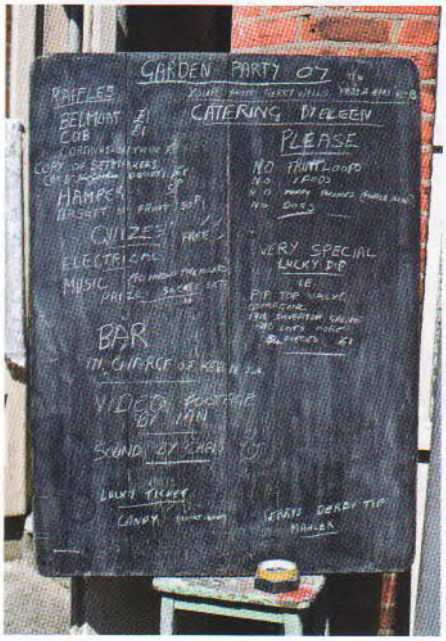
Since the end of the Soviet era in 1991, almost all radio factories in the former USSR eventually closed, mainly due to competition from cheaper sets imported from the Far East. The Vega factory in Berdsk closed in 1996 following the bankruptcy of a chain of electrical stores in Russia. The VEF factory was bought by RRR in 1998 and VEF-Radiotehnika-RRR now build hi-fi equipment under the Rigonda and Acoustic Reference brand names but their combined workforce, once 36,000 people, is now less than 500. The Sokol factory in Moscow was bought by the Japanese AKAI electronics giant and now builds vast numbers of television sets and DVD players for the Russian market.

Images from Gerry Wells' garden party, 2nd June 2007

Photographed by Carl Glover
A tip of the hat to Alan Carter for bringing Sylvia Peters to the event

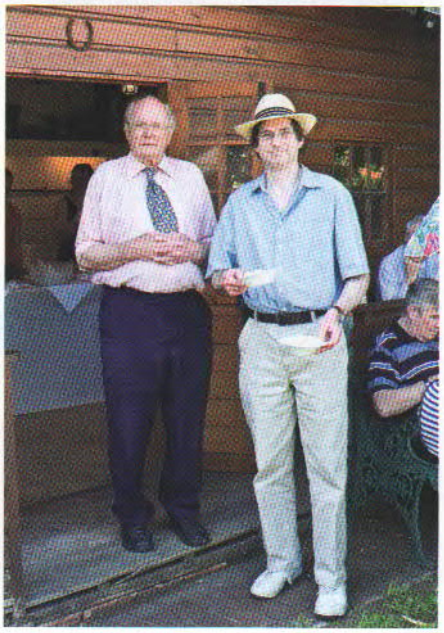
Above: Some of the prizes to be won by contestants in draws and quizzes at the garden party.

Below: Gerry keeping cool in the shade



Below: Gerry Wells with Bulletin contributor Peter Kyne

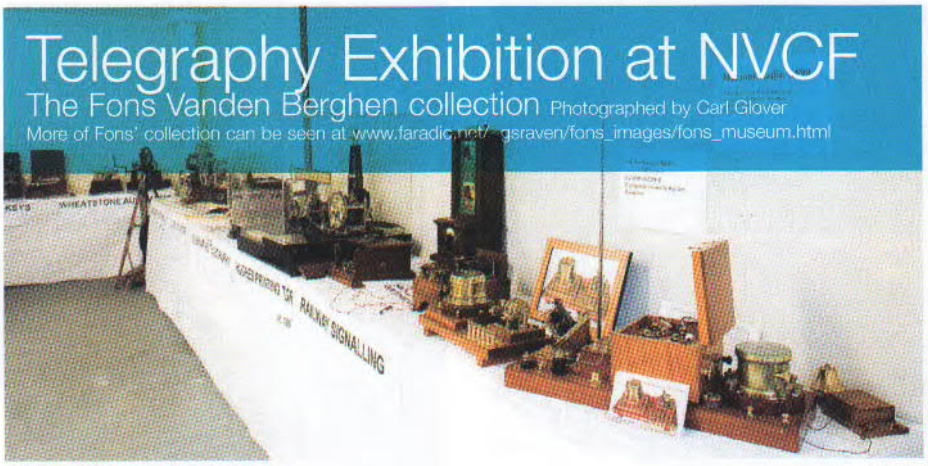
Below: BWS member Russell Atkinson with Sylvia Peters



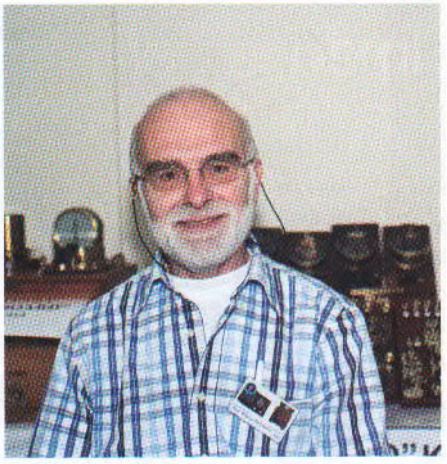
Telegraphy Exhibition at NVCF

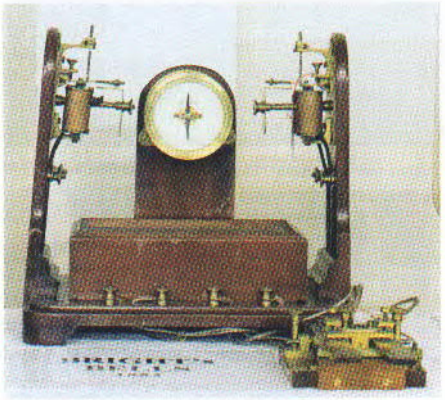
The Fons Vanden Berghen collection Photographed by Carl Glover

More of Fons' collection can be seen at www.faradic.net/~gsraven/fons_images/fons_museum.html

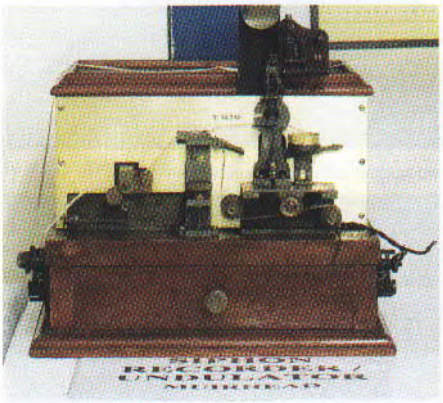


View of a small part of the exhibition

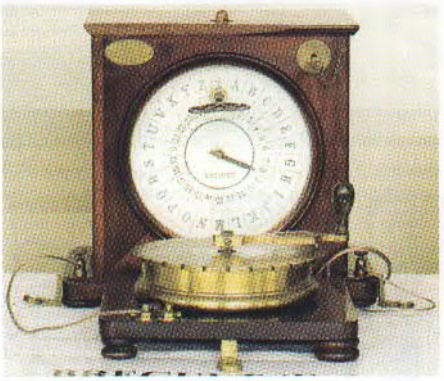




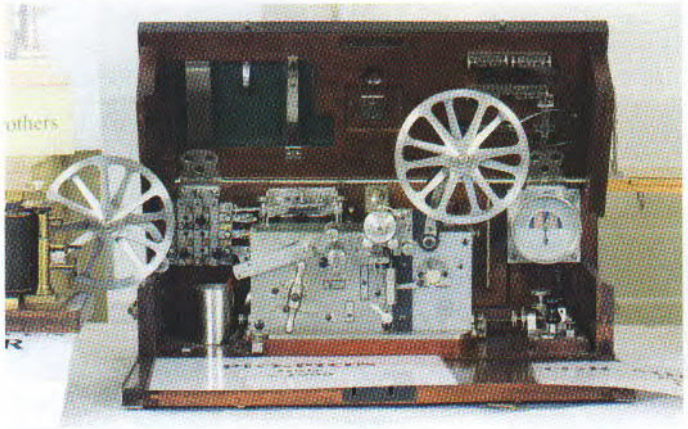
Bright's Bells (UK 1852)



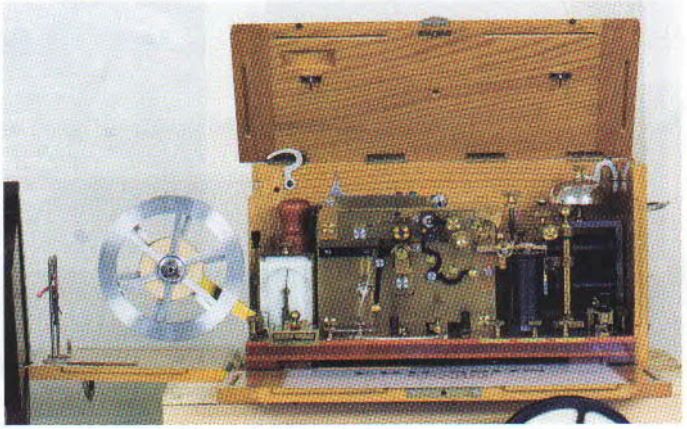
Undulator/Siphon Recorder by Muirhead (UK)



ABC Telegraph (Transmitter & Receiver) by Breguet (France c. 1850)

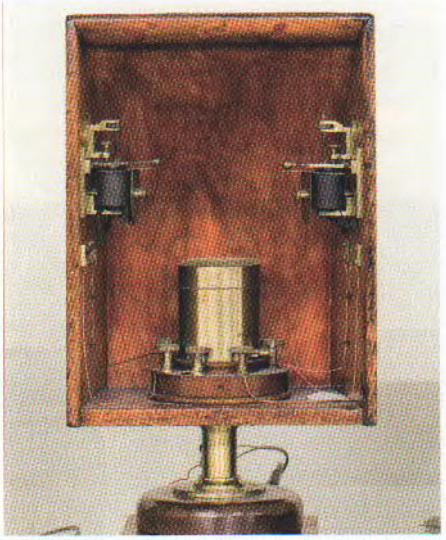


Complete Portable Telegraph system by Pio-Pion (Italy)



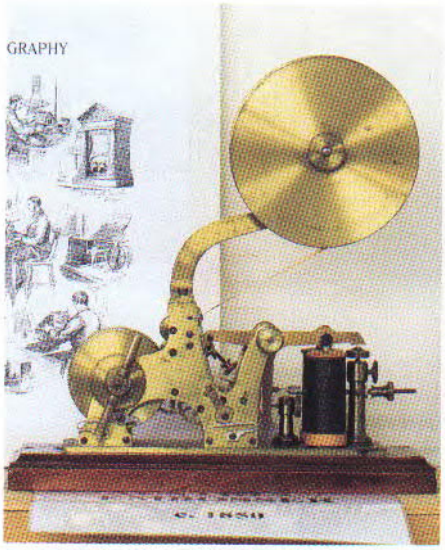
Complete Telegraph System by Ericsson (Sweden c.1885)

Single Needle Telegraph (UK c.1865)

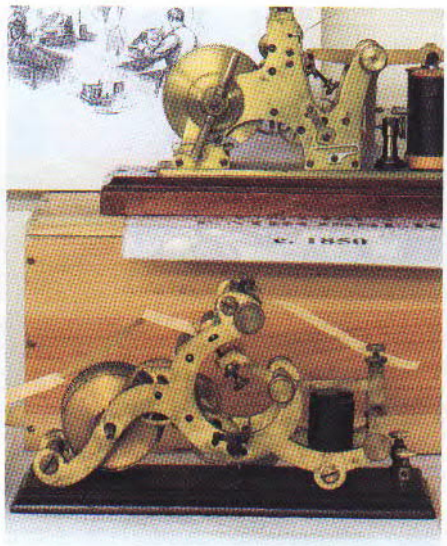


Double Plate Sounder (UK c.1860)

ABC Telegraph by Wheatstone (UK 1858)

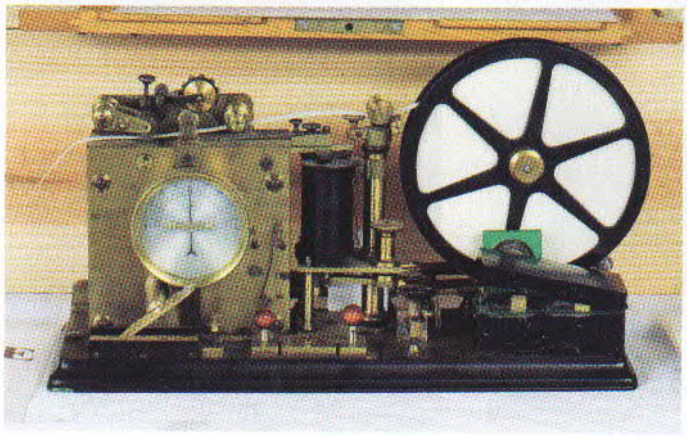


Embosser by Leopolder (Austria c. 1850)

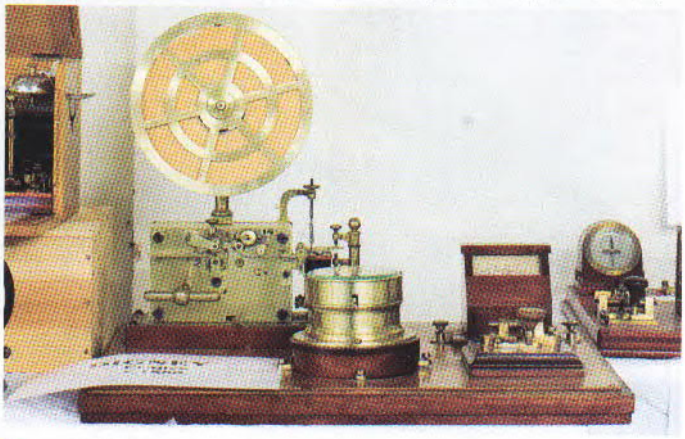


Weight driven Embosser by Tillotson (USA c. 1860)

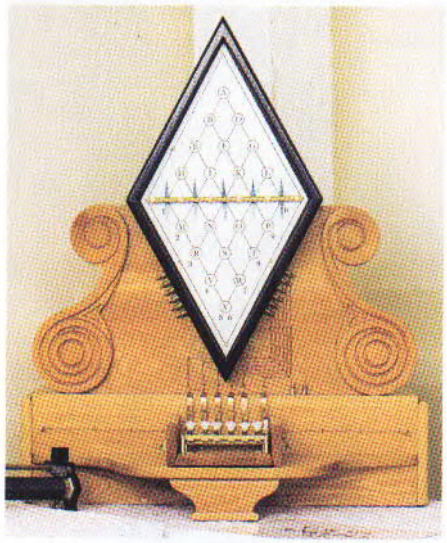
Multiplexer (Distributor) by Baudot (France c. 1880).



Portable Military Telegraph (France c. 1890)



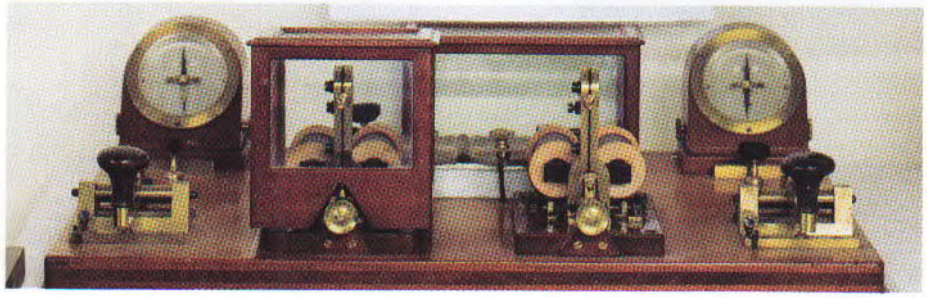
Telegraph Table by Digney (France c. 1880)



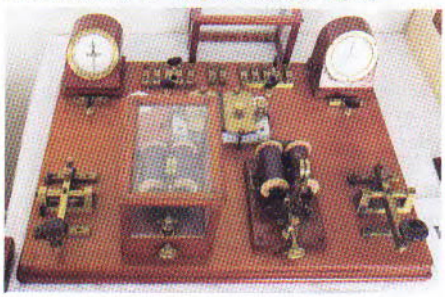
Replica of the 5 Needle Telegraph by Cooke & Wheatstone (UK 1837)

Double Needle Telegraph by Cooke & Wheatstone (UK c.1840)

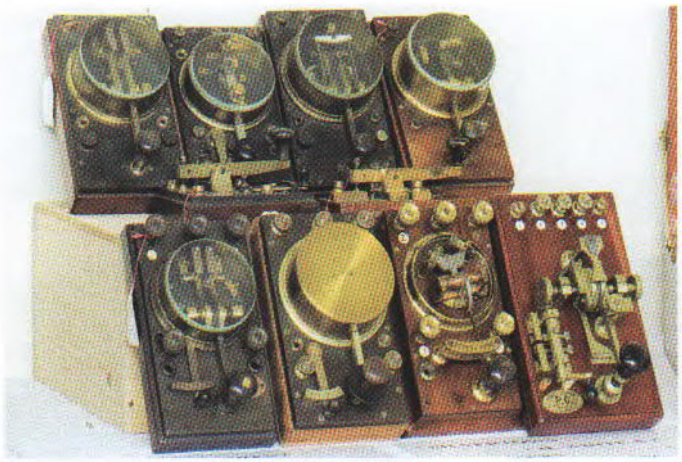
Another view of the Telegraph Table by Digney



Repeater Station by Siemens Brothers (UK)

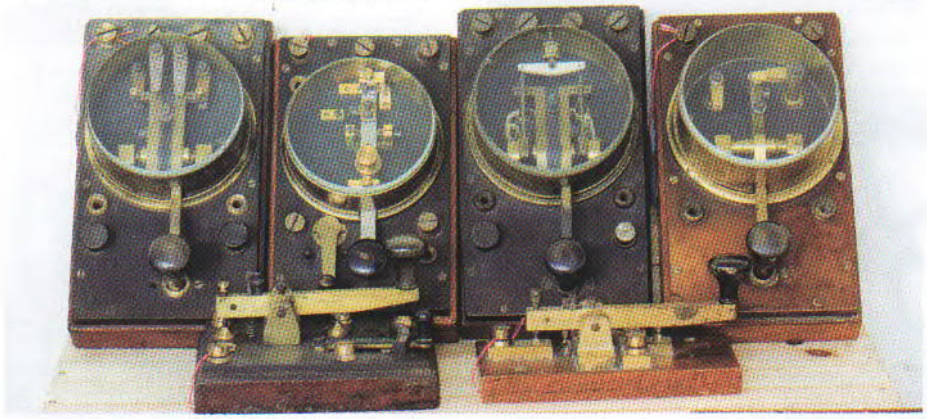


Another view of the Siemens Brothers Repeater Station



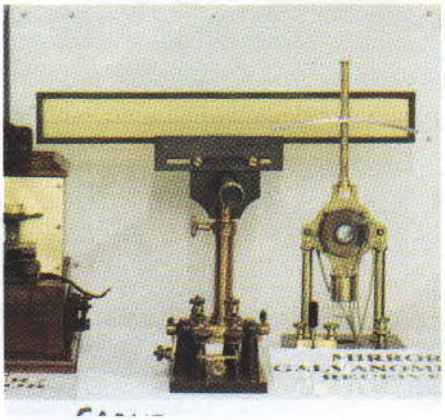
Eight 'special' and two 'classical' Keys (UK 4Q 1800)

Replica of a Braun Coherer Receiver (Germany c.1902)



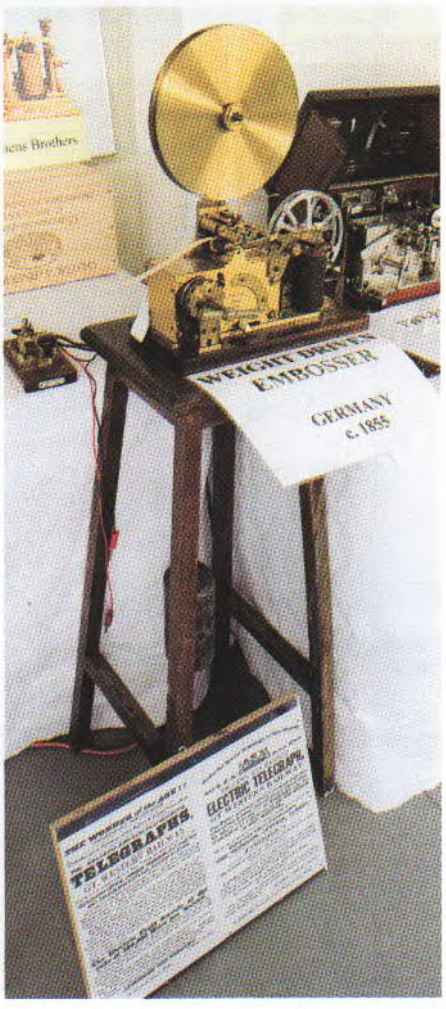
A closer look at some of the special UK Keys

Military Baseboard (UK WW1)



Receiving system with a Mirror Galvanometer

Heliograph (UK)



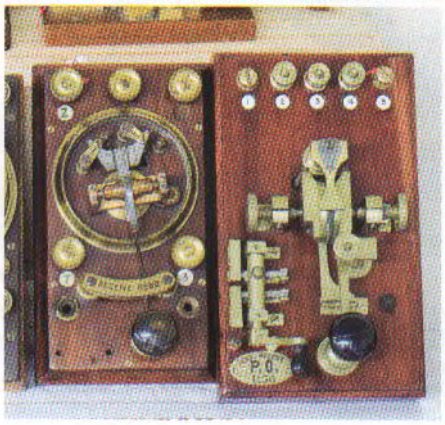
Weight driven Embosser by Kräntzer (Germany c. 1855)

Self Winding Stock Ticker by Western Union (USA 1902)

Replica of a Marconi Coherer Receiver (UK 1899)

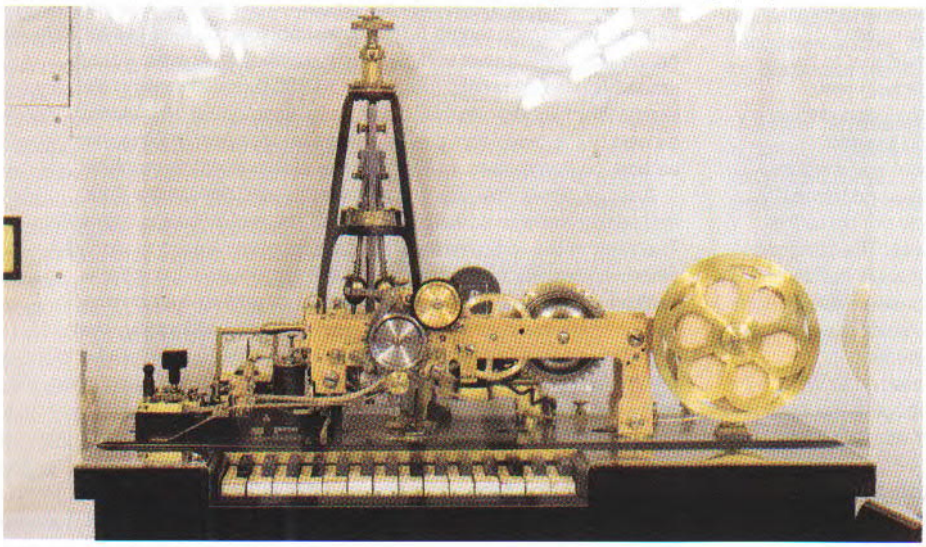
Sounders and Key On Boards (Sweden, UK and USA)

Universal Stock Ticker by T. Edison (USA 1872)



Two very old and special keys (UK)

Railway Block Telegraphs



Hughes Printing Telegraph (c.1870)

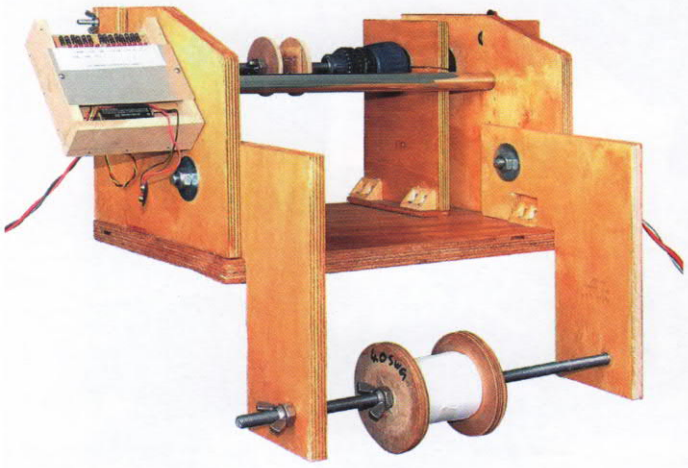
Single Needle Telegraph (UK c. 1845)

Making a Coil Winder, Part Two, and Winding an Inter-Stage Transformer

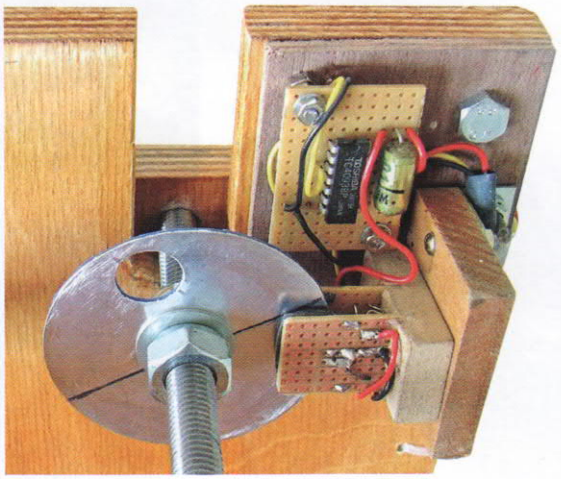
by Gary Tempest

Introduction

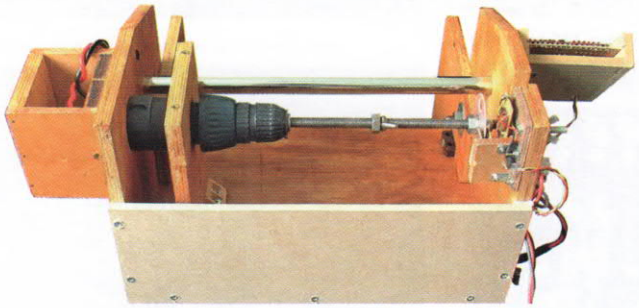
Part 1 of this project was in the last issue of the Bulletin. In this part I have detailed the changes made to make winding fine wires easier (with less or hopefully no breaks) and improvements and simplifications to the 'chopper disc' and sensor for the turns counter. Finally there is the example of winding fine wires for the push-pull Inter-Stage Transformer mentioned last time.



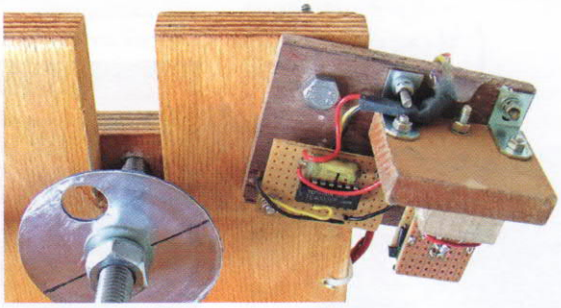
Winder with feed wire extensions (back not fitted yet



New Slotted Switch mounting



Winder with back fitted



New Slotted Switch hinged out of the way

Modifications

Without going into detail, I had more than one attempt at winding the Inter-Stage Transformer, including more breaks than were acceptable to me. I believe the main reason for this was the way the wire came off the feed reel. This was now much wider than the former for the transformer and so once again there was the problem of 'snagging' when the wire was on one side of the feed reel and on the opposite side of the former. My solution was to increase the path length from the feed reel to the former, reducing the 'angle of attack' coming off the feed reel. The inspiration for this was seeing film of wire being drawn and coming from large drums to the die over room–sized lengths.

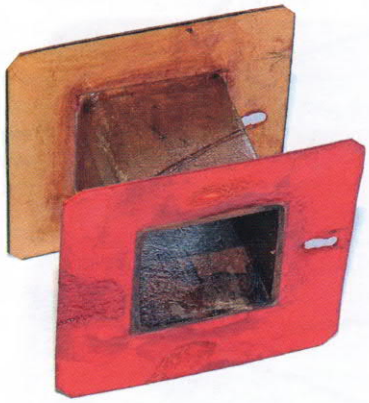
Two things, amongst many, that I have learnt about coil winders is that they need to be solid, and if it can come loose and move it will. The mounting, for the left-hand side, was simply not up to the task; it could be flexed easily with light hand pressure. The other side was acceptable because of the stiffness of the twin walls needed for mounting the motor. So I have beefed up the construction, by including a back panel and fitting a length of 6 mm studding through the chrome tube used for guiding the wire. Things coming loose included the chopper disc, which as the grommet started to wear, wound its way up the motor spindle eventually dislodging the sensor. Also it started to slip and so there was potential for miscounting.

Changes in Mounting the Feed Wire and the Slotted Switch

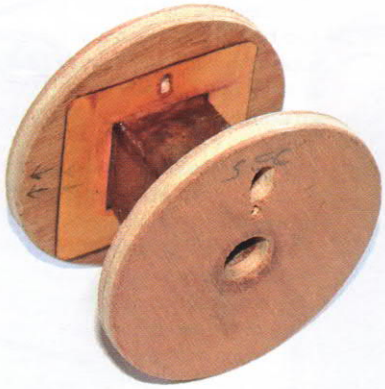
To mount the feed reel further away from the motor spindle additional pieces of 15 mm plywood were used (see picture). These were bolted onto the sides using the original feed reel spindle holes and in use overhang the front of the bench. The reel is moved out by seven inches and down by the same amount and doubles the wire path length to about fifteen inches. Would mounting it further away have been better still? It depends upon the bench and chair height but if it were much lower, knees would not go under it to use the foot pedal. For my setup, I could move the reel outwards by another four to five inches but would leave the height alone. Increasing the path length further may improve the feed but for this gauge (42 SWG) it was sufficient as the transformer was wound smoothly without breaks (nominally 15,000 turns). If making the winder from scratch, the feed reel extensions could be included as part of the sides and cut as one piece. However, having them as bolt–on items does make for easier stowage of the machine.

Another possibility was just putting the feed reel on the floor and letting the wire spool off the top of the reel in fishing reel style. The twist in the wire seems of no consequence. I used to do this when winding series field coils with the battery drill in a vice. It certainly works but there are many ways of getting wire breaks and entanglement with the feet is one of them, particularly when the winder has a foot pedal. Actually, being able to easily see and manipulate the feed reel is an advantage, particularly if turns need to be taken off, such as when the wire jumps a former cheek.

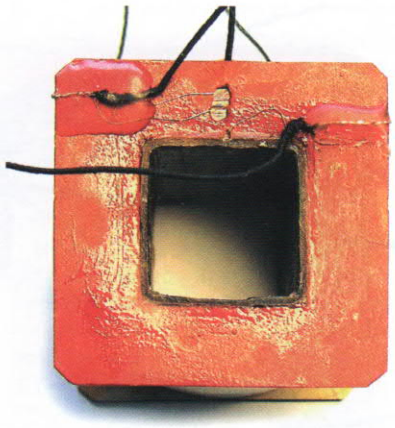
To get around the moving chopper disc I cut a new one and it is bolted securely to the motor- shaft with washers and lock nuts. The width of the slot in the side panel had to be increased so it passes the left-hand lock nut when withdrawing the shaft. The fixed disc does mean that coil bobbins can only be mounted from the motor end but this is not a problem. Lateral



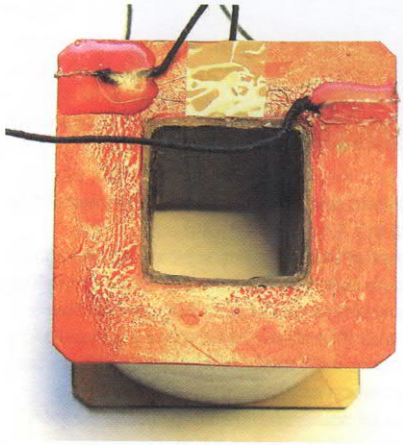
Coil former showing lead out wire holes



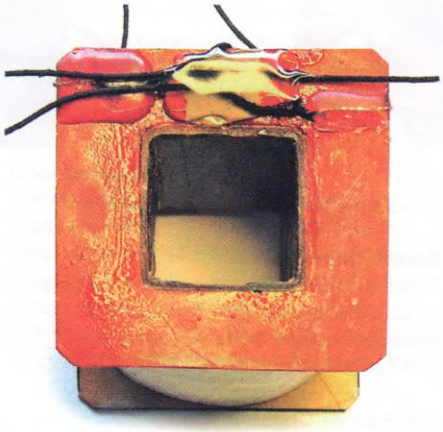
Coil former with support cheeks



Transformer lead out wires secured



Holes for the lead out wires taped over



Then covered with glue stick

The seal between the bobbin outer covering and the former cheeks can be seen

positioning of the disc, in the slot, is done by setting it so minor adjustment can be made as the drill chuck is tightened.

The Slotted Switch

The Optek OPB625

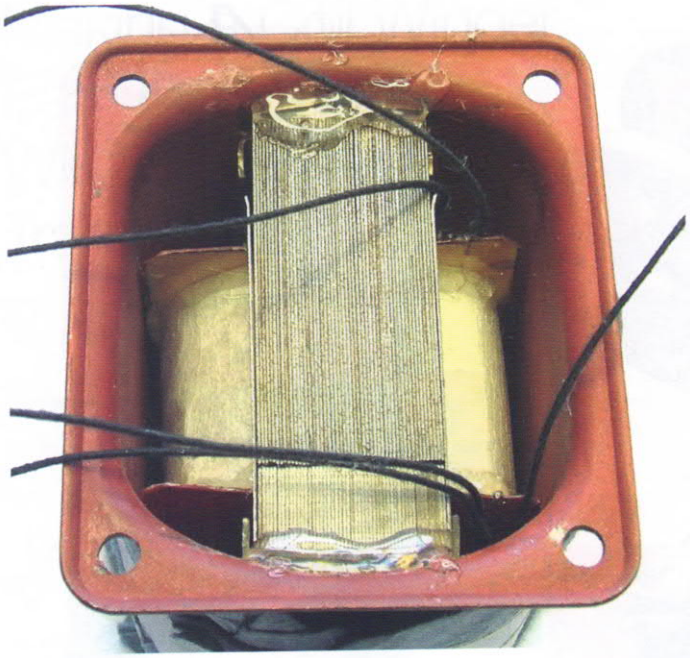
At first sight of the Data Sheet this device, available from Farnell for just over three pounds, looks ideal for the task. It consists "... of an infra-red emitting diode and a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schimitt trigger on a single silicon chip". The package is small, easily fitting on a thumbnail, with a five mm gap for the disc. "So why are you bothering to make one with discrete components you Stupid Boy!" Well, one immediate disadvantage is that the pin spacing is not tenth of a mm grid so it won't fit on copper clad Vero Board. But worse, it doesn't work that well unless you can operate the sensor and disc in near darkness (they don't mention that on the Data Sheet). When I first hooked up a package I was convinced that I had things wrong because it did nothing, but this was because I was working next to a window on a sunny day. It's interesting that with the light completely cut off from the diode (or it not even connected) the output can be made to change state just by shining a pocket torch across it (not directly into the receive window) from a foot away. One of the problems with the complete silicon chip package is that you can't look inside, at intermediate circuit points, as you can with a discrete component design. It's possible with this to optimise things so that there are good voltage changes at the output of the receive amplifier but with the integrated design you haven't a clue. I had already built a new sensor, with the discrete transmit and receive devices, and saw no reason to change from it. If anyone wants to try the Optek device it should be electronically interchangeable as far as the counter is concerned (it replaces the devices and the Schimitt trigger). My trial conditions were a 10V well decoupled supply, 20 mA through the diode and a 10K pull up resistor for the output transistor, additional to the one inside the package.

When I first hooked up a package I was convinced that I had things wrong because it did nothing, but this was because I was working next to a window on a sunny day.

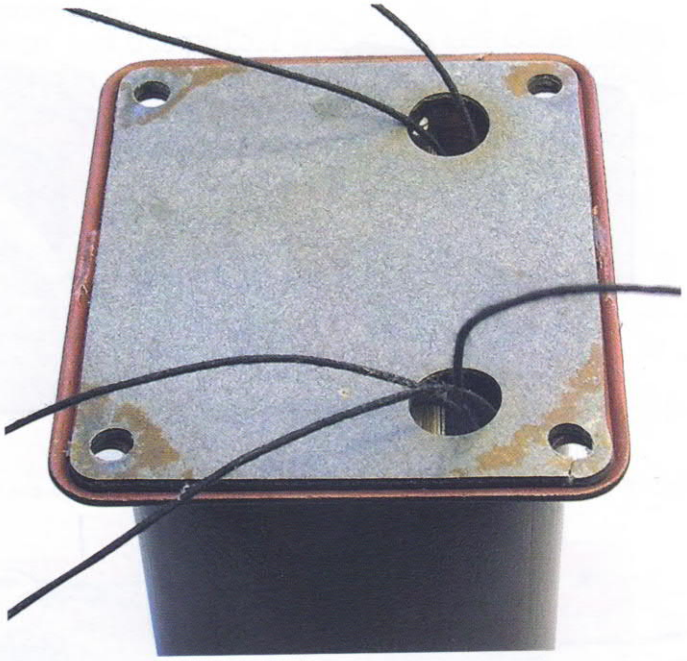
The New Slotted Switch with Discrete Components

In making the new sensor I cut the slots in the MDF just right and the Vero board pieces were a nice tight fit in them. This allowed me to optimise their position, with the 'scope monitoring the receive output, before sealing them in place with Epoxy. Doing this gave sensor output levels of just over 1 V to 8 V (with the light cut off). This sensor is affected slightly by external light but is a lot less sensitive to it: it's insensitive anyway, needing 40 mA through the diode for operation. If the torch is waved across the top of the disc, with it cutting off the light from the transmit diode, the 8V level blips slightly by maybe a volt. It's not enough to change the Schimitt trigger output though, as typically, according to the data sheet it would have to fall to 4V to do this.

I tried two chopper discs; one cut from copper-clad fibreglass board and the other from the soft blue plastic top of another pillbox. I was



Transformer back in the can



The finished item

hoping that it would be totally light tight, but it wasn't, so I covered one side with self adhesive Metal Repair Tape, made by Griptite and it does! It wasn't wide enough to cover the disc in one pass and so I used two pieces and a black spirit pen over the junction. Of the two I prefer the soft one as it is more forgiving than the rigid fibreglass type. The hole tends to 'chew' if the disc moves a little, and it does, whereas the soft one just flexes. The reason the disc creeps is due to a small amount of end float in the drill. I couldn't see an easy way of eliminating this or in decoupling the disc from it. I did imagine the disc being on a separate shaft with a flexible coupler or belt but this is getting too complicated and beyond my mechanical abilities. In use, I kept an eye on the disc position and re-centred it if need be.

I decided to simplify the sensor mounting and make it just hinge out of the way (see pictures) and have fixed wiring. With hindsight the original arrangement was unnecessarily complicated.

Winding the Transformer

Technique

I did away with the masking tape over the ends of forefingers and thumb because for this wire I needed as much dexterity as possible. Now don't start laughing at this, but to counteract acids, whilst steering the wire, I painted the pads of the same digits with brushed super-glue. I don't believe that used occasionally this has any harmful long-term effects; it is regularly applied to the hands by wind-surfers during prolonged sailing periods to avoid blisters; none that I know of have had any problems. A good soak in a hot bath with your tipple of choice is a pleasant way of removing it.

I did away with the masking tape over the ends of fore fingers and thumb because for this wire I needed as much dexterity as possible. Now don't start laughing at this, but to counteract acids, whilst steering the wire, I painted the pads of the same digits with brushed super-glue.

Source for new wire

There is a company with a web site, wires.co.uk, who supply several varieties of enamelled copper wire, on convenient sized spools, down to 46 SWG.

Coil Former Construction

For simplicity I used the old former with the addition of cheeks made from thin cardboard. The original coil had been wound without cheeks, stopping short of the edges of the former by about three mm. I didn't intend to do this and, winding right out to the cheeks, hoped to get back some of the turns lost from the larger wire size over the original 46 SWG. It was simple to cut out the cardboard cheeks and glue them to the ends of the substantial square former, with epoxy, before painting them with a couple of coats of shellac (French Polish) to keep out moisture.

Once again I used support cheeks made from 6 mm plywood (see picture) that include slightly tapered and glued on projections that were a snug fit inside the former centre. It's easier to do this than make one solid centrepiece: to get a 10 mm hole, right through the centre for the motor spindle probably requires a lathe with a four jaw chuck. It needs to be central otherwise the resulting wobble, whilst winding, would make things even more difficult. Having two parts, from thinner material, gave wobble free running and they were made using just a column drill press. I don't think I would want to try it with a hand drill although it may be possible.

Slots were needed through the former cheeks to feed out the wires for the individual windings. The position of these can be estimated and the slots made long enough to cover error. The slots were made using the smallest size on a leather punch. The first wire (the start of first secondary) exits through a hole made with a small drill, as the position of this is known. A hole or a slot is of course needed in the side support cheeks, but these can be made larger.

The book by B.B. Babani "Coil Design and Construction Manual", recommends use of a lead out wire (I used stranded (4) double cotton covered) with two turns wrapped around the bobbin before the actual coil wire. I didn't do this for several reasons: it takes up space I probably couldn't spare, it makes the winding uneven and it is tricky to do. It's easier to add the lead out wires when the transformer is wound and removed from its supports. My method was to strip the wires and join them, having enough length to bend and clench over the former cheek. This locates the lead out wire and it is then fixed with a dab of hot melt glue stick. When all the wires for one side had been done (primary on one side and secondaries on the other) then the hole in the former was covered with a small piece of tape and then glue stick (see picture sequence).

For the most even coupling the book by Babani, suggests winding one secondary first followed by the primary and then the second secondary. I insulated between the windings using a turn of Mylar like film followed by a turn and a half of cut down 3M-parcel tape. The 'Mylar' tape actually came from the stiff clear wrapper (we used to call this cellophane) of a greetings card. If you are cautious you may want to put a temporary wrap over the final winding and not bother to connect a lead out wire. This enables a quick test with the transformer loosely 'lammed' up and if the balance between the secondaries is not spot on the turns of the final winding can be adjusted. My final wrap of the transformer was masking tape and then I sealed the edges of this to the bobbin cheeks with hot

melt glue stick. This has the added advantage of holding everything solidly together.

The stack of laminations was approximately 2 1/2 x 2 x 3/4 inches and were installed as follows. All the E's, bar two, went in from one side with these going in from the other side with all the I's set between them. I suppose this gave much quicker installation than interleaving. Two brass compression plates go along the sides (the one where the I's are) and once pressed home into the coil can everything is secure.

The transformer can was originally pitch filled and I used a hot oven to melt it out and then several soaks in White Spirit to clean everything up. I decided against re-filling with either pitch or wax; neither it seems to me guarantee that the wire won't corrode and 'greenspot'. Certainly whilst the radio is with me it won't be going in a damp shed. Spools of wire left indoors come to no harm and I don't see why the transformer should be any different. Hot fillings are a messy business and make doing a future rewind, due to unforeseen problems, so much more difficult. I did secure the transformer core to the can with a little hot melt glue stick.

Coil Calculations (see Appendix 1)

In Part 1, I gave sources for calculating the number of turns that would fit into a particular winding space. For this job I had to get things correct otherwise when I came to the last winding there might not be room! As the Internet method had been the most accurate, for the field coil, I used that. However, I was going to reduce the calculated number of turns by at least the 15% that I had previously found too high.

Calculation of the Number of Turns (Appendix 1)

F. Langford Smith says "When a centre tapped secondary is used the turns ratio is calculated for the whole secondary". Well I shan't forget this another time as I initially wound the transformer with a 2:1 step up to each half. Apart from audio gain I didn't need there were insufficient primary turns and inductance. The consequence of this is a poor low frequency response as the falling reactance loads the Ra of the driver tube.

The number of turns that would fill the winding space was calculated as 17,762 and 15% less would give about 15,000 turns. To be on the safe side I opted to wind three windings of 4800 turns each.

Conclusions

The changes to construction have been worthwhile and the winder should handle wires as fine as 44 SWG. The simplified design of the slotted switch is easy to use although there are still some shortcomings with the switch. This is due to the small amount of end float of the drill allowing the disc to creep out of centre of the sensor. For an occasional–use machine it's acceptable and just requires keeping an eye on the sensor and readjustment whilst winding.

For the Inter Stage transformer the turns and insulating layers filled the former nicely to the brim. The reduction in the calculated turns, by the Internet Method, of 18% was just right.

Using a signal generator with a 10K Ohm feed resistor, to simulate the Ra of the audio driver tube, it was easy to check performance with an oscilloscope. Frequency response was 3dB down at 55 Hz and flat to beyond 10 kHz. Re-checking the figures with the transformer in circuit and with DC in the primary gave similar results.

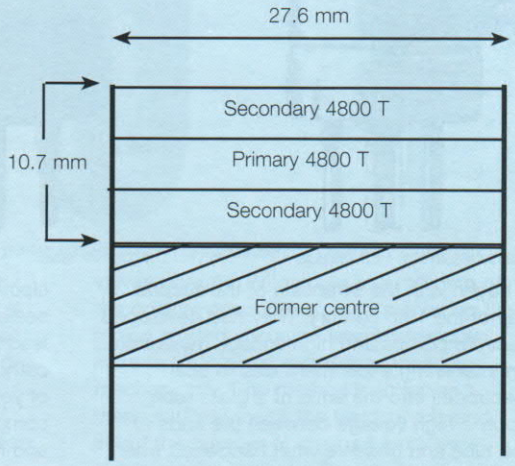
If you are tempted to use a modern tiny replacement transformer (available from Antique Electronic Supply in the USA), these are intended to be shunt fed, via a capacitor, and do show a marked fall off at low frequencies for even a small amount of direct current. I was able to borrow one (Hammond P-T124B) to try and the response was 3 dB down at 300 Hz with 6 mA of DC. Take away the direct current and the 3 dB point improves to 100 Hz. This is quite a tiny transformer weighing in at a mere 0.4 lbs. against the rewound transformer of more than a pound.

Appendix 1. Calculating the Number of Turns

F. Langford Smith says that "When a centre tapped secondary is used the turns ratio is calculated for the whole secondary". For this transformer this is 2·25 to 1. Practically this is close to putting on three equal windings giving a turns ratio of 2 to 1 with only just over 1 dB of gain loss.

The bare wire diameter is 0·1016 mm. Using the Internet method and adding on 10% to allow for the coating equals 0·11176 mm. For random winding another 15% is added giving a 'working wire' diameter of 0·1285 mm.

The former inside length is 27·6 mm and so the turns per layer will be 214. The depth of the former is 10·7 mm, therefore the maximum number of layers equals 83. The maximum number of turns is therefore 17,762. But removing 15% for inaccuracies found when winding the field coil, gives approximately 15,000. To be safe wind three windings of 4800 turns each.



Electronics began with almost nothing by LL Williams

A radio valve contains, apart from some simple metal assemblies, almost nothing. By far the most important component is the 'almost nothing', a substance which exhibits some fascinating properties.

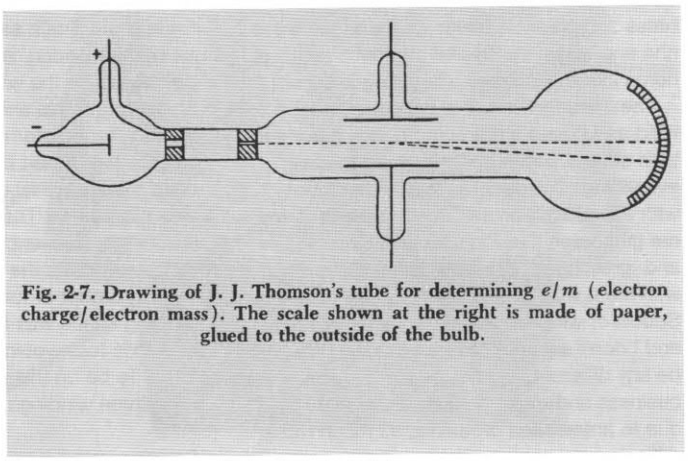
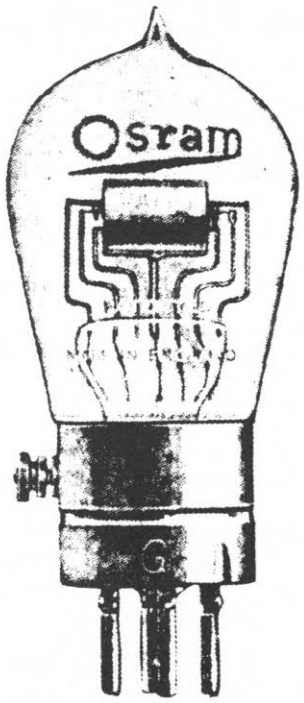
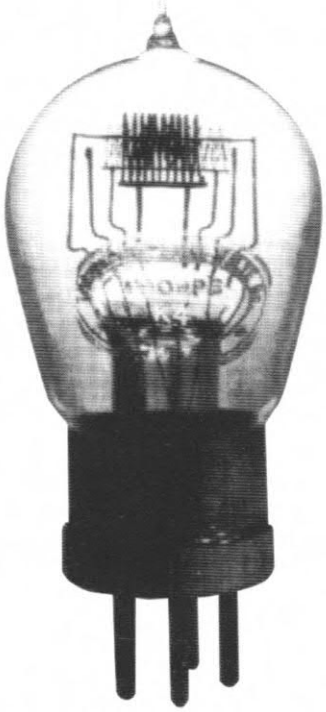


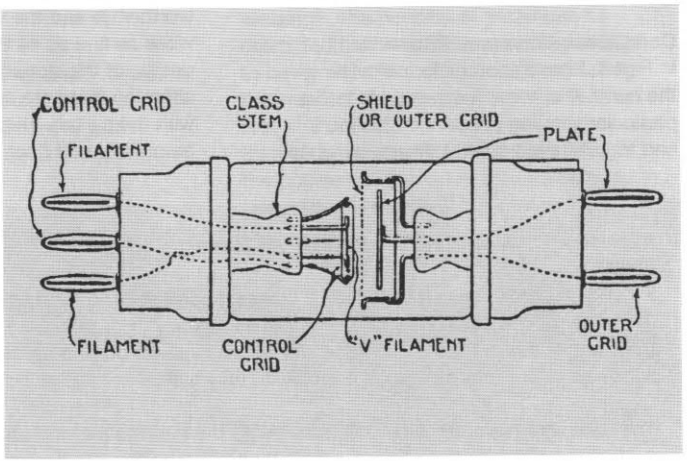
Fig. 2-7. Drawing of J. J. Thomson's tube for determining e/m (electron charge/electron mass). The scale shown at the right is made of paper, glued to the outside of the bulb.



Marconi–Osram FE3 tetrode



Thorpe K4 valve



Marconi–Osram S625 valve

It began with the scientists of the second half of the 19th century. They had developed vacuum pumps and high voltage generators. An interesting experiment was to seal electrodes into the ends of a glass tube, apply a high voltage between the ends of the tube and observe what happened when the air was pumped out. If the electrodes were too far apart for the high voltage supply to break down the air at ambient pressure no detectable current flowed in the tube. When the air in the tube had been reduced in pressure sufficiently, a glow appeared inside the tube and current could be detected flowing between the electrodes. It was observed that the glow did not fill all of the space between the electrodes, there being a space with no visible glow adjacent to the electrode surfaces. These spaces were named 'Faraday's and Crooke's dark spaces. It was noted that as the air pressure in the tube fell lower, the dark spaces became longer and the glow shorter and if the pump could reach a high enough vacuum, the two dark spaces would meet and the glow would be extinguished.

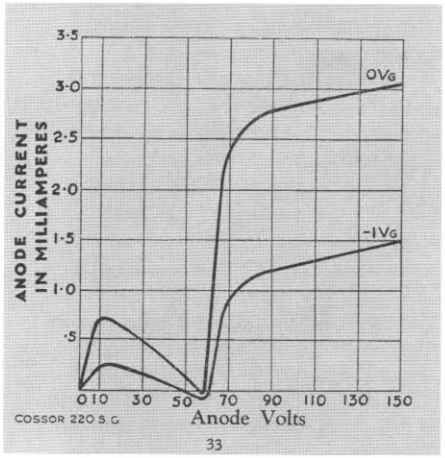
I will discuss the nature of the glow, the dark spaces and their relevance to electronics later. The glow tubes lead to electrodes of all sorts of geometries being sealed into evacuated glass bulbs which lead to a very important invention; the cathode ray tube. It may surprise some of you to hear that the earliest electronic component was the cathode ray tube and it predated both the discovery of the electron by JJ Thompson (later Lord Kelvin) in 1897, and JA Fleming's diode valve in 1904. The name 'cathode ray' tells us it predates the electron; were it otherwise we would call them electron beam tubes.

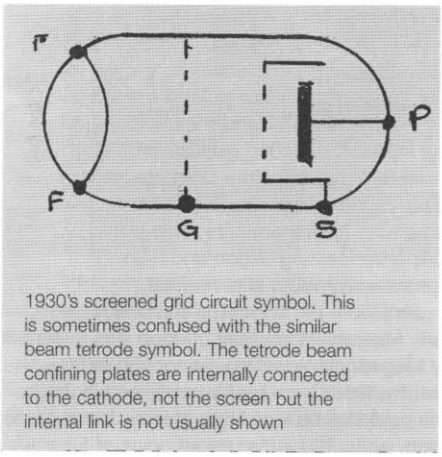
The Victorian physicists observed that when an electrode sealed into an envelope containing a high vacuum was biased with a high negative potential, something invisible to the eye was emitted from it which could cause a suitable coating on the glass envelope to fluoresce. A piece of mica interposed between the cathode electrode and the screen cast a shadow and because mica is transparent to light, what came from the cathode could not be electromagnetic radiation. The phenomenon was therefore called a cathode ray.

JJ Thompson's 1897 apparatus is instantly recognisable as an electrostatic cathode ray tube with an electron lens to produce a focused beam and deflector plates. The electron beam was easily deflected by either electric or magnetic fields and was virtually inertia–less. It was quickly adopted as an ideal tool for visualising oscillatory phenomena in physics. The first picture of a waveform photographed from an oscilloscope screen was published in 1899, five years before Fleming's diode valve. Fleming seeking a high–frequency rectifier, investigated the Edison effect by sealing a metal plate inside a filament lamp and the rest is history. Fleming called his device an 'oscillation valve' by analogy with a hydraulic non–return valve. The name 'valve' stuck and was later applied to a wide variety of devices irrespective of their function, construction or mode of operation. There is a vast number of publications on the development, manufacture and application of valves.

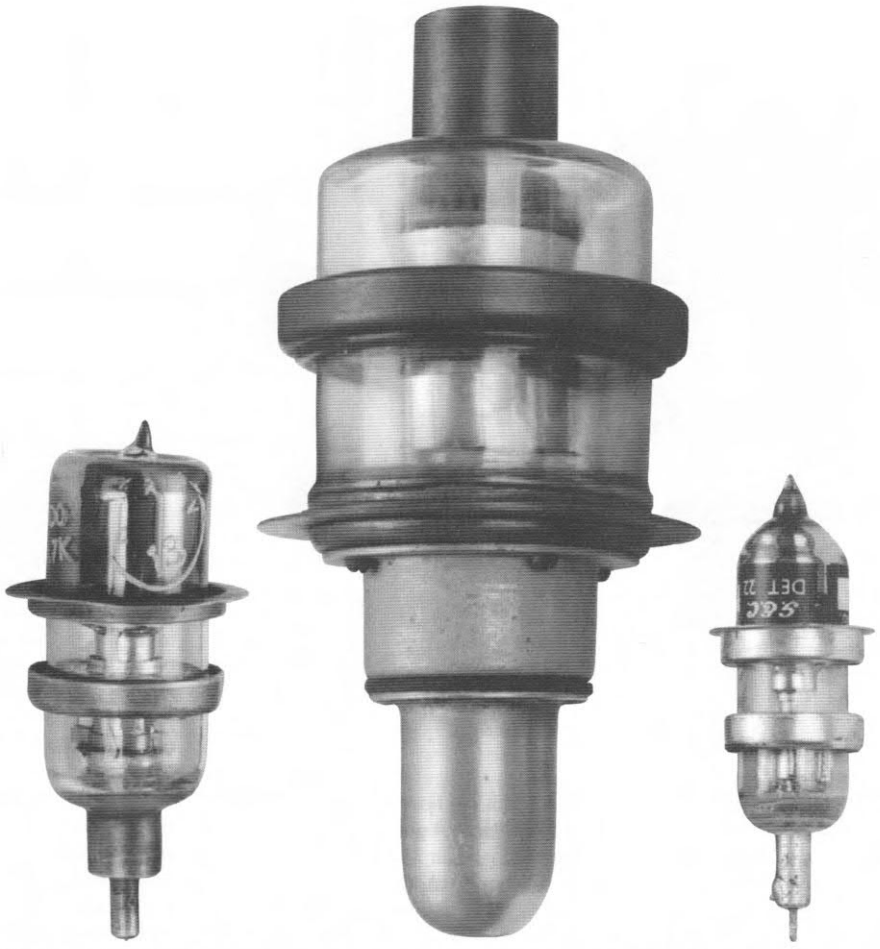
What I am attempting to do is shine a light into a few dark corners for some of you – perhaps alert you to the existence of some fascinating pieces of early technology which you may see if you are lucky and even collect if you are very lucky. They turn up occasionally, often thrown into skips by people, including museum curators who don't know what they are. If nothing more perhaps I can take a few

Below: A tetrode kink. The negative resistance region (Dynatron) is from 10 to 60 anode volts for linear amplification. The anode can only swing 90 to 150v.





1930's screened grid circuit symbol. This is sometimes confused with the similar beam tetrode symbol. The tetrode beam confining plates are internally connected to the cathode, not the screen but the internal link is not usually shown



British disc seal triodes for UHF and microwave power amplification in grounded grid mode

old–timers on a trip down memory lane.

Before going further I need to say a few words about the vacuum. A vacuum is defined as a space entirely devoid of all matter. As far as I know there is no such space anywhere in the universe except in the heads of physicists who perform experiments of the mind inside the hypothetical valves in elementary text books. This is no minor quibble. The effects of the residual gas left in any practical near–vacuum determined the development of early devices and is a factor which had to be considered in the design of all vacuum devices up to the present day. It is a very important almost–nothing!

I will attempt to give you some feel for what the numbers I will use to designate varying degrees of vacuum imply. Starting with the air you are breathing – you are not aware of it because fortunately the inside of your body is at the same pressure as the outside, or you would be squashed flat, but that air exerts a force of about 15 lb on every square inch or near 1 ton on a square foot. The nominal pressure of the air at sea level is called 1 atmosphere or 1 Bar relative to an absolute vacuum. This pressure is the effect of air molecules striking every surface it is in contact with. It is therefore a measure of how many air molecules there are in a given volume at a specific temperature. One millilitre of air at 1 bar weighs circa 1.2 mg. Doesn't sound much but it means the air in my lounge weighs circa 100 kg. Given the density of air at 1 Bar I can take a guesstimated mean value for the atomic weight of the gases in air and calculate how many atoms there are in a given volume at any pressure. It is a number which decides how a valve will function at any degree of vacuum. At 1 Bar and 20°C the number of atoms in 1 millilitre of air is circa 5×10^{19} (5 followed by 19 zeros).

The fundamental reason why we must pump some of the air out of a valve is immediately apparent. Even if it were possible to heat a filament in air to the temperature at which it emitted electrons, when an electron was flung out of the filament it would instantly collide with a gas atom and because the atom is tens of thousands times heavier it would bounce straight back. If we pump the air out until only one part in a thousand remains we have reached a pressure of 1 milibar which is about as low as we can measure with a mercury barometer. This is a region called soft vacuums where glow tubes and soft valves operate. When only one millionth of the original gas remains we are entering the region of hard vacuums where pressures have to be inferred rather than measured mechanically. One method is to ionise a measured volume of the residual gas and count the number of charged particles electronically. We are now entering the world of the radio valve. When I last had anything to do with ultra high vacuums (about 50 years ago) the best we could do was about one millionth of one millionth of a Bar. It was a very long job and having got below the range of mechanical pumps and diffusion pumps we resorted to tricks like ionising the gas and dragging it out with electric fields. Even at this degree of vacuum the number of atoms in a millilitre is still huge.

In interplanetary space pressure is circa ten thousand times lower still. Even empty space between the galaxies contains a lot of atoms in a cup full – enough to measure from earth. A physicist commented that the conquest of space would be worthwhile for the importation of high vacuums. Only a little more spade work now and we will have enough knowledge to understand some fascinating applications. How good a vacuum we need depends upon the application and

Below: American lighthouse triode grounded grid power amplifier. The anode radiator can be removed for liquid cooling. One of these produced 250w CW continuous power (FM) for over 6 years 24/7 operation in a beacon at 1.3 GHz.

Right: This vacuum variable capacitor rated at 10KV was used by the writer to tune a VHF power amplifier anode circuit.

a statistical quantity called mean free path. We have seen that even the best practical vacuums teem with millions of gas atoms but atoms are very, very small, so that in a practical vacuum the space between atoms of gas is many times the diameter of an atom. Imagine a set of snooker balls set randomly on the table; now drive the cue ball at random. The average distance the cue ball runs before striking another ball is the mean free path. Reduce the number of balls on the table (lower the pressure), and the mean free path increases.

Back to the Victorians' glow tube. An electron leaving the cathode travels towards the anode attracted by the positive charge until it hits a gas atom – the mean free path. If it has acquired sufficient energy it can knock an electron out of the atom leaving it with a net positive charge. The two electrons continue towards the anode and more collisions so that a space is formed which is filled with electrons and positive ions, a condition called a plasma; this is the glow. The electrons flow towards the anode and the positive ions drift toward the cathode but slowly because they are many thousands of times heavier than electrons. They stay charged until either they capture an electron or reach the cathode and are neutralised. The distance electrons travel from the cathode before an ionising collision is the dark space. It is also the mean free path and you can measure it with a ruler. The plasma having lots of free electrons is highly conductive and almost all the potential is across the dark spaces.

A hard vacuum (too low a gas pressure to form a plasma) is a wonderful engineering material. It is almost a perfect dielectric (insulator) – there is almost nothing there to carry current. Close spaced electrodes in a hard vacuum can have very high potential differences without danger of breakdown providing there are no sharp edges (these may emit high field electrons). A vacuum capacitor can be physically small because close spacing is possible and yet very high voltages can be applied and there is virtually no dielectric loss. There is almost nothing there to absorb energy. If you need a physically small relay to break high voltages, vacuum is it. Low powered transmitters can send TV pictures billions of miles from the outer planets. There's not much in the path to absorb the signal. With the best vacuums used in transmitting valves, mean free path is of the order of 100's of mm, making very high voltage operation possible. Mean free path has some very practical applications, one of which is quite counter–intuitive. At very high altitudes when high voltages are used in electronic equipment, glow discharges may take place and since the plasma has low resistance, destructive current may flow. The cure is to bring the points from which the glow forms much closer together. When they are inside the dark space there can be no plasma. It's true – I have done it.

When a wire grid was placed between the filament (cathode) and plate (anode) in Fleming's diode, it made a device which had the potential to detect radio signals, amplify, generate continuous oscillations and modulate them; one device which provided every function needed for radiotelephony and thereby making public broadcasting practical, founding the radio industry and beginning the science of electronics which now runs the whole world. Originally we used electronics to distinguish the many functions of valves from their initial use in radio. One of my colleagues called what we did 'electron tricks'. In my youth, academic institutions called it thermionics, which was a bit of a misnomer because many of the devices I used had no heaters.

At first triodes were only used as detectors; it was several years before their potential as amplifiers and oscillators was realised. When small scale production of triodes began it was noted that sometimes a device would exhibit spectacular sensitivity although it was in no way different in construction. Lee De Forest, credited with the invention of the triode, called these super valves 'grade X'. A letter exists stating, 'Grade X cannot be willfully made but simply occurs so their supply is beyond our control'.

Research showed that the super sensitivity was related to the residual gas in the valve. The pumping process employed in the early days was not very consistent. At this point the major directions of valve development in the USA and the UK diverged for almost a decade. In the USA the direction was towards better vacuums enabling valves of reproducible characteristics to be mass produced. Better vacuums also permitted high voltage operation and high power for transmitters. This put the USA ahead when public broadcasting began and high volume production of a consistent product was needed.

In the UK the principal users were the commercial wireless telegraph companies chiefly Marconi. What they needed was a reliable sensitive detector for very long range reception. For continuous wave (narrow band) telegraphy, there was the Alexanderson high frequency alternator. These could be built as large steam–driven machines capable of outputs up to 100 kW at frequencies of 50 kHz. It would be a long time before valves could do better than that and they were ideal for low frequency telegraphy. Some big Alexanderson machines were in use until after World War II. Consequently Marconi (principally HJ Round) and also some UK universities concentrated upon trying to produce a 'soft valve' which gave a reproducible super sensitivity. Two different mechanisms, both a consequence of the residual gas, were responsible for the soft valves' very high sensitivity. Unfortunately it was also responsible for the non–reproducibility of these most desirable characteristics.

One mechanism important for sensitive detection occurred when a combination of residual gas pressure, temperature and electrode bias were brought together. The optimum combination was unique to a particular valve and varied during prolonged operation and it also changed rapidly with valve age. Consequently it needed a very skilled operator to keep tweaking it. If the mutual characteristics (anode current v grid voltage) of one of these valves were carefully measured when it was in its sensitive mode, sharp discontinuities in the characteristic could be observed. At these 'sensitive spots' the anode current could jump 10% for a grid excursion of 1 mV. If an operator, by continuous minute adjustment of filament current and bias, could hold it on a 'sensitive spot' it had a sensitivity only surpassed much later by super regenerative detectors.

The second gas effect is called the gas amplification factor. If the valve operating conditions are set up right, a mode exists in which electrons from the cathode are controlled by the grid in the normal way, but having passed into the grid anode space are accelerated to a speed at which they can knock electrons from atoms. With the right combination of anode voltage and gas pressure a full saturated plasma with a low resistance is not formed but a cascade takes place in which secondary electrons liberate more electrons resulting

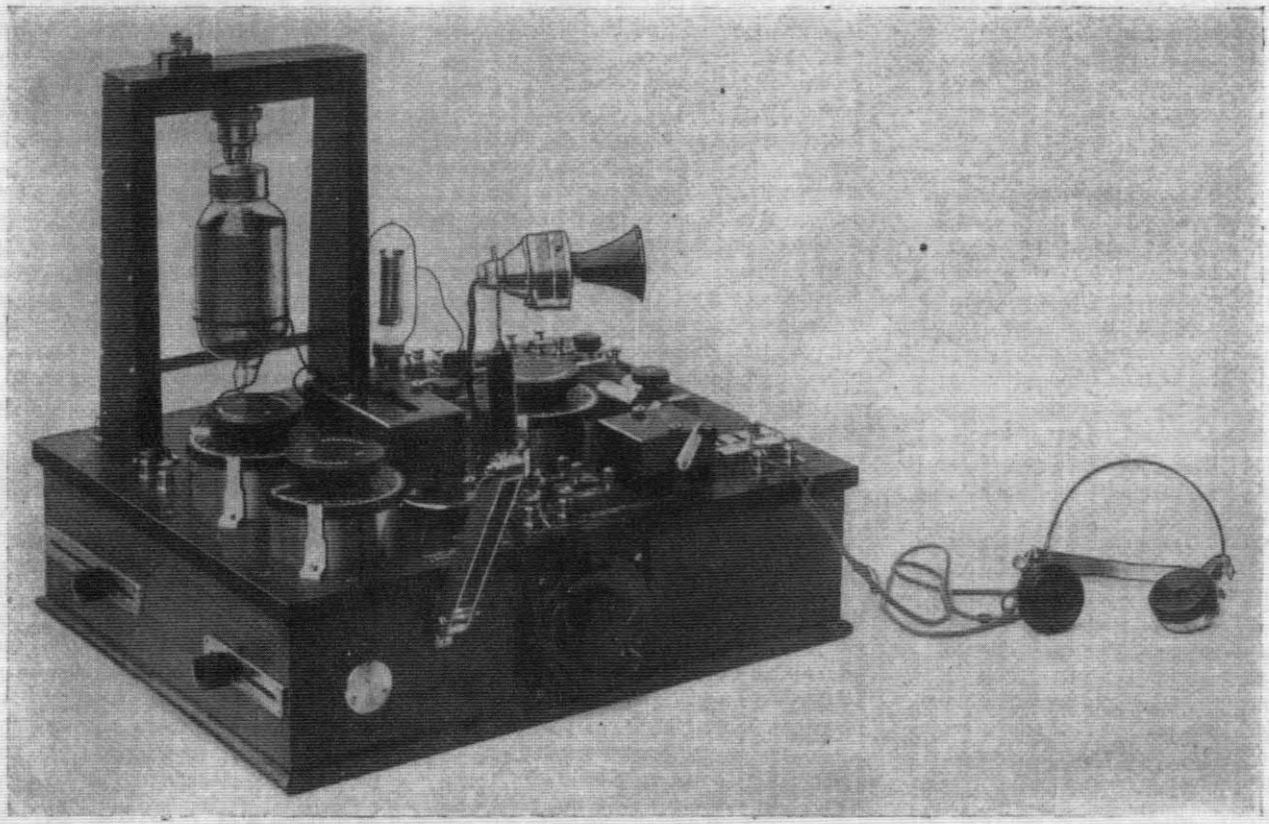


FIG. 11.—Transmitting and Receiving Apparatus for Wireless Telephony, based on the use of the Valve Generator and Receiver (Marconi-Round system).

Portable two way radio circa 1914. The large valve in the gallows is a type TN and the small one is a Type C.

in several electrons arriving at the anode for every one passing through the grid without the grid losing control, which would happen if a full plasma formed. The ratio of electrons arriving at the anode to the electrons passing through the grid is the gas amplification factor which may be 10 or more. Thus a soft valve can have an effective mutual conductance 10 or more times that of the same valve with a hard vacuum. Gas amplification factor had some successful applications including the photo cells which read the sound track on moving pictures. It is easy to see the rewards to be had if soft valves could be produced with stable, predictable and reproducible characteristics and a lot of effort was applied to this end over almost 10 years.

Knowing that the residual gas pressure was critical, valves had a glow discharge set up at the final stage of pumping and the bulb was sealed off when the dark space was the right length. The gas pressure was controlled to the optimum value but it was all in vain. The pressure may have been right but it wasn't stable; residual gas was absorbed into the electrodes reducing the pressure. HJ Round added tubulations to the bulbs of most of his soft valves. These contained asbestos fibres or other minerals enabling the gas to be replenished by heating the tubulation. He also completely enclosed the filaments in a fine wire mesh to prevent any electrons from escaping and forming a charge on the inside of the bulb. The electric field from a charge was known to interfere with the conditions in the valve.

HJ Round produced a whole family of soft valves of which the 'C' type and the similar 'T' and 'N' types are best known. These functioned as detectors, amplifiers and oscillators in receivers and low power transmitters and some very successful apparatus was produced using them. Of special interest was a short range radio telephone in portable form circa 1914. (The first mobile phone? – and it was British!). Large numbers of HJ Round's soft valves were used by all branches of the armed forces in World War 1 but the problem was that in addition to requiring constant adjustment by a skilled operator they were difficult to produce. HJ Round wrote, 'Again and again we lost the knack of making good tubes due to slight changes in the materials used'.

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A very long time ago I was privileged to talk to a RFC wireless operator. I asked how the tubulations were heated and was told, 'by the cautious application of a match flame'. I have read that electrical heaters were developed for the purpose. Tubulations were heated before take–off but often by the time the aircraft was in position, ready to spot for the artillery, the transmitter valve would stop oscillating. It conjures up a picture of the operator who was probably gunner, navigator and spotter as well, attempting to heat the tubulation in an open cockpit while the pilot had to stay in position while avoiding enemy fighters. It isn't surprising that by the end of the war, the services would prefer the much less sensitive but consistent hard valve. I have read that three stages of a contemporary hard valve, eg the 'R' type, were required to equal the sensitivity of the 'C' type. After the war HJ Round gave up the struggle to perfect soft valves and did some very important work with hard valves.

It was far from the end of the story of the soft valves but the types yet to come had little resemblance to the HJ Round valves and although they could and still do, some very important jobs which hard valves are not well suited to, they only had limited applications in radios and TV sets. The more modern devices were usually called 'gas filled valves' rather than 'soft'. The internal pressures were still low as in soft valves but the gas was deliberately introduced and not the result of incomplete pumping.

These valves were first pumped to a high vacuum and then back–filled, to the required pressure, with the desired gas type specific for the intended use, eg mercury vapour, argon, neon, xenon, hydrogen etc. This enabled the valves to operate with a highly conductive plasma which could pass large currents with an anode – cathode potential difference of only about 12 volts when they were conducting, and withstand high voltages when they were not conducting. Thus mercury vapour rectifiers were used for power rectifiers in almost all high power audio systems and transmitters until high voltage silicon rectifiers became available.

The low internal resistance of the gas filled rectifier made it much more efficient than vacuum rectifiers, improved the supply regulation and reduced the size of the transformers because they had less losses to supply. Mercury vapour had the great advantage that a surplus of liquid mercury introduced during manufacture automatically tops up the vapour in these devices. The gas loss of the early soft valves therefore doesn't happen, but as ever it comes at a price. Should you ever remove a mercury vapour valve from its socket and lay it on its side, liquid mercury may run into contact with the electrodes. The valve must undergo a lengthy conditioning process in which it is heated in an upright position to evaporate the mercury and condense it on the bulb when it will run down into the bottom of the valve where it should be. Failure to do this may result in a spectacular and expensive fireworks display. Be very careful with mercury – it is a very toxic metal which can be inhaled as vapour and absorbed through the skin. If you saw the effects of mercury poisoning, you would be very careful indeed. We used to cover up mercury globules with flowers of sulphur before cleaning up. I do not know what the recommendations are now.

Mercury had another problem. it has a long de–ionisation time, meaning that the gas remains conductive for some time after the current flow ceases. This renders mercury vapour devices unsuitable for operation much above the 50 to 60 Hz mains frequency. Around 1950, gas–filled devices became available with xenon instead of mercury vapour and other inert gasses singly or in mixtures soon followed. These were much smaller than mercury vapour rectifiers of equivalent ratings, could operate in any position and had short de–ionisation times enabling their use on 400 Hz supplies, which at that time were becoming standard on aircraft. We used them very successfully in power supplies for the early valve computers which demanded huge HT currents and the problem of gas absorption must have been solved because they ran 24 hours a day for years. I have one removed from a computer PSU when the machine became obsolete and it is still in good shape. One last form of gas–filled rectifier you will find in radios you may collect is the cold cathode rectifier. The most common type used in the UK was the OZ4 which performed as an HT rectifier in valve car radios until about 1950. Valve rectifiers were used to overcome some of the problems of synchronous vibrators; having no moving parts they did not require precisely timed contacts. Because the cathode of an HT rectifier is at HT+ potential a well insulated filament supply is needed, but filaments in valve car radios are powered from the car battery. Cold cathodes are therefore very useful but how do they work?

It goes back to the Victorian glow tubes. It was observed that the current flowing was roughly proportional to the surface area of the cathode independent of the anode configuration. Thus if you make a device with, say a large metal tube as cathode and a thin rod down its axis as anode, an appreciable current will only flow when the anode rod is positive. All cold cathode devices do this. If you take a look inside a cold cathode device (voltage stabilisers can easily be seen through the glass) you will see that the large tube which you may have thought was the anode is actually connected to the cathode pins and the wire down the centre to the anode pins.

If a gas–filled rectifier is fitted with a grid it becomes a thyratron (from the Greek word for a gate). The operation of a thyratron is quite unlike the HJ Round soft valves. When the grid had sufficient bias to prevent electrons from the cathode from entering the anode to grid space, the device was in a non–conducting state. Dropping the grid bias lets electrons into the anode – grid space where they are quickly accelerated to produce an avalanche of electrons and gas ions resulting in a very low resistance plasma. Once this happens the grid has no control. The device may only be turned off by reducing the anode voltage to a value low enough to extinguish the plasma when the valve is again non–conducting. If the grid bias is restored, the anode voltage may return to its full value and the valve remains off until it is triggered again. Thyratrons of all sorts have lots of uses where a fast switch which can handle big currents is needed. Special thyratrons and their modern developments with hydrogen or deuterium filling were used to generate the megawatt and higher pulses used in physics, lasers etc. The early ones in the low power form you will find in early TV sets. These usually had argon gas which was less than ideal. The thyratron was used to rapidly discharge the TV time base timing capacitor thus producing fly back ready for the next scan. The problem was the one of gas absorption. After about 1000 hours the line thyratron, would start to trigger erratically. The first thing to try was to swap the frame thyratron which fired 50 times per second and so had an easy life, with the line thyratron which fired 10,000 times per second. If the two had not been swapped before, it usually worked. The line thyratron would often work in the frame circuit because it had a longer period in which to trigger. The service kit usually had a couple of new boxed thyratrons and an inexhaustible supply of 'frame only' ones. Hard valve time bases put an end to all that. I think that's about all I want to say about gas–filled devices. There were and still are very many I haven't mentioned and some of the applications were very interesting but it is not radio.

The French took space tetrodes much more seriously. They called them 'Bigrilles' and they must have been fairly popular because at least half a dozen types were made by several different companies.

Hard valves have been well covered elsewhere but there is one aspect I would like to mention. What has a cathode, 2 grids and an anode? The answer must be a tetrode (4 electrodes) but what sort of tetrode? There are at least three forms of tetrode which are operated in a different way, have different characteristics and do a different job in a radio. The earliest form is a space charge grid tetrode. A serious problem with early triodes was obtaining sufficient anode current. Often the vacuum was not very good and this restricted the anode voltage to perhaps no more than 40 volts and pure tungsten filaments don't produce a lot of electrons. In a triode the grid prevents the electric field from the anode exerting much attraction upon electrons coming from the filament, so they tend to form a cloud around the filament. Since this electron cloud has a negative charge it repels any further electrons which are emitted back to the filament and very few penetrate the grid to reach the anode. The electron cloud around the filament is called a space charge. One approach to the problem is to raise the filament temperature so that the electrons are emitted with higher energies to penetrate the space charge. This requires more heater power and shortens filament life. The 'R' type requires about 3/4 of an Amp at 4 volts to heat the filament sufficiently to produce an anode current of a couple of mA resulting in a filament life of only 1000 hours. A second grid inside the normal grid with a small positive bias on it could be used to neutralise the space charge. A tetrode, but not as we know it. In the 1920's Marconi produced the FE2, FE3 and DE7 space charge tetrodes. I have left out the FE1 because it is a unique type; neither space charge or screen grid tetrode, and was used in an equally unique circuit, the two together meriting a short article all to themselves.

You may come across a Thorpe K4. This is a space charge tetrode made for a receiver called the Unidyne or Solodyne, which was powered entirely from the LT supply. Filament, space charge, grid and anode were all supplied from one 4 volt battery. 4 volts is much too low for an anode supply and not so surprisingly the Unidyne was only capable of weak headphone reception, not much better than a crystal set, and the Unidyne which appeared in 1925 had gone by 1927. The French took space tetrodes much more seriously. They called them 'Bigrilles' and they must have been fairly popular because

at least half a dozen types were made by several different companies. Sometimes an innovative circuit designer uses a valve in a way the maker did not foresee. You may have the good fortune to discover a mid 1920's broadcast superhet with a bigrille frequency changer (Vol. 6 No. 2).

The next form of tetrode was the screened grid. HJ Round again; in 1927 he produced the S.625 the most perfect screened grid there ever was, except that in construction it really is a screened anode. The S.625 is double ended in a tubular envelope. At one end the anode disc is completely enclosed in a metal tube, the end of which is closed by a wire mesh (the screen). Thus the anode is sealed inside a perfect Faraday cage. The filament and grid were mounted on the other end ensuring that the grid circuit was widely separated from the anode circuit. No screened grid ever produced a lower anode to grid capacity than the S.625. It only had one fault – it was difficult to produce and was not suited to the machinery being introduced to mass–produce valves for the booming valves industry. Within a year the design had been turned inside out with the grid and filament inside the screen and the anode outside, built on a standard valve base and enclosed in a standard glass bulb with a top cap grid connection. This design became the industry standard but it does make a nonsense of the screened grid circuit symbol pictograph which is a section of an S.625.

The screen grid has a well known defect; the tetrode kink which renders it unsuitable as a large signal amplifier (output stage), although it is an excellent HF small signal amplifier. The cause of the kink and its cure by the suppressor grid making a pentode is too well known to repeat here, but as is often the case one man's defect is another's opportunity. When the anode voltage is reduced below that of the screen, usually about 2/3 of the anode voltage, the anode current first falls to a very low value, maybe even negative, and then with further reduction in anode voltage, rises again until the anode voltage is as low as 10 volts. Any circuit which draws more current as the potential across it is reduced has negative resistance. The slope of the characteristic which is the resistance is controlled by the grid voltage. Thus it is possible to make a box with two terminals across which a negative resistance appears and to adjust the value of the negative resistance by changing the grid bias. When a screened grid is used this way it is called a dynatron. Screened grids haven't been produced for a very long time but many HF pentodes which have a separate pin for the suppressor grid will function as dynatrons if the suppressor is connected to the screen, but there are better ways to obtain a negative resistance for laboratory use.

The screened grid also had a brief period of use as a frequency changer but its circuit functions were taken over by pentodes long ago. The third form of tetrode is the outstandingly succesful one. Known as the beam or kinkless tetrode, it outperforms pentodes as large signal amplifiers in any application from audio to VHF power amplifiers. The later forms use grids which have wires parallel with the tube axis with the screen wires set in the shadow of the grid wires and a cylindrical anode. All the anode surface is used – there is very little screen current and no beam confining plates are used. It is very efficient and very linear and it is still produced but again it makes a nonsense of the circuit symbol. I must change tack before I get into twelve things to do with pentodes with separately connected suppressors and this article goes on and on.

This is a piece of speculation which may appeal to readers with a serious interest in valves. Suppose the early users of triode valves had earthed the grid and applied the signal to the filament instead of the other way round. The anode current is still controlled by the filament to grid potential difference quite independent of where the earth is connected. When the grid is earthed it provides an earth potential screen between the amplifier input (cathode) and output (anode). The result is a circuit capable of stable high frequency amplification up to 1000 MHz and beyond. We call this mode grounded grid. Had this come about in early days, would the screened pentode ever have been invented? They came about to overcome the grounded cathode triode's inability to provide stable high–frequency amplification. Grounded grid operation became common in World War 2 to meet the need to work at much higher frequencies than pentodes and tetrodes could reach and resulted in the American lighthouse tubes and British disc seal tetrodes designed so that the grid was a continuation of the screen between input and output circuits.

High voltage is what valves do best and if you want high power and high efficiency, high voltage is the only possibility. That is why the electricity grid runs at 275,000 volts.

The success of these devices brought about a mindset that grounded grid was a UHF circuit. It of course works all the way down to zero frequency (dc) and has two very useful additional properties. It has much lower distortion than a grounded cathode amplifier. This makes it the preferred circuit for linear amplifiers to the present day. It also has the property of being a non–inverting amplifier (cathode and anode are in phase) which can be very useful when phase relations are important (inside feedback loops) and transformers or an extra stage to get the phase right are not practical. This is particularly true in dc control loops, eg regulated HT supplies. It is true that grounded grid amplifiers have a low input impedance and require some signal drive power but then so do bi–polar transistors and it is not seen to be a problem. In the last twenty or thirty years triode grounded grid linear amplifiers for HF transmitters have become the preferred circuit and late 1930's audio power triodes (which are back in production to meet the demand) produce hundreds of Watts at high frequencies up to 30 MHz.

People sometimes ask why I try to encourage interest in valves. I am told they are no longer used and anything they did can be done much better with transistors. If the discussion were confined to glass bulbs in radio receivers, both statements would be true. If we take a wider view of the application of valve technology both statements are self evidently untrue. The technology of the valve can do some things no transistor can or ever will do. Transistors are not a replacement for valves. The two families have fundamentally different underlying physics which make semiconductors far better in very many applications, but valves still have the edge in many others. I would ask my questioners what kind of transistors they use in their microwave ovens. The magnetron is a development of Fleming's diode, with a special anode shape and a magnet, over sixty years old. It's very small for what it does (most of the space to the side of the oven is occupied by the mains transformer) and nothing does the job better. I am told a problem with valves is the high voltages. The little magnetron in the microwave runs at about 3000v and it doesn't worry anyone. High voltage is what valves do best and if you want high power and high efficiency, high voltage is the only possibility. That is why the electricity grid runs at 275,000 volts.

My questioners may be aware that the British and French grid systems are linked by an underwater cable carrying DC at very high voltage and very large currents to transfer the output of several power stations in either direction depending upon the demand and spare capacity at each end. At either end a device is required to turn AC into DC or DC into AC depending upon which direction energy is flowing. The family of the valve using metal and low pressure gas can easily be scaled up to civil engineering proportions if required, which is something you cannot do with semiconductors. Even if you could scale them up, they wouldn't work. You would be forced to use huge numbers of small ones and that must result in fearsome possibilities of cascade failures and poor reliability.

I think the descendants of Fleming's valve will be with us for a long time in the fields of high power and high frequencies but not in radios and computers. That means knowledge of the underlying physics and the practical problems of fabrication must be preserved.

That's quite a lot to know about almost nothing. I had difficulties in writing this article; not what to say but what to leave out. This is my third re–write reduced to half the length of the first draft. The intention was to give a glimpse of a fascinating subject while keeping to a readable length. Consequently, much has been skipped. I hope I may inspire a few to look deeper. If any reader wants to know more I may be able to help.

A – Z of BBC-2 trade test colour films – complete list part 2 by Malcy B

GIUSEPPINA
A James Hill production for B.P.
28 minutes duration
First showing 7th October 1968
Final showing 24th August 1973
at 2.30pm and in fact the very last Trade Test Colour Film ever shown !!
Antonia Scalari as Giuseppina
Giulio Marchetti as Signor Rossi
Associate producer Massino Saraceni
Script/Direction by James Hill
Music by Jack Beaver.
Probably second favourite for most people of all trade test colour films, just pipped by it's sister film 'The Home-made Car', this is a delightful tale about a bored young Italian girl living through the Summer of 1966 at her father's petrol station where daily life carries on without much excitement. Giuseppina sees people come and people go and we eavesdrop on this quaint out in the sticks service station and its comings and goings. For me, the classic line comes towards the end of the day when Beppe, a local five year old boy stops and asks Signor Rossi to fill up his toy car. Giuseppina's dad obliges and takes care and time over Beppe. After he has gone Giuseppina turns to her dad and says "Why bother with Beppe, he's only five, not a bit important?" Signor Rossi turns to his daughter and says "Everyone is important Giuseppina… …Everyone."
Made In 1959.

The GOLD MINERS
A Film Of Africa Production
21 minutes
First showing 27th December 1968
Final showing 2nd June 1969

The GOLDEN CRESCENT
A Rayant Pictures Production.
27 minutes duration
First showing 7th September 1970
Final showing 30th December 1970
A film about modern and ancient Turkey showing the impression made by man on the landscape.
Made In 1960.

The GRASS GROWERS
New Zealand Film Unit
11 minutes duration
First showing 17th August 1970
Final showing 22nd August 1973
New Zealand farmers are basically grass growers who produce 90% of their country 's exports. This film shows how four farmers make the best use of their land.
Made In 1969.

The GROWING FLAME
A Shell Film
10 minutes duration
First showing 19th March 1968
Final showing 16th August 1969
The research and development of the technique of carbon dioxide enrichment of market gardening.
Made In 1965.

HANDLE WITH CARE
A Shell Film
23 minutes duration
First showing 12th March 1963
Final showing 20th November 1963
This film demonstrates the importance of packaging. Following a packing case on a difficult voyage from the factory to the docks, across the ocean, on to a river steamer and travelling across mountain tracks.
Directed by Geoffrey Hughes.
Made In 1952.

THE HEART IS HIGHLAND
A BTF British Transport Film
20 minutes duration
First showing 6th November 1962
Final showing 11th April 1964
This classic British Transport film shows the lives of the people of the Highlands of Scotland, linking present developments in industry, agriculture and transport with the country's past.
Made In 1952.

HIGHLAND PLAYGROUND
A British Traveller's Association Film
11 minutes duration
First showing 31st March 1969
Final showing 9th August 1973
Two films showcasing the Scottish Highlands were made at much the same time: Highland Playground and Highlands In The Sun.
Highland Playground is a more dynamic film set in and around the ski resort of Aviemore.
Made In 1968.

HIGHLANDS IN THE SUN
A British Travellers' Association Film
11 minutes duration
First showing 5th May 1969
Final showing 17th August 1973
Two films showcasing the Scottish Highlands were made at much the same time: Highland Playground and Highlands In The Sun. Highlands In The Sun takes a relaxed "Scottish heritage" look at the great outdoors and the various sporting facilities available in the Cairngorms.
Made In 1968.

HOLD BACK THE SEA
A Royal Dutch Shell Film
28 minutes duration
First showing 7th January 1964
Final showing 6th April 1964
This film is about the natural and man-made forces that have shaped the Netherland's coastline.
Made In 1960.

The HOME-MADE CAR
A James Hill production for B.P.
28 minutes duration
First showing 28th August 1963
Final showing 23rd August 1973
Starring Ronald Chudley, Caroline Mortimer, Alice Bowes as Auntie and Sandra Leo as the little girl.
Production Manager Angela Levy
Script/Direction James Hill
Music by Ron Grainer
Probably the most well-known and much loved of all the trade test colour films was this delightful half-hour film about the assembly of a Bull Nosed Morris. Ron Grainer's musical adaptation of his tune 'Mexican Marmalade' meanders through the whole film without any need for commentary. This simple little story is a real gem.
Made In 1963.

HOOK, LINE AND SINKER
An Esso Film
Music by Clifton Parker
19 minutes duration
First showing 22nd January 1964
Final showing 3rd June 1969
This documentary film covers the maiden voyage of the 'Glenstruan' a great line fishing vessel from Aberdeen to within the Arctic Circle and back again.
Made In 1959.

HOW A MOTOR CAR WORKS
– Part One – The Engine
A Shell Film
16 minutes duration
First showing 27th January 1968
Final showing 14th August 1973
The ultimate mechanical industrial short documentary! Note that Part Three of this film "A Question Of Springing" was also shown.
Made In 1961.

HYDRAULIC POWER TRANSMISSION
A Random Production for Shell-Mex and B.P.
28 minutes duration
First showing 25th March 1964
Final showing 21st April 1967
The history and development of both hydrostatic and hydrokinetic systems from 1790 to the present day, explaining how they work and giving examples of the uses to which they can be put.
Made In 1963.

IMPRESSIONS OF… EXPO '67
National Film Board Of Canada
8 minutes duration
First showing 26th April 1968
Final showing 29th July 1971
The exhibition held in Toronto, Canada.
Made In 1967.

IT'S THE TUBE THAT MAKES THE COLOUR
A Mullard Film
18 minutes duration
First showing 6th May 1968
Final showing 22nd August 1973
This was the film that replaced Mullard's "Colour Television". A more user friendly look into the manufacture of Colour TV Sets.
Made In 1968.

JAMAICA - NO PLACE LIKE HOME
From the Jamaica Tourist Board
Duration 16 minutes
First showing 9th February 1970
Final showing 26th March 1970
Travelogue on Jamaica.

JAPAN - SEASON BY SEASON
Japan Tourist Film Organisation
28 minutes duration
First showing 21st November 1968
Final showing 7th August 1969
A travelogue.
Made In 1968.

JAPAN - The BEAUTIFUL
A Shohiku Company Production
27 minutes duration
First showing 1st March 1971
Final showing 15th December 1971
Festivals, customs and daily life in modern Japan.
Made In 1965.

JOURNEY INTO HISTORY
A BTF British Transport Film
11 minutes duration
First showing 14th November 1962
Final showing 26th November 1963
This film explores the world of 18th century England, as seen through visits to art galleries, museums and old houses in and around London.
Musical score by Sir Arnold Bax and The Philharmonia Orchestra.
Made in 1952.

A JOURNEY INTO THE WEALD OF KENT
A Random Film Production for National Benzole
Part of "Our National Heritage" series of films
21 minutes duration
First showing 5th November 1962
Final showing 24th August 1973
Sir John Betjeman narrates this and its sister film Beauty In Trust with his usual intimate style. A wonderful meander through the hop fields of Kent.
Some of the places visited: - Wrotham Hill, Marden, Smarden, Benneden, Nettlestead, Sissinghurst Castle, Bayham Abbey
Music by Elisabeth Lutyens
Made In 1959.

KERMESSE FANTASTIQUE
A Philips Film Produced By Joop Geesink's Film Produktie Dollywood.
10 minutes duration
First showing 4th October 1969
Final showing 8th December 1970
A clay-model stop-frame animation film. The central character sits alone in a room listening to a radio broadcast of a piece of music called 'Kermesse Fantastique'. He is transported by the music to the fantastic funfair itself, where he literally has a roller-coaster, helter-skelter adventure
Music by Georges Auric's Les Six.
Made In 1951.

L. FOR LOGIC
A Central Office Of Information Film
13 minutes duration
First showing 24th July 1973
Final showing 7th August 1973
A film about the UK Driving Test.
Made In 1972.

LA COTE D'HIVER
Production Details: unknown
15 minutes duration
First showing 23rd September 1968
Final showing 7th November 1968
"The coast in winter" A trip along the French Riviera.

LAND OF THE SUN RETURNING
A Unicorn Production
27 minutes duration
First showing 13th September 1971
Final showing 7th August 1973
A film about the Philippines.

LAND RECLAMATION
A B.P. / Shell Mex Film
A Random Production
22 minutes duration
First showing 22nd August 1966
Final showing 20th July 1972
How new techniques are enabling farmers to reclaim farm land which nature has encroached.
Made In 1959.

LIGHT
A film by Hattum Hoving for Philips Production Multifilm, Holland
16 minutes duration
First showing 10th April 1972
Final showing 20th August 1973
Opening with Haydn's Creation, this film explores the many forms of light and its uses, including sunlight, artificial lights and laser beams and its effect on everyday living.
Made In 1970.

LONDON'S COUNTRY
A BTF British Transport Film
20 minutes duration
First showing 16th January 1964
Final showing 27th March 1964
Showing Londoners' recreation in the home counties, featuring archery at Sevenoaks, riding at Knole park, Morris dancing at Westerham and a look in the Rochester Dicken's houses.
Made In 1954.

LURE OF THE BAHAMAS
A Sound Magic Production
27 minutes duration
First showing 28th October 1968
Final showing 24th March 1969
This films shows the tourist attractions on Nassau, the capital city of the Bahamas and its resort islands.
Made In 1966.

MACHINES ON THE FARM
A Shell Mex / BP Film
29 minutes duration
First showing 10th November 1962
Final showing 17th April 1967
This film highlights the development and uses of modern farm machinery.
Made In 1961.

MOUNTAIN ROAD
Central Office Of Information Film.
25 minutes duration
First showing 11th July 1967
Final showing 13th July 1967
(Only Two Showings)
Produced as an aid to the recruitment of officers for the Women's Royal Army Corps. This film tells the story of a young WRAC officer faced with a dramatic situation.
Made In 1962.

MULTIPLICITY
A Crawley Film Production
26 minutes duration
First showing 4th January 1972
Final showing 22nd August 1973
Transport by rail, road, sea and air across the length and breadth of Canada.
A film showing the activities of the Canadian Pacific Railway.
Music by Larry Crosley.
Made In 1969.

NETWORK
An A.E.I. Film
28 minutes duration
First showing 4th January 1964
Final showing 17th June 1968
A film about telecommunication and shipping. How the world network of radio, telephone and teleprinter serves a ship in need of engine replacements.
Made In 1962.

NEWSPAPER RUN
A BP / Rayant Pictures Production
19 minutes duration
First showing 21st January 1964
Final showing 10th April 1964
This film shows how aircraft are used for the transportation of newspapers in Sweden from Stockholm to the frozen north.
Made In 1961.

NO CLAIMS BONUS
A Central Office Of Information (CDI) Film
5 minutes duration
First showing 9th December 1966
Final showing 25th January 1967
The work and purpose of the V-bomber force
Commentary By Gary Watson.
Made In 1963.

The NORTH SEA QUEST
A B.P. Film
Music by Peter Jeffries
16 minutes duration
First showing 17th November 1969
Final showing 24th August 1973
The North Sea and its pioneers who made the first gas explorations, sometimes against all odds.
A tribute to the rig "Sea Gem" which capsized in 1965.
Made In 1967.

NORTH WEST 200
A Random Production For The Irish Tourist Board, Shell-Mex And B.P.
13 minutes duration
First showing 31st March 1967
Final showing 24th November 1967
The 1958 motor cycle road races in Ulster.
Made In 1958.

OFF THE BEATEN TRACK
A British Transport Film.
17 minutes duration
First showing 10th July 1967
Final showing 10th July 1967
(Only One Showing)
This film shows the way British Railways cater for Youth Hostel tourists. Music by Elisabeth Lutyens.
Commentary by Paul Le Saux.
Made In 1960.

OIL UNDERGROUND
A Shell Film
17 minutes duration
First showing 10th May 1967
Final showing 22nd August 1973
Oil exploration film shows how a reservoir engineer obtains the maximum production of oil in the most economical way.
Made In 1960.

OMNIBUS (OMNIBUS FOR ALL)
A British Transport Film
Music by Kenneth V. Jones
18 minutes duration
First showing 5th July 1967
Final showing 27th November 1967
For the benefit of the bus and coach industry, architects and town planners, this film tours the whole country seeking out ways of improving traffic congestion and improving public transport systems.
Made In 1963.

ON THE SAFE SIDE
An Atomic Energy Association Film (U.K.A.E.A.)
18 minutes duration
First showing 1st May 1968
Final showing 17th July 1973
A film showing safety precautions undertaken in a UK power station.
Made In 1967.

ONE JUMP AHEAD
A GPO / Littleton Park Production
9 minutes duration
First showing 3rd April 1970
Final showing 15th August 1973
A film about technology in Britain's postal service. How electronically controlled machines have been developed to segregate the different classes of mail and send them ready for dispatch to their destination, as demonstrated at the Norwich GPO. The new concept of postal coding is explained and how the use of these codes enables machines to speed up the handling of letters.
Music by Edwin Astley.
Made In 1967.

ORAONS OF BIHAR
A Burmah Shell Film / Art Films Of Asia.
16 minutes duration
First showing 18th January 1964
Final showing 17th April 1964
This film follows the daily life, work, festivals, and traditional dances of the Oraon tribe, one of the aboriginal peoples from the Bihar State of India. (A Film In The Folk Dances Of India Series).
Made In 1958.

OUR NATIVE SHORE
An Esso Film
28 minutes duration
First showing 13th January 1964
Final showing 7th April 1964
This film shows some scenery, traditions, life and activities along the coast line of Great Britain.
Made In 1956.

OVERHAUL
A British Transport Film
Music by Kenneth V. Jones
16 minutes duration
First showing 10th January 1964
Final showing 1st December 1967
A guided tour of the once famous Aldenham bus overhaul works of London Transport in the 1950's.
A real enthusiasts film !
Made In 1957.

PAINT
A Shell Film
Music by Donald Fraser
25 minutes duration
First showing 7th February 1968
Final showing 23rd August 1973
Painting techniques are illustrated musically, imitations of ancient instruments for Egyptian art, pentatonic harmony for Japanese lacquerware and an 18th Century pastiche for an elaborately decorated harpsichord. Sit and watch it all dry!
Commentary By Gary Watson.
Made In 1967.

PAN-TELE-TRON
A Philips Film
10 minutes duration
First showing 6th March 1970
Final showing 17th August 1973
A Pearl & Dean Cartoon about telecommunications.
Music by Frank Cordell.
Made In 1957.

A PEACEFUL REVOLUTION
An A.E.I. Film
26 minutes duration
First showing 8th January 1964
Final showing 12th March 1971
New life and ways in India, showing development in industry and agriculture.
Made In 1961.

PEMBROKESHIRE - MY COUNTY
An Esso Film
26 minutes duration
First showing 16th January 1964
Final showing 16th February 1968
A tour of Pembrokeshire, capturing the Preseley Hills, St. David's Cathedral, Caldy Island and sea birds in the nature reserves.
Narrated By Hywel Davies.
Made In 1960.

PEOPLE PLUS LEISURE EQUALS
A Film in "Our National Heritage" series.
A Pilot Films Production for National Benzole Shell Mex/B.P.
29 minutes duration
First showing 18th June 1973
Final showing 8th August 1973
How people cope with more leisure time and the environment.
Made In 1968.

THE PHOENIX TOWER
A BICC / CAS Production
39 minutes duration
First showing 14th March 1964
Final showing 13th April 1964
The preparation and erection of the television tower on the old Crystal Palace site. An example of a high building of steel.
Made In 1957.

PICCOLO, SAXO AND COMPANY
A Philips Film / Joop Geesink's Dollywood Production Unit.
14 minutes duration
First showing 14th April 1964
Final showing 26th August 1965
A puppet film illustrating the instruments of the orchestra
Made In 1959.

A PLACE TO LIVE
A Swedish Institute Film
18 minutes duration
First showing 1st June 1970
Final showing 22nd January 1971
A portrait of Sweden and its architecture.
Music by Bo Nilsson.

POWER BOAT '66
A B.P Film
23 minutes duration
First showing 12th August 1968
Final showing 13th May 1970
The 1966 Daily Express International Offshore Power Boat Race in the Solent.
Made In 1966.

THE POWER TO FLY
A Shell Film
20 minutes duration
First showing 7th November 1962
Final showing 22nd June 1967
A Hallas & Batchelor Animation telling the story of aviation from Daedalus to jets.
Made In 1954.

THE POWER WE NEED
The National Coal Board Film Unit
13 minutes duration
First showing 17th January 1964
Final showing 13th April 1964
This film looks at the economic future of the coal industry in relation to other sources of power. Includes footage of Beverscotes Colliery, Nottinghamshire.
Made In 1963.

THE PROMISE OF PAKISTAN
A Rayant Picture for Caltex.
27 minutes duration
First showing 2nd November 1970
Final showing 30th March 1971
An outline of ancient and modern Pakistan showing its economic, social life and customs.
Commentary by Deryck Guyler.
Made In 1965.

PROSPECT FOR PLASTICS
A Shell Film
28 minutes duration
First showing 8th August 1963
Final showing 7th November 1972
Industrial film documentary about the influx of plastics on our lives.
Music by Stanley Myers.
Commentary by Gordon Henry Davies.
Made In 1962.

A QUESTION OF SPRINGING
A Shell Film
17 minutes duration
First showing 9th November 1962
Final showing 1st March 1967
Sister film to How A Motor Car Works, examining suspension springing in motor vehicles.
Made In 1961.

A QUESTIONING CITY
A British Travel Association Film.
21 minutes duration
First showing 9th November 1962
Final showing 12th April 1967
The two faces of Cambridge, the city of beauty and ancient tradition and the home of the questioning scientific spirit. Commentary spoken by Sir Michael Redgrave.
Made In 1959.

RIDE THE WHITE HORSES
A Ford Film Unit Production
25 minutes duration
First showing 3rd August 1970
Final showing 21st August 1973
The 1969 powerboat race around the coast of Britain.
Music by Jeff Wayne.
Made In 1969.

THE RIGHT LINE
A BP Film for R.H.R. Productions.
26 minutes duration
First showing 8th January 1964
Final showing 9th April 1964
An introduction to the sport of motor-cycle racing with Bob MacIntyre along with scenes of trials and scenes of road racing.
Made In 1961.

RISK
A World Wide Pictures Production on behalf of the Stenhouse Group
14 minutes duration
First showing 25th April 1969
Final showing 25th November 1971
A film showing the scope of international insurance broking
The ever-present risks to which human and animal life is subject and how insurance can compensate when these risks become reality.
Commentary by John Westbrook.
Made In 1966.

THE RIVAL WORLD
A Shell Film
24 minutes duration
First showing 8th November 1962
Final showing 21st August 1967
Depicts the human struggle against hunger and sickness. Insects outnumber man by 50 million to one and are man's rival for food. Man has interfered with the balance of nature and now can only come to terms with his rivals by using organised scientific methods of control. Examples are drawn from many parts of the world, including the desert locust in East Africa and the use of aircraft against them.
Music by James Stevens.
Made In 1955.

ROADS TO ROAM
New Zealand Film Unit
13 minutes duration
First showing 18th March 1968
Final showing 15th August 1973
A film showing the development of transport systems in New Zealand.
Made In 1967.

ROSEWORLD '71
New Zealand Film Unit
10 minutes duration
First showing 3rd July 1973
Final showing 20th August 1973
A film about the World's first Rose Convention held in Hamilton, New Zealand in 1971.
Made In 1973.

ROUTE BURN
New Zealand Film Unit
10 minutes duration
First showing 8th January 1973
Final showing 21st August 1973
This film follows walkers making the Routeburn walk around New Zealand's National Park territory in just three days.
Made In 1972.

ROYAL RIVER
British Travel Association Film
17 minutes duration
First showing 30th March 1967
Final showing 23rd November 1967
Along the river viewing Windsor Castle and other Royal Gardens and Palaces along the way.
Made In 1960.

RUN AWAY TO SEA
An Athos Film Production
Music by Christopher Gunning
22 minutes duration
First showing 27th December 1968
Final showing 8th September 1970
A fantasy P & O cruise on the Canberra.
Made In 1968.

RURAL AREAS
A Shell Film
23 minutes duration
First showing 24th November 1965
Final showing 24th November 1965
(Only The One Showing)

SCHLIEREN
A Shell Film
18 minutes duration
First showing 31st May 1963
Final showing 31st May 1963
(Only Two Showings On One Day!)
An explanation of Schlieren photography, which makes any phenomenon that changes the refractive index of transparent substances visible. Its use for photographing shock-waves around aircraft models in wind tunnels.
Directed by Peter De Normanville.
Made In 1958.

THE SEA OF TRIESTE
A film from Italy
15 minutes duration
First showing 23rd March 1970
Final showing 6th January 1972

SEPTEMBER SPRING
A World Wide Picture for BP
18 minutes duration
First showing 22nd August 1966
Final showing 22nd March 1967
The half completed Snowy Mountain scheme in New South Wales and Victoria is a twenty-five year project to harness the waste waters of the mountains for hydro-electric power and irrigation of the barren interior. The transformation of this Australian landscape is described.
Made In 1964.

SEVERN WESTWARD
A SCF / BBC Production
25 minutes duration
First showing 6th November 1962
Final showing 27th November 1963

The SHADOW OF PROGRESS
A BP/Greenpark Production
Music by Wilfred Josephs
24 minute duration
First showing 22nd February 1971
Final showing 23rd August 1973
In meeting the demands for a richer and fuller life technology has polluted and destroyed much of his environment. This film illustrates this paradox and indicates some of the possible solutions.
Made In 1970.

SKYHOOK
A B.P. / James Hill Production
17 minutes duration
First showing 6th November 1962
Final showing 4th October 1971
A film about the use of helicopters to transport an oil-drilling rig to a prospecting site deep in the Papua New Guinea jungle.
Music by Jack Beaver.
Commentary by Bernard Braden.
Made In 1958.

The SMALL PROPELLER
A B.P. Film
Duration 22 minutes
First showing 2nd December 1967
Final showing 23rd August 1973
This film looks at motor boats around the world. The various uses of small boats for transport in Venice, speed and surfing in Australia, pleasure in Stockholm and carrying medical supplies in Singapore.
Music by Johnny Hawksworth.
Made In 1967.

SMALL SMOKE AT BLAZE CREEK
National Film Board Of Canada
9 minutes duration
First showing 11th September 1972
Final showing 23rd August 1973
The Canadian National Forestry Service tells the story of the fight to contain a forest fire in British Columbia.
Made In 1971.

SNOFARI
New Zealand Film Unit
17 minutes duration
First showing 24th August 1969
Final showing 18th June 1970
An Australian girl's holiday in Queenstown and the New Zealand Alps.
Made In 1969.

SOMETHING NICE TO EAT
A Gas Council Film
20 minutes duration
First showing 6th July 1970
Final showing 23rd May 1973
This film shows that luxurious cooking by experts can be achieved by everyone. Featuring model Jean Shrimpton. Music by Johnny Hawksworth.
Made In 1967.

SONG OF THE CLOUDS
A Shell Film
32 minutes duration
First showing 7th November 1962
Final showing 25th March 1967
This film stresses the "internationalism" of the air. It shows airport activities in all parts of the world and co-operation between countries to ensure the comfort and safety of passengers. Music by Richard Rodney Bennett.
Made In 1957.

SOUVENIRS FROM SWEDEN
Swedish Institute Film
21 minutes duration
First showing 27th April 1970
Final showing 14th August 1973
Centred on an Englishman character named Harry Fenton who has been enjoying a year's stay living in Sweden, as he wanders around the gift shop in Stockholm seeking a gift to take back he memorises some of the places he has visited and we are treated to a tour around this part of Scandinavia. Narrated by David Hohneh. Music by Bengt Hallberg.
Made In 1960.

The SPLENDID DOMAIN
National Film Board Of Canada
28 minutes duration
First showing 13th February 1968
Final showing 12th August 1971
A film about Canada.
Made In 1965.

SPRING IN COLOR
A Philips / Uniefilm Production
5 minutes duration
First showing 17th February 1969
Final showing 5th June 1972
Blooming flowers in color! A visual and musical delight! A look around the Keukenhof Gardens in Holland.

STORY IN THE ROCKS
A Shell Film made for the Royal Dutch Shell Group
18 minutes duration
First showing 2nd December 1967
Final showing 23rd January 1971
The study of fossils, palaeontology is the theme of this fascinating short industry film as it explores the six main periods of time – Carboniferous, Triassic, Jurassic, Cretacious, Tertiary and Ice ages
Music by Jan Masseus. Written and Directed by Han Van Gelder
Producer Bert Haanstra.

STUDY IN STEEL
A Worldwide Picture for the British Steel Corporation.
26 minutes duration
First showing 14th October 1969
Final showing 22nd August 1973
The latest production methods in steel making are described together with the basic chemical changes which take place in the transition from iron ore to steel. Special steels and the use of automation for production control, chemical analysis etc. are seen. Music by Tony Osborne.
Made In 1968.

SURF BEACH
An Australian
Film Unit Production
17 minutes duration
First showing 26th July 1971
Final showing 10th August 1973
This film shows surf riding, the work of lifesavers and a surf lifesavers' carnival in Sydney.
Music by Laurie Lewes.
Made in 1965.

SURF BOATS OF ACCRA
A Unilever Film.
15 minutes duration
First showing 11th January 1964
Final showing 18th April 1964
Before the new harbours of Tema and Takoradi were built, this film shows the lighter age of cargoes by surfboat.
Commentary by John Westbrook.
Made In 1958.

The TIDE OF TRAFFIC
A BP / Greenpark Production
27 minutes duration
First showing 8th January 1973
Final showing 15th August 1973
A grim picture is portrayed in this documentay sister film to the "Shadow of Progress" looking at excess traffic in cities over the world. It traces the way in which urban and rural traffic, with its continual demand for greater amounts of road space, has increased. The film was made as a contribution to the United Nations Conference on Human Environment, held in Stockholm in 1972. Music by Humphrey Searle. Written and directed by Derek Williams.
Made In 1972.

TOE HOLD ON A HARBOUR
New Zealand Film Unit
10 minutes duration
First showing 27th January 1968
Final showing 14th December 1968
This film gives a colourful impression of Wellington city, its hills, its winding streets, its busy people and strong winds.
Made In 1966.

TRADERS IN LEATHER
A Unilever Film.
13 minutes duration
First showing 9th January 1964
Final showing 30th March 1964
Leather traders in Northern Nigeria. This films looks at the life, the craft, the people and the export trade of Northern Nigeria.
Made In 1957.

TRANS – CANADA JOURNEY
National Film Board Of Canada
28 minutes duration
First showing 9th May 1968
Final showing 20th January 1971
A travelogue aimed at giving an impression of the size and nature of Canada. Music by Robert Fleming. Commentary by Christopher Plummer.
Made In 1962.

TRANSPORT ABILITY
A United Kingdom Atomic Energy Association Film (U.K.A.E.A) .
Ace Film Productions.
18 minutes duration
First showing 7th October 1969
Final showing 16th August 1973
A film showing the transport of spent nuclear fuel to Britain including the first shipment across the Atlantic from Canada.
Made In 1967.

TRAWLER BOY
A Shell-Mex / BP Film
27 minutes duration
First showing 5th November 1962
Final showing 28th March 1967
This film shows life on the modern diesel trawler from the viewpoint of the junior deckhand on a Fleetwood trawler. It aims to recruit youngsters to the fishing industry.
Made In 1956.

THE TWILIGHT FOREST
A Unilever Film
25 minutes duration
First showing 10th January 1964
Final showing 10th April 1964
This film tells the story of an industrial enterprise which showed for the first time how the forest resources of Nigeria and Ghana could be used. Commentary by John Westbrook.
Made In 1957.

UNDERWATER SEARCH - 1
A Shell Film
20 minutes duration
First showing 22nd August 1966
Final showing 12th April 1967
This film shows Shell's worldwide activities and achievements in offshore exploration and production of oil. The future possibilities of rig anchorage, direct loading of tankers at sea and underwater working at great depths by men and robots are also shown.
Made In 1965.

UNDERWATER SEARCH - 2
A Shell Film
20 minutes duration
First showing 22nd August 1966
Final showing 12th April 1967
This film shows Shell's worldwide activities and achievements in offshore exploration and production of oil. The future possibilities of rig anchorage, direct loading of tankers at sea and underwater working at great depths by men and robots are also shown.
Made In 1965.

The UNSPOILT LAND
New Zealand Film Unit
Music by Brian Hands
18 minutes duration
First showing 22nd January 1973
Final showing 15th August 1973
New Zealand's ten National Parks cover 5 million acres, one thirteenth of the land area of the country. This area offers facilities to skiers, mountain climbers, trampers, swimmers and boating enthusiastists. We join an open-top car journey viewing the contrasts between high-speed modern life and the timeless natural landscape. Made In 1972.

The VANISHING COAST
A Film in "Our National Heritage" series.
A Pilot Films Production for National Benzole Shell Mex/B.P.
27 minutes duration
First showing 9th December 1968
Final showing 14th December 1971
A fascinating study of the 3,000 miles of British coastline in co-operation with the National Trust and its likely decline in years to come! Narration written by James Cameron. Spoken by Stephen Murray. Music by James Harpham. Conducted by Muir Mathieson. Produced and Directed by John Taylor.
Made In 1965.

VIEW OF MIDDELHARNIS
A Multifilm Production for Royal Dutch Shell
20 minutes duration
First showing 13th March 1963
Final showing 23rd November 1963
The rebuilding of burst dykes on the island of Goeree Overflakkee in the Netherlands.
Made In 1954.

VILLA "MON REVE"
Films Pierre Remont.
13 minutes duration
First showing 26th August 1968
Final showing 27th December 1969
A humourous cartoon from France entitled "My Dream House" telling the misadventures of a French middle-class family that decide to buy a cottage.
Made In 1961.

WELSH WELCOME
A British Travellers' Association Film, Telstar Productions.
15 minutes duration
First showing 26th October 1970
Final showing 29th October 1971
An introduction to Wales, featuring its tourist attractions.
Made In 1970.

WE'VE COME A LONG WAY
A B.P. Film
A Hallas and Batchelor cartoon
10 minutes duration
First showing 11th May 1970
Final showing 16th August 1973
A cartoon tracing the development of oil tankers. Music by Matyas Seiber.
Made In 1951.

The YOUNG GIANT KAINGAROA
New Zealand Film Unit
18 minutes duration
First showing 11th March 1968
Final showing 10th April 1968
The story of Kaingaroa forest, the largest man-made forest in the Southern hemisphere.
Made In 1960.

The YOUTHFUL MARCH OF KOREA
A National Film Centre Production
21 minutes duration
First showing 11th December 1969
Final showing 6th February 1970

Hi-De-Hi Def

Dicky Howett and daughter pose in 1989 before a BBC 'Eureka' High Definition tv scanner, parked outside the Royal Albert Hall. Such plans and dreams, back in the days when the BBC had its very own mighty OB fleet and could mount elaborate 'trial' programmes to test the latest systems.

A brief resumé of British (and several overseas) finished goods & component manufacturers (as at May 2005) part 14 by Dave Hazell

Paco. In 1964, they made a sweep generator (wobbulator), signal tracer and capacitor tester (ready assembled or in kit form), which was marketed in the UK by KLB Electric Ltd, 335 Whitehorse Road, Croydon, Surrey. KLB also made their own equipment, such as a component bridge.

Pact International Electronics Ltd, Church Lane, Wallington, Surrey (in 1972). UK distributor of test equipment. See also under Electrocomponents (Radiospares).

Painton. Painton and Co., of Kingsthorpe, Northampton (since at least 1937). Founded by Mr P R Painton in 1937 to make wirewound resistors. Mr Painton died the same year and C M Benham took over the business and remained with it until Plessey acquired it. Manufacturers of a wide range of resistors, professional faders, switches, terminals, knobs, connectors (e.g. the "Multicon" range) and valveholders. In 1965, they acquired Electroprints Ltd, of Portsmouth – a maker of printed wiring on rigid and flexible materials. They were taken over by Plessey circa 1970 but many products continued to be made.

Pam (Radio & Television) Ltd, 295 Regent Street, London, W1 (in 1954 & 1962). A Pye company. In March 1956, Pam marketed the first transistor radio in the UK (designed and made by Pye).

Pamphonic Reproducers Ltd, 17 Stratton Street, London, W1 (in 1957). Circa 1952, the Pamphonic sales office (at least, for Pamphonic branded TV sets made by Pye) was at 400 Holloway Road, London, N7. In 1962, they relocated to Westmoreland Road, London, NW9 & Heath Works, Baldock Road, Royston, Herts (later, the Royston address was the location of Pye Ling and then LTV Ling Altec, also W Bryan Savage and Pye Business Communications). HiFi and public address equipment. A Pye company. Still going in 1966, at Royston and possibly merged into Pye Business Communications (formed in 1970), who designed PA systems based on Philips equipment (and had a site at Royston). In 1968, following the takeover of Pye by Philips, Peto Scott Ltd handled all Pamphonic audio products – but shortly after this, Peto Scott was merged into Pye TVT Ltd.

Panduit Ltd, Sittingbourne Ind Park, Unit 22a Crown Quay Lane, Sittingbourne, Kent (in 1975). Maker of cable management accessories (e.g. cable ties and bases).

Pantak (EMI) Ltd, Vale Road, Windsor, Berks (in 1976). X-ray equipment and HV power supplies.

Pantiya Electronics Ltd. see Unitech Ltd. In 1955, Pantiya Tea and Rubber Co ceased trading and formed Pantiya Electronics Ltd. In 1956, it acquired Walmore Electronics Ltd and in 1964, Marlyne Electronics Ltd (who also owned Stern-Clyne Ltd). Around 1965, Pantiya formed Saba Electronics Ltd, to market SABA products in the UK.

Parkinson Cowan Appliances Ltd, Stetchford, Birmingham 33 (in 1964). In 1966, Parkinson Cowan Measurement, Talbot Road, Stretford, Manchester (and at Oldham). Gas appliance manufacturer (e.g. cookers). Taken over by Thorn in 1971. Now owned by Electrolux of Sweden.

Parmeko. Parmeko Ltd, Percy Road, Aylestone, Leicester (in 1948 & 64), Parmeko manufacture transformers and other wound products. Originally called Partridge & Mee Ltd, of Leicester. In the 1950's, they made the wound components for the classic Mullard valve hi-fi designs of that period. In the 1950's & 60's, they made a range of public address and domestic audio equipment (originally called Altobass). They are still in business (2001) but no longer make iron or ferrite cored transformers and chokes.

Parnall (Yate) Ltd, The Aerodrome, Yate, Near Bristol (in 1948 & 58). Maker of refrigerators (and other domestic appliances, including electric grills and tumble driers). Offices at 255 North Circular Road, London, NW10 (also in 1958). Later became part of the Radiation group – see "Radiation". In 2004, there is a tumble drier factory owned by Merloni (of Italy) at Yate – possibly on the original Parnall site. Merloni bought Hotpoint/Creda from GEC/ Marconi, circa 2000. Creda (Simplex) was part of the Tube Investments group (TI), who also owned Radiation, New World, Sunhouse, Ascot, Jackson and Russell Hobbs until the mid-1980s.

Partridge. Partridge Transformers Ltd., of 76-78 Petty France, London, SW1 (in 1948), then moved to Peckford Place, London, SW9 (in 1948) and a new factory was built in 1948/9 at Roebuck Road, Kingston Bypass, Tolworth, Surrey) In 1958 & 65, they were at Roebuck Road, Chessington, Surrey. Transformer manufacturer.

Partridge, Wilson & Co Ltd, Davenset Works, Evington Valley, Leicester (in 1946 & 64). "Davenset" battery chargers. Later taken over by Westinghouse Brake & Signal Co Ltd. In 2002, the brand was owned by Elequip of Leicester.

Paxolin. The famous insulating material used extensively for the mounting of sockets, tag strips, etc. Made by The Micanite and Insulators Co., of Walthamstow, London.

Peak Sound (Harrow) Ltd, 10 Asher Drive, Mill Ride, Ascot, berks (in 1966). Manufacturer of "Cir-kit" prototype wiring system, utilising self adhesive copper foil tape that could be laid out onto an insulating board and then drilled, to form a basic pcb. In 1968, at 32 St Jude's Road, Englefield Green, Egham, Surry – supplier of the "Baxandall" loudspeaker kit.

Pedoka Ltd, 28-29 White Lion Street, London, N1 (in 1978). Supplier of appearance items and mechanical fittings for electrical and electronic industries (e.g. knobs).

Peerless Radio Ltd, 374 Kensington High Street, London, W14 (in 1947). Maker of radio and radiogram chassis. Peerless name used in 1950 by Telemechanics Ltd, 3 Newman Yard, Newman Street, London, W1 (still for r/gram chassis).

Peerless Fabrikkerne A/S, 2860 Søborg, Copenhagen, Denmark (in 1967). Loudpseaker and loudspeaker enclosure manufacturer. In 1967, their UK distributor was C E Hammond & Co Ltd, 90 High Street, Eton, Windsor, Berks.

Pena Industries Ltd. In 1958, a holding company for a wide range of subsidiaries in the fields of electronics, metals, plastics, finance, general and service. It took over Peto Scott in 1958. In the same year, Pena itself issued a petition for its compulsory winding up, but this was deferred. Pena Industries subsequently went into liquidation and Philips took over Peto Scott circa 1961.

Penco Products Ltd, 36 Coniston Road, Kings Langley, Herts (in 1957). Maker of "Epigram" record players.

Pennine Amplifiers, 9-11 Southgate, Elland, Yorkshire (in 1948 & 50). Maker of "Ranger" model E54/2 table radio receiver (and The Rover in 1950).

Perdec Solder Products Ltd, Abbey Mills, Waltham Abbey, Essex (in 1957).

Perdio Ltd, Dunstan House, St Cross Street, London, EC1 (in 1957). In 1962, name changed to Perdio Electronics Ltd, Bonhill Street, London, EC2 (when Perdio became a public company in 1962). and opened a factory near Sunderland. Established in 1956, by Derek Wilmot and financed by Irish peer, Lord Suirdale. Perdio stood for Personal Radio. Perdio quickly established a big share of the transistor portable radio market. In 1963, they were selling the "KH" high impedance meter adaptor (see Kenure-Holt). In the early 1960's they also made transistor portable TV sets (The "Portarama"). They struggeld to compete with imported far eastern "Empire made" transistor portables and their "Portarama" TV set didn't do as well as hoped. Consequently, Perdio went into receivership in 1965. By 1965, Perdio also owned: Kenure-Holt Electronics and Electric Audio Reproducers Ltd. The brand was subsequently used on imported radios by others. In 1966, Dansette Products Ltd, a company recently formed to take over the assets of Perdio Electronics Ltd acquired the company. Mr Louis Margolin (of Dansette) became the MD of Perdio and Dansette.

Permanoid. In 1948 & 50, a brand name of Associated Technical Manufacturers Ltd, Vincent Works, New Islington, Manchester, 4. By 1957, the company was called Permanoid Ltd, same address (also in 1965). Makers of insulating materials, sleeving, connectors and equipment wire.

Perspex – made by ICI (in 1950)

Perth Radios Ltd, 60 Newman Street, London, W1 (in 1953). In 1954, at 90 Judd Street, London, WC1. In 1958, moved to new HQ at Marten House, East Road, London, N1. Founded by Mr M H Ismail. Maker of radiograms.

Petbow Ltd, Station Estate, Balmoral Road, Watford, Herts (in 1946). Maker of welding equipment (incorporating: Agile Electrodes Ltd, Weldrics (1922) Ltd and Power Electrode Co Ltd).

Peto Scott Electrical Instruments Ltd, Pilot House, Church Street, Stoke Newington, London, N16 (in 1945) – maker of communications and domestic radio receivers. In 1922, the business was called The Peto Scott Co., and located at 7 Featherstone Buildings, High Holborn, London, WC1. In 1947 & 67, at Weybridge Trading Estate, Addlestone Road, Weybridge, Surrey. The company was first registered in 1928 and changed its name in 1937 and 1944. In 1945 it acquired all the shares of Thorpe & Thorpe Ltd but these were disposed of some time around 1952. An advert on p66 of British Radio & Television Retailing, May 1957 states "first in radio – 1919, first in TV – 1928". A sales brochure from 1933 shows 1919 as the year Peto Scott was established. Maker of radio and TV sets, also flying spot film scanners and TV cameras. It was taken over by Péna Industries Ltd in 1958. Péna Industries subsequently went into liquidation and Peto Scott became a Philips company in the early 1960's. After the takeover, Philips marketed Peto Scott badged versions of their own TV sets – but only for a couple of years. By 1965, Peto Scott were distributing certain Philips professional products, such as audio tape recorders and in the same year, they opened a new service department at Beddington Lane, Croydon, Surrey. In the UK, several Philips semi-professional, educational and industrial TV products were re-badged as Peto Scott (e.g. early semi-professional VTRs). By 1966, the company name was changed to Peto Scott Ltd. In 1968, following the takeover of Pye by Philips, Pye TVT Ltd was merged with Peto Scott Ltd. The merged company was known as Pye TVT Ltd. . By Dec 1968, the former Peto Scott adverts in Wireless World were now under the Pye TVT Ltd banner, at Addlestone Road, Weybridge, Surrey. Also in 1968, the sound division of Peto Scott started handling Pamphonic audio products. However, when Pye Business Communications Ltd was formed, circa 1970, it absorbed some of the former Peto Scott (Weybridge) activities, such as CCTV, public address, etc. – but not broadcast equipment, which remained with Pye TVT Ltd.

Philbrick – see Teledyne.

Philco Radio & Television Corporation of Great Britain Ltd, Aintree Road, Perivale, Middlesex, in 1934 (the UK offshoot of Philco USA, which made radios and electronic test equipment). Circa 1930s, their London office was at 10 Smith Square, London, SW1. In 1947, at Wadsworth Road, Perivale, Greenford, Middx. The British subsidiary of Philco International Corporation, Philadelphia. PA, USA. Philco's origins were in the Helios Electric Company, formed in 1892. In 1950, Thorn Electrical Industries Ltd reached an agreement with Philco USA, to manufacture Philco TV and radio sets in their UK factories, for Philco (Great Britain) Ltd and Philco (Overseas) Ltd. This gave Thorn access to Philco's US manufacturing technology. In 1957, Philco operated 26 manufacturing plants (totalling 6.1 million square feet of manufacturing space. In 1954, the UK Philco radio & TV factory was at Romford Road, Chigwell, Essex. In 1959, Thorn bought Philco (Overseas) Ltd, Philco's UK manufacturing operation (which also owned the UK sales company Philco (GB) Ltd) – this included the Chigwell factory. Thorn used the Philco brand in the UK until the early 1960's. In 1956, the UK company was known as Philco (Great Britain) Ltd. In 1957, the service department was relocated to Freshwater Road, Dagenham, Essex and the sales office was at 30-32 Grays Inn Road, London, WC1 (sales still there in 1960). In the US, Ford bought some of Philco's assets and produced radios, etc under the Philco-Ford brand. In 1961, Philco International Ltd sold "P.E.T.E." Philco Electronic Training Equipment teaching/ learning transistor laboratory kits, from South Street, Bishop's Stortford, Herts. In 1968, Philco International Ltd, 42 Leicester Square, London, WC2 ("Philco Ford" domestic appliances). Also in 1968, Philco-Ford Corporation,Tioga & C Streets, Philadelphia, Pennsylvania (producing IC's). In 2002, the Philco name is still used, for example by a Italian white goods manufacturer.

In 1957, Plessey took a 51% share in Semiconductors Ltd, Cheney Manor, Swindon – a new UK company set up with Philco USA, to make transistors using Philco technology – such as the Micro Alloy Technology (MAT) types. The US parent went bust in the late 1950's and parts of the business were carried on by Ford (cars), as Philco-Ford (including domestic appliances). Thorn (Ferguson) made sets with the Philco brand for Philco (Overseas) Ltd, from 1950 to around 1962. Prior to this, see Airmec.

Philco Ford semiconductors.
Closed down in 1971.

PHILIPS
Philips is a Dutch company, founded in 1891 in Eindhoven, Holland to manufacture incandescent electric lamps. The founder was Dr Gerard Philips - N V Philips Gloeilampenfabrieken (Philips Incandescent Lamp Works Holding Co). Gerard Philips had financial backing from his businessman father, whose interests included gas street lighting. In 1894, his younger brother Anton had joined the company. Anton's son, Frederik Jacques Philips (known as "Frits"), was born in 1905 and joined the company in 1931 and by 1939 was Managing Director. Following WW2, he was appointed the company's Vice President. In 1961, he became President. He took an interest in Matsushita of Japan, that was sold in the early 1990s for £1 billion. He retired in 1971 and died in 2005.

In 1920, a public holding company (with a special shares structure) called "NV Gemeenschappelijk Bezit van Aandeleen Philips Gloeilampenfabrieken" (abbreviated to NV Bezit) was set up in order to keep control of "NV Philips Gloeilampenfabrieken" in Dutch hands. In 1954, NV Bezit owned over 99% of NV Philips.

Philips rapidly diversified into the embryonic electronics industry and bought shares in Mullard in 1924 and acquired full control in 1929.

In 1925, NV Philips set up a UK subsidiary – Philips Lamps Ltd – primarily to manufacture electric lamps, but soon took on radio manufacture. The name was later to change to Philips Electrical Ltd. In 1937, their UK head office was Philips Lamps Ltd, 145 Charring Cross Road, London, WC2.

In 1939, NV Philips set up the Philips British Trust, to which it transferred all of its UK businesses (The Mullard Radio Valve Co Ltd and Philips Electrical Ltd). This was to avoid these companies being seized by the Custodian of Enemy Property, during the impending war.

In 1947, the UK interests of NV Philips were reorganised under a new UK holding company, Philips Electrical Industries Ltd. The wholly owned subsidiaries of the new holding company included Philips Electrical Ltd and Radio Equipment Ltd (the latter having Mullard Ltd as a wholly owned subsidiary).

The (Dutch) Philips works football team was called Philips Sports Vereniging (Philips Sports Union) – later known as PSV Eindhoven.

Later (and for many years - at least since 1946), their UK Head Office was Century House, Shaftesbury Avenue, London, WC2.

Other Philips products included: welding, medical, test and measurement equipment, PA, CCTV, radiotelephones, Broadcast studio equipment, passive and active electronic components, including CRTs and a manufacturer of TV, radio, audio, VCR, "Philishave" shavers, etc. Philips developed the compact audio cassette and compact disc systems. Over the last ten-fifteen years, Philips has sold of many off its divisions, including passive components, mobile radio, test & measurement. Its displays division (CRTs & LCDs) was put into a joint venture with LG (formerly Lucky Goldstar) of South Korea, circa 2000. In early 2005, Philips reached an agreement with TPV Technologies of Taiwan, whereby TPV will acquire Philip's OEM monitors and entry-level flat screen products businesses, in order to manufacture Philips branded PC monitors and flat screen TVs (for Philips). This involves TPV taking over the Philips monitor and flat screen plants in Suzhou and Dongguan in China, as well as their monitor factories in Szekesfehervar, Hungary and Manaus in Brazil. Also included is the Philips R&D centre in Chungli, Taoyuan County, Taiwan. In the process, Philips will acquire a stake or around 15% in TPV.

Here is a list of known UK Philips companies over the years:-

Philips Lamps Ltd (in 1946). Formed in 1925 as a wholly owned subsidiary of NV Philips, Holland. Later renamed Philips Electrical Ltd.

Philips Electrical Ltd. In 1950's & 60's.

Philips Electronic & Associated Industries Ltd. Set up in 1964, as the UK holding company of NV Philips of Holland. Prior to this, it was known as Philips Electrical Industries Ltd (established in 1947). Prior to

1947, Philips Lamps Ltd (set up in 1925) was the UK holding company of NV Philips.

In 1968, Philips main UK lighting companies were:

Philips Electrical Ltd. Manufacture and sale of Philips, Stella and Corona branded lamps. (Corona was set up by Philips in 1961, in order to enter the cheaper end of the market. Trading ceased in 1967.)

The Stella Lamp Co Ltd.
Sales of Stella brand lamps.

Mullard Ltd.
manufacture of wires and filaments used in lamps.

Also in 1968, Philips had controlling interests in:

Luxram Lamp Works Ltd,
Rochester, Kent. Lamp manufacturer (Philips acquired 60% in 1965).
Luxram Electric Ltd. Sales of Luxram and Corona branded lamps. The Kingston Lamp Co Ltd, Kingston upon Hull. Manufacturer and seller of Kingston branded lamps. Philips acquired a 60% interest in Kingston in 1966, through the Philips subsidiary ADA (Halifax) Ltd.

Philips introduced the "Compact Cassette" audio tape recording system in 1963, at the Berlin Radio Fair.

Philips Data Systems, Elektra House, 2 Bergholt Road, Colchester, Essex (in 1979). Business machines, incl. accounting systems, bank terminals, small business computers.

Philips Domestic Appliances, Lightcliffe Factory, Hipperholme, Nr Halifax, Yorks. Design and manufacture of washing machines and tumble driers (in 1979). Formerly Ajax Domestic Appliances Ltd (ADA). Philips formed a joint venture with Whirlpool (USA) in the late 1980's, eventually selling out their share to Whirlpool. The Halifax factory was the subject of a management buyout in 1986.

Philips Electric Arc Welding Ltd. Actarc Works, 127 Nitshill Road, Glasgow (in 1979).

Philips Electrical (Ireland) Ltd,
20,Eustace Street, Dublin.

Philips Electronic and Associated Industries Ltd (in 1978). Arundel Great Court, 8 Arundel Street, London, WC2. The UK holding company for Philips (incl. MEL), Mullard and the Pye of Cambridge Group.

Philips Hamilton – Wellhall Road, Hamilton, Lanarks. In 1979, factory for electric shavers, heating appliances and lamps (incl. flashbulbs).

Philips Records Ltd, Stanhope House, Stanhope Place, London, W2 (in 1968 & 69). Record company (subsidiary of Philips Phonographic Industries, Baarn, Holland).

Philips Research Laboratories, Cross Oak Lane, Salfords, Redhill, Surrey (in 1978). Previously known as the Mullard Research labs.

Philips Electronic Industries Ltd, Commerce Way, Purley Way, Croydon, Surrey (in 1957). New TV & radio plant.

Philips Medical Systems Ltd, 45 Nightingale Lane, London, SW12 (in 1966 & 70, although at this address in 1961 as Philips Electrical Ltd). Maker of X-ray equipment. In 1979, Kelvin House, 63-75 Glenthorne Road, Hammersmith, London, W6.

Philips Lamps Ltd, Philips House, 145, Charing Cross road, London WC2 in 1932 – manufacturers of electric lamps, wireless apparatus, neon signs, "Metalix" X-ray tubes, cardboard,glassware, fittings, etc. Directors Dr A F Philips, L G Sloan, Sir W Horwood, C J Powell, Managing Directors D C F van Eendenburg, A deJong. In 1945 and 1962, at Century House, Shaftesbury Avenue, London, WC2. Also in 1945, the radio service department was at: Cherry Orchard Road, Croydon, Surrey. Century House was the HQ for Philips in the UK until the 1970's, when they relocated to Arundel Great Court, 8 Arundel Street, London, WC2. In the 1980's, they moved again, to City House, 420-430 London Road, Croydon. Century House was also HQ for Mullard until they moved to Mullard House, Torrington Place, London, WC1, in 1957.

The Philips TV plant opened in 1954, but did not reach full capacity until 1957, when it employed 4,000 people. It was later known as Philips Croydon, Commerce Way, Purley Way, Croydon – it closed in the mid-1980's. Prior to the opening of Croydon, work was done at Mitcham, Harlesden and Glasgow.

Phillips (V C), 56 Lower Friar Street, Newcastle-upon-Tyne, 1 (in 1950). Maker of radiograms, including the "Intergram" model.

Phillips & Bonson Ltd, Pond Works, 8 Millfields Road, London, E5 (in 1955). Maker of HiFi amplifier.

Phycomp. The name given to a passive components division of Philips, when it was sold of circa 2000. It is now a subsidiary of Yageo. Main product – multilayer ceramic capacitors.

Pickering & Co Inc, Oceanside, NY (in 1955). Maker of pickups.

Piezo Ltd, 26 St Albans Road, Watford, Herts (in 1961). Quartz crystal manufacturer.

Pifco Ltd, Pifco House, Watling Street, Manchester 4 (in 1964, 47 and 1936). In 1933, at High Street, Manchester. In the 1930's, a maker of meters and test equipment (Rotameters & Radiometers). I think this is almost certainly the same Pifco that later moved into domestic appliances, torches, etc? Pifco was originally called the Provincial Incandescent Fittings Co Ltd – still used in 1948 (but Pifco Ltd by 1958). In 1964, Pifco acquired additional production facilities in a mill at Middleton, near Manchester. Following the failure of Polly Peck plc, in the 1980's, Pifco Holdings plc (of Failsworth, Manchester) bough the Russell Hobbs Tower operation, circa 1991. In 2001, Salton Inc (USA) bought Pifco Holdings plc. In 2001, Pifco Holdings plc owned the following brands: Pifco, Salton, Carmen, Russell Hobbs, Tower, Mountain Breeze, Hi-Tech and Haden.

Piher International Ltd, Romar House, The Causeway, Staines, Middx (in 1972). The UK office of the Spanish component manufacturer (resistors, potentiometers and semiconductors). By 2002, a Meggitt company.

Pilot Radio Ltd, of 31-37 Park Royal Road, London, NW10 (in 1944 & 1958). Maker of radio and TV receivers. Pilot Radio Ltd was established in May 1936, at Park Royal, London, with the technical assistance of Pilot Radio Corporation, USA.

The US company has its origins in the Beacon Electrical Co set up (in New York city) by Isidor Goldberg in 1908. This merged with The Pilot Electrical manufacturing Co in 1926. The merged company initiallly made radio components – only later making complete sets. It relocated to Laurence, Massachusetts in 1929. In 1933, the firm collapsed. Isidor Goldberg set up a new company – The Pilot Radio Corporation, in Long Island City, NY. By 1935, they were exporting to many countries. Pilot Radio Corporation, 37-06 36th Street, Long Island City 1, NY (in 1955) – also made HiFi amplifiers. Pilot USA may have been taken over by Emerson.

H L Levy was the MD of Pilot Radio Ltd (the UK company), from the start. Their original products were short wave receivers based on American designs. In 1938, they introduced the first of the "Little Maestro" sets. During the war, their factory produced electronic and mechanical equipment for the armed services and a second factory was acquired. Post-war, Pilot exported >50% of their production. They established factories in Eire, South Africa and Israel. In 1950, part of their factory at Park Royal, London, was completely destroyed by a fire. Also in 1950 (and possibly as a result of the fire), their service department moved to 154 Dukes Road, Western Avenue, London, W3. By 1957, they had three factories in the UK. By 1958, they also produced a range of HiFi equipment. The UK company was taken over by Ultra Electric Ltd., in 1959. In 1959, the company name changed and relocated to: Pilot Radio & Television Ltd, Stonefield Way, South Ruislip, Middx. In 1964, Pilot Radio & Television Ltd, Television House, Eastcote, Ruislip, Middx (the base of Ultra Radio & Television Ltd) – by then a Thorn company. The Pilot trade name was only used for a few years after Ultra takeover, although I do remember seeing a Pilot branded small colour TV in Rumbelows (a Thorn retail brand) in the 1970's. In 2004, I saw an abandoned Pilot branded fridge, which was made by Thorn Domestic Appliances.

Pinnacle Electronics Ltd, 27a Howland Street, London, W1 (in 1955 & 64). In 1955, they introduced a range of valves for the TV and Radio trade (sold by wholesalers and later, reps.). In 1958, the Managing Director was David Toms. In 1965 & 70, at Achilles Street, New Cross, London, SE14. In 1977, Pinnacle Electronic Components, Electron House, Cray Avenue, St Mary Cray, Orpington, Kent. Valve supplier – later semiconductors and stylii.

Pioneer. Pioneer Electronic Corporation, Tokyo, Japan (in 1966). In 1966, their UK agents changed from C E Hammond, to Swisstone Ltd, 26 Leigh Place, Chobham, Surrey. In 1975, Shiro UK Ltd, Shiro House, The Ridgeway, Iver, Bucks. HiFi from Japan.

Pioneer Gen-E-Motor Corporation, 5841-49 Dickens Avenue, Chcago, Illinois (circa 1940's). Manufacturer of dc-dc "Dynamotor" electromechanical voltage converters.

Pirgo Electronics Inc, 130 Central Avenue, Farmingdale, Long Island, NY (in 1970). An affiliate of Sprague Electric. Semiconductor manufacturer.

Pirelli General Cables Ltd. A company that was initially jointly owned by Pirelli of Italy and GEC of the UK. In 1962, Pirelli's parent company acquired most of the GEC holding. In 1971, P-G acquired Aberdare Cables Ltd. In 2005, Pirelli of Italy sold its cables and systems business to US venture capital company (Goldman Sachs) and it was re-named Prysmian Cables & Systems.

Plastic Capacitors Ltd, Maydown, County Londonderry, N. Ireland (in 1969).

PLESSEY

The Plessey Company Ltd, headquartered in Vicarage Lane, Ilford, Essex (in 1948). A company effectively founded by American Allen Clark in the 1920s (he died on 30th June 1962, as Sir Allen Clark). Plessey was first registered in 1925 and became a public company in 1937. Prior to this, there was a company founded in 1917, to carry out jobbing engineering work. His son then took over the helm (John?). Plessey made radio and TV receivers for other brands for many years (up to 1966) and record decks (pre-Garrard ownership). They also made electronic components (including variable capacitor tuning gangs for radios, dust cores (e.g. in "Caslite"), scan coils and line output transformers, loudspeakers, pickups, turntables, ferrite materials (e.g. "Caslam"), vibrators and those dubious two-tone red and black encapsulated electrolytics, with the yellow self-adhesive label).

Also ventured briefly into t/v transposer equipments and UHF amplifiers. Low power amps used 'stripline techniques – known as "Plessey Triplates", also made a 200w TWT UHF amplifier an example of which is held by the Science Museum – ex BBC Sutton Coldfield test bed for the equipment!

By 1952, Plessey had a large presence in Swindon (2,700 employees) at their Swindon works (Kembrey Street & Cheney Manor). In March 1952 a social club was opened at Cricklade Road, Swindon still having a Plessey sign on it in the late 1990's!

In 1957, they introduced "Plesseal" lacquer sealed waxed paper capacitors. Plessey were also big in telecommunications equipment. Plessey Semiconductors was originally a joint venture set up in 1957 with the US Philco company and called "Semiconductors Ltd". It manufactured transistors using Philco technology. This unit was responsible for the famous SL901 IC, used in the colour decoder of early Bush/Murphy colour TV sets. They built a new semiconductor factory ("fab") (MOS devices) in Roborough, near Plymouth in 1983/84. Plessey grew by acquisition, including: TCC, Painton, Garrard, Ericsson Telephones (UK) and the Automatic Telephone and Electric Company. They succumbed to a joint take-over by Siemens of Germany and GEC (UK). Thereafter, the business was carved up between these two.

Before Plessey was taken over, it disposed of its resistors division, which became Citec in the 1980's. Citec was then taken over by BICC. Later still, BICC sold it to Meggitt plc and Citec became a part of Meggitt Electronic Components. By 2005, it had been sold on to Tyco?

Plessey Semiconductors was merged with GEC's operations to form GEC-Plessey Semiconductors, which was sold to Mitel of Canada in ca. 1997. Mitel Semiconductors is now known as Zarlink.

John Allen Clark, elder son of Alan Clark, became Chairman of Plessey by 1965. By 1971, he was chairman and chief executive of Plessey and was knighted in that year.

Chemical & Metallurgical Division. Wood Burcote Way, Towcester, Northants (in 1955). By 1970, the site was the Microelectronics Division –Optoelectronic & Microwave Unit. Plessey Optoelectronics & Microwave Ltd, Wood Burcote Way, Towcester, Northants (in 1980). Maker of Infra Red detectors. In 1973, they also made memories for computer applications.

Allen Clark Research Centre, Caswell, Nr Towcester, Northants (in 1969). By 1975, they were making Surface Wave Acoustic Filters (SWAF) there.

Electronics Group research centres at Roke Manor (Hants) and Martin Road, West Leigh, Havant, Hants (in 1969).

Hagan Controls Ltd (in 1960)

Plessey Acoustics Division, New Lane, Havant, Hants (in 1967). Merged with Goodmans Industries Ltd in the same year.

Plessey Assessment Services Ltd, Titchfield, Fareham, Hants (in 1976 & 1980). Testing house for own and other manufacturers products (heat, humidity, Electro Magnetic Compatibility, etc.).

Plessey Avionics and Communications, Martin Road, West Leigh, Havant, Hants in 1974 & 78.

Plessey Capacitors, Bathgate, West Lothian, Scotland (in 1972 and 76). Tel 0506 53511. The factory closed in 1985 (as Arcotronics)

Plessey Circuits Ltd, South Shields (opened in 1980). PCB manufacture.

Plessey Components Group. Headquartered in Kembrey Street, Swindon, Wilts. Formed circa 1967, to manage the company's various component manufacturing divisions.

Plessey Controls Ltd, Sopers Lane, Poole, Dorset (in 1978). Makers of telegraph test sets.

Plessey Distributors, Vicarage Lane, Ilford, Essex (in 1976). Electronic component distributors.

Plessey EAE Ltd, Offshore House, 284-5 Southdown Road, Great Yarmouth, Norfolk (in 1980). Communications systems for the oil industry.

Plessey Electronics, Radio Systems Division, Braxted Park, Witham, Essex (new laboratories opened in 1966).

Plessey – moulded fibre division, Kembrey Street, Swindon (in 1961). Loudspeaker cone materials.

Plessey Radar Ltd (in 1969), based at Addlestone, Surrey. In 1965, Plessey acquired part of Decca's radar interests.

Plessey Radar, Newport Road, Cowes, Isle of Wight (in 1968 & 79).

Plessey Research (Caswell) Ltd, Allen Clark Research Centre, Caswell, Towcester, Northants (in 1982).

Plessey Sheet Metal Division, Osborne Street, Swindon, in 1967.

Plessey BTR Ltd, changed its name to Plessey Telecommunications Research Ltd, in 1970. (at Taplow). BTR = British Telecommunications Research. Established in 1946 jointly by BICC and AT&E. When Plessey bought AT&E in 1961, it became the majority shareholder in the company.

Plessey Telecommunications Ltd, Beeston, Nottingham (in 1970). Formerly Ericsson Telephones Ltd.

Plessey Telecommunications Group, Edge Lane, Liverpool (in 1971). Formerly Automatic Telephone & Electric Co Ltd.

Plessey Telecommunications Research Ltd, Taplow Court, Taplow, Maidenhead, Berks (in 1978).

Plessey Windings Ltd, Abbey Works, Titchfield, Fareham, Hants (in 1975). LOPTx, deflection components, the "Magispark" gas lighter, etc.

Plessey Wound Products Ltd, Titchfield, Hants (in 1978).

Resistor & Capacitor Products Division. Kembrey Street, Swindon, Wilts (in 1957 & 60).

Resistor Division (in 1970), Cheney Manor, Swindon, Wilts.

Signal Technology Ltd, established as a joint venture by Plessey and Anderson Laboratories Inc. SAWF technology. Based in Swindon.

Microelectronics Division, Cheney Manor, Swindon (in 1970).

Variable capacitor (for radios, etc.) division – New Lane, Havant, Hants (in 1958).

Industrial Electronics Division, Ilford, Essex (in 1958).

Data and telegraph test equipment, Sopers Lane, Poole, Dorset (in 1973).

Polar. Brand name of Wingrove & Rogers Ltd, Polar Works, Mill Lane, Old Swan, Liverpool, Lancs. (in 1948). In 1964 & 66, at Domville Road, Mill Lane, Liverpool 13. Established in 1919 (WW ad, May 1979, p 27). Manufacturer of tuning capacitors and associated drive components. In 1965 & 66, London offices at Paramount House, 75 Uxbridge Road, Ealing, London, W5. In 1970, they were (also?) at 95b High Street, Great Missenden, Bucks. In 1978, they reorganised into four divisions: Polar Jaeger – connectors; Polar – variable capacitors, tuning drives, tuners, etc.; Polar JM – capacitors, resistors loudspeakers; Polar Capacitors – precision met film polycarb capacitors (all at Domville Road, Liverpool). Circa 1980, Jackson Bros. Acquired the Polar variable capacitors business from Wingrove & Rogers, hence subsequent ads for Jackson-Polar in the 1980's. See also Polar Capacitors Ltd.

Polar Capacitors Ltd, Domville Road, Liverpool (in 1978). Distributor of Wingrove & Rogers Ltd plastic film capacitors (marketing subsidiary?).

Portadyne – Dynaport Radio & Television Ltd, Portadyne Works, 18-19 Gorst Road, North Acton, London, NW10 (in 1947). In 1957 & 64, at 30-40 Gorst Road.....In 1964, at Audio Works, Paxton Road, Tottenham, London, N17. In 1944, Portadyne Radio Ltd, Gorst Road, North Acton, London, NW10. A maker of the wartime utility radio – makers code U29.

Portogram Radio Electrical Industries Ltd, Preil Works, St Rule Street, London, SW8 (in 1947 & 58). H F Bowers and his brother S Bowers ran the business in 1964 (maybe the company founders?). In 1960 & 62, at Audio Works, Paxton Road, Tottenham, London, N17. In 1964, they sold their Tottenham factory to the Tottenham Hotsput football club. Maker of radios, tape recorders and radiograms. In 1952, also the "Preil" audio amplifier.

Potter & Brumfield. A US relay manufacturer, of ?? and established in 1932. It had a manufacturing facility at Whitstable, Kent at some point. It was later taken over by AMF. AMF sold the company to Siemens in the late 1980's/early 1990's. Siemens have subsequently sold it to Tyco Electronics.

Power Controls Ltd, Exning Road, Newmarket – same phone number as Magnetic Devices ! (in 1955 & 56). Maker of connectors and rotary transformers.

Powerline Electronics Ltd, Nimrod Way, Elgar Road, Reading, Berks, RG2 0EB (in 1982). Power supply manufacturer.

Precision Monoliths Inc (PMI). US semiconductor firm.

Premier. British (?) maker/supplier of coils for radio sets. May be the same company as Premier Radio Co Ltd?

Premier Radio Co Ltd. 167 Lower Clapton Road, London, E5. Supplier/manufacturer of dc to HT inverter unit. See also Stern-Clyne.

Pressac. Based in Leopold Street, Long Eaton, Nottingham. Pressac were manufacturers of connectors for use in the consumer electronics industry. They made the (angled) "two flat blade" mains lead connector favoured by Philips in the 1960s and the connectors used in the Decca 80/100, Philips G11 and Rank T20 colour TV chassis. They also made PCB's – as used in RBM sets of the late 70's. Nowadays, they have moved into manufacture of components for the car industry.

Presspahn. Presspahn Ltd, based in Bradford, Yorks. Manufacturers of electrical insulating materials that were widely used in the TV and radio industry.

Prestcold. Refrigeration equipment brand of The Pressed Steel Co Ltd, Cowley, Oxford. For many years, they had a large factory at Theale, Berks (which closed in the 1980's?).

Printed Circuits Ltd (an associate of the Millett Levens Group), Stirling Corner, Barnet By-pass, Borehamwood, Herts (in 1957 & 64). Millet Levens (Instruments & Engineering) Ltd, same address, produced test equipment. The company was originally established soon after WW2 ended, by Leslie Levens, at Bow in East London. Later, the business relocated to Finsbury Park in North London. In the mid-1950s it moved again to Borehamwood, Herts. Leslie Levens left the company circa 1968 and found a new career in property – at one time owning Bush House, home of the BBC's World Service. He died on 1st February 2004, aged 93. The company was taken over by GEC (Great Britain) in 1962. By 1968, it had either relocated, or was additionally at: Printed Circuits Ltd, Spon Street, Coventry (a major factory location of GEC).

Prowest Electronics Ltd, Boyn Valley Road, Maidenhead, Berks (in 1969). Maker of broadcast TV equipment (e.g. monitors). In 1971, the company was taken over by the recently formed Broadcast Systems Ltd (previously, the major shareholders in Prowest were Westward Television and Grampian Television).

PRT Laboratories – later Airmec Laboratories (by 1947). Formed circa 1944. In 1946, Airmec Ltd apparently made Philco sets in the UK (Wireless World article). At that time, Airmec Ltd was a subsidiary of Radio & Television Trust. Airmec Laboratories Ltd, High Wycombe, Bucks (in 1950). By 1955, simply Airmec Ltd. By 1966, Airmec was owned by the Controls & Communications group, who also owned the British Communications Corporation. Airmec (the C&C Group) was taken over by Racal in 1969 and Airmec was merged with Racal Instruments.

Pullin Optical Co Ltd, 11 Aintree Road, Perivale, Middlesex (in 1964). Acquired by Rank Organisation at the end of 1964 and renamed Pullin Photographic. Pullin also had a subsidiary, Neville Brown. In 1965, Pullin Photographic became the UK distributor for Akai tape recorders. By 1965, Pullin became a division of Rank Audio Visual of Great West Road, Bentford, Middlesex.

Pullin (R B) & Co Ltd, Phoenix Works, Great West Road, Brentford, Middx (in 1955 & 64). Electronics – same as Measuring Instruments (Pullin) Ltd? Rank took over later....

PYE

Originally a scientific instrument maker for the Cambridge colleges, W G Pye & Co (founded in 1896) diversified into radio manufacture in 1922. In 1929, the radio division was formed into a separate company – Pye Radio Ltd. At about this time, the Irishman, Mr Charles Orr Stanley (photo in WW Dec 52, p496), became involved with the group - buying the radio business. By 1937 he took control of the entire Pye group and went on to be Chief Executive for almost thirty years. By the 1960s had built the company into a very diverse group, that included:

E K Cole Ltd
Ekco Electronics Ltd, Southed-on-Sea (in 1967). Avionics and inverters. In 1961, also at Rochford, Essex. In 1969, Pye of Cambridge Ltd transferred the aviation radar activities of Ekco Electronics Ltd into the aviation division of Pye Telecommunications Ltd and it became the Ekco Electronics Aviation Division of Pye Telecom. The Ekco Electronics instruments activity was transferred into a new company, Ekco Instruments Ltd.
Egen Electric Ltd
Dynatron Radio Ltd
Ferranti Radio & Television Ltd
Ether Controls Ltd
Telephone Manufacturing Co Ltd
British Relay Wireless & TV Ltd (substantial shareholing by 1967)
TV Manufacturing Ltd, Oulton Works, Lowestoft, Suffolk.
Unidare Ltd
Pye Electric Ltd, Drury Lane, Hastings, Sussex (in 1967). Maker/seller of the Pye Autotwin 9092 twin-tub washing machine. Same address as L G Hawkins – a Pye subsidiary.
Pye Printed Motors Ltd
Pamphonic Reproducers Ltd
High Definition Television Ltd
Faraday Electronic Instruments Ltd
W Bryan Savage Ltd (in 1966, a maker of variable frequency ac power supplies, at Heath Works, Baldock Road, Royston, Herts – later in that year, production transferred to Pye TVT Ltd, P O Box 41, Coldhams Lane, Cambridge)
Unicam Instruments Ltd (in 1966, at York Street, Cambridge). In 1968, merged with W G Pye & Co Ltd, to form Pye Unicam Ltd.
W Watson & Sons Ltd
The Lindley Thompson Transformer & Service Co Ltd
Bepi (Electronics) Ltd, of Galashiels and Kelso, Scotland. A PCB manufacturer bought in 1969.
Orr Radio Ltd. Later renamed Labgear (Cambridge) Ltd.

Coronet Industries Ltd, Kowloon, Hong Kong (51% interest). Maker of transistor radios, etc.
W G Pye & Co (scientific instruments), Granta Works, Cambridge – the original Pye company. In 1968, the company was merged with Unicam Instruments Ltd, to form Pye Unicam Ltd (both subsidiaries of Pye Holdings Ltd).
W Watson & Sons Ltd (lenses & optics), of Barnet and London, est. 1837.
Pye Group (Radio & Television) Ltd – formed in 1967, to encompass the previous Pye/ Ekco TV & radio sales companies.
Pye HDT Ltd (formed in 1965 to combine the CCTV interests of Pye Telecom with the original Pye HDT Company. HDT = High Definition Television.
Pye (Ireland) Ltd, Manor Works, Dundrum, Dublin (in 1982)
Pye Ling Ltd
Pye TVT Ltd.
Pye TMC Ltd (telecoms equipment)
Pye Switches Ltd – microswitches
Pye Telecommunications Ltd (mobile radio)
E.K. Cole Ltd (Ekco)
Rees-Mace Marine Ltd VHF radiotelephones
Pye Records Ltd – later sold to Associated TeleVision (ATV).
Pye-Nixa (in 1956), record manufacturers
Pye Ether Ltd. (sensors). Pye acquired Ether Controls Ltd in 1964.
Pye Unicam Ltd (scientific instruments)
Newmarket Transistors Ltd (semiconductors and modules)
Labgear Ltd (school laboratory equipment, aerials, boosters, resistors)
Cathodeon Crystals Ltd, High Street, Linton, Cambs (in 1965 & 79).
Cathodeon Ltd (monoscopes, CRTs, crystals)
L G Hawkins (electric kettles, etc.)
Varelco Ltd (connectors)
Pye Electro Devices Ltd (switches, relays, capacitors)
Pye Marine Ltd
Pye Industrial Electronics Ltd.

The group was brought to near collapse in 1966, by overreaching itself in its domestic TV manufacturing and rental operations, which resulted in the departure of C O Stanley (who by then was Chairman) and his son, John Stanley by July 1966. C O remained as "Honorary President". CO was replaced as Chairman and Chief Executive of Pye of Cambridge Ltd, by Frank B Duncan. At the same time, other Pye directors became MD's of various Pye Divisions: J R Brinkley – telecommunications; R M A Jones – radio & TV; C A W Harmer – overseas companies and F W Coulling – instrumentation & controls. J R Brinkley resigned later in 1967 and joined the radio group of STC as executive director. Norman A Twemlow, who had been with Pye since 1934, resigned as a director in 1967, to become chairman of Radio Rentaset Products Ltd (the manufacturing company of the Radio Rentals Ltd). Philips of Holland acquired a controlling interest in early 1967, by setting up a new UK company – Philips Electronic Holdings Ltd, to buy all the 5/- ordinary shares of Pye of Cambridge Ltd. The holding company was later renamed Pye Holdings Ltd. Philips agreed to keep Pye at arm's length for ten years – as Pye Holdings Ltd - but after that, Philips absorbed the Pye TV manufacturing and sales division and "common" chassis CTV products commenced with the G11 chassis (the last UK designed Philips TV chassis). By 1982, Philips had acquired all of the shares in Pye Holdings that it didn't already own. Philips then spun off many of the former Pye "second division" companies into a holding company called Cambridge Electronic Industries plc (see separate entry). Philips retained, for a time, Pye Telecommunications, Pye TMC, Pye Unicam and Pye TVT. They had all been sold by the mid-90's.

By the early 1980's, Philips re-branded all its Pye subsidiaries and their products (except consumer electronics) as "Philips" companies. Pye Telecom became Philips Mobile Radio but this was subsequently sold off circa 1996 and is now (2001) Simoco Radio, still at St Andrew's Road, Cambridge. Pye TVT was sold and became Varian TVT and now (2002) Harris Broadcast. Pye Unicam is still at York Street, Cambridge and is called Philips Analytical.

Cathodeon Ltd, Nuffield Road, Cambridge (in 1979). Specialised vacuum and gas filled electronic devices, icl. special lamps for scientific equipment.

Cathodeon Crystals Ltd, High Street, Linton, Cambs (in 1965 & 79). Quartz crystal products. Formed in 1953.

Cathodeon Electronic Ltd, Bircham Road, Southen-on-Sea, Essex (in 1959). CRT manufacturer/rebuilder.

Ekco Avionics (a division of Pye Telecommunications Ltd), Priory Crescent, Southend-on-Sea, Essex (in 1970). In 1971, the business was merged into MEL (a Philips subsidiary).

Ekco Ensign Electric Ltd, 45 Essex Street, London, WC2 (in 1964) – London office.

Ekco Heating & Electrical Ltd, 41-47 Old Street, London, EC1 (in 1964). Service: Ekco Works, Malmesbury, Wilts.

Ekco Heating & Appliances Ltd, Drury Lane, Hastings, Sussex (in 1979). Heating products and small domestic appliances (incl. "Hostess" trolleys). Originally the L G Hawkins factory, before the 1960 Pye/Ekco merger.

Ekco Instruments, Prittlebrook Industrial Estate, Southend-on-Sea, Essex (in 1979). Development and manufacture of electronic safety systems for capital equipment and scoring systems for missile and projectile trials. See also Ekco Electronics Ltd. Closed down in early 1980's?

Ekco Plastics Ltd, Ekco Works, Southend-on-Sea, Essex (in 1964).

Ekco Radio & Televisions Ltd, Ekco Works, Southend-on-Sea, Essex (in 1964).

Graseby Dynamics Ltd. Formed in 1981, by the merger of Graseby Instruments Ltd and Pye Dynamics Ltd.

High Definition Television Ltd, St Andrews Road, Cambridge (in 1964 "Trader" yearbook). A Pye subsidiary.

Labgear Ltd, Abbey Walk, Cambridge (in 1979). TV and FM radio reception products, wired distribution systems, test equipment for TV & radio trade and Teletext adaptors.

Newmarket Transistors Ltd, Exning Road, Newmarket, Suffolk (in 1958, 70 & 79) – tel 0638 3381. Established in 1953 by Pye Ltd, (according to WW June 1970 ad) as "The Transistor Development Company". It was renamed The Newmarket Transistor Company in 1957 and, in 1958, Newmarket Transistors Ltd. The company later became Newmarket Microsystems (circa 1982, with the formation of Cambridge Electronic Industries plc), then (when CEI plc changed its name to Graseby plc in 1982) Graseby Microsystems. When Smiths Industries plc took over Graseby plc in 1997, the company was merged with Smiths existing Micro Circuit Engineering (MCE) company at Tewkesbury. In 2002, the Newmarket and Tewkesbury locations remains open.

Pye (Ireland) Ltd, Dundrum, Dublin 14 (in 1961 7 64). This company remained under the control of C O Stanley for some time after the main UK Pye company was acquired by Philips.

Pye of Cambridge Ltd, St Andrews Road, Cambridge (in 1975 and 79). Holding company for the "Pye of Cambridge" group of subsidiary companies.

Pye Ltd, St Andrews Road, Cambridge (in 1972). The TV and Radio company.

Pye Ltd, RF Heating Division, 28 James Street, Cambridge (in 1960).

Pye Ltd, 137 Ditton Walk, Cambridge (in 1979). The HQ and sales office for Pye branded consumer products (by then a wholly owned subsidiary of Philips).

Pye Ltd, Audio Products Division, Caxton Way, Stevenage, Herts (in 1974). Newly set up in 1974, to make car radios, radiograms and audio equipment. This site was formerly occupied by Electro Methods Ltd and Pye Ether.

Pye Ltd, Manufacturing Division, Oulton Works, School Lane, Lowestoft, Suffolk (in 1973 and 1979). TV factory. Closed by Philips in the early 1980's and the site was later sold to Sanyo, who then made TV sets there! In 2005, Sanyo in Japan announced a world-wide restructuring and the Lowestoft plant looks like it will close.

Pye Ltd, Switch Division, Otehall Works, Burgess Hill, West Sussex (in 1957 & 65). Maker of microswitches.

Pye Ltd, Radio Works, St Andrew's Road, Cambridge (in 1952).

Pye Ltd, PO Box 49, Cambridge (in 1956). (Radio & TV business)

Continued on page 43

Letters

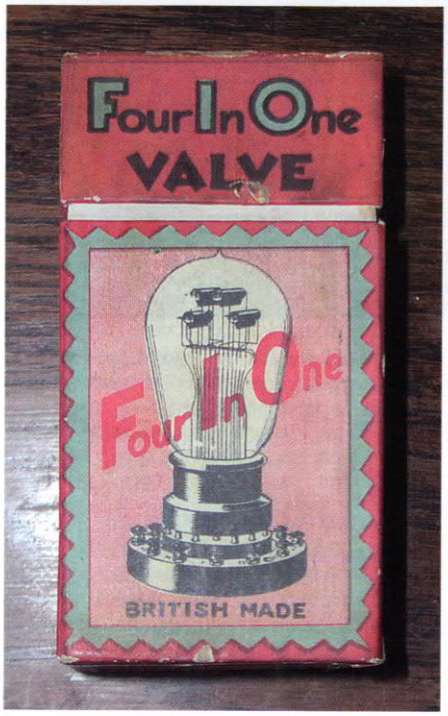
Dear Editor

I recently bought a boxed Four-in-One valve at a Radiophile auction and, looking back through old copies of the BVWS bulletin, noticed an article about multiple valves by David Read in the Spring 1999 issue, in which one was pictured and he requested more information. I am sending some photos of the valve and box. The ratings given on the side of the box are as follows, Filament Consumption .5A at 1.8V, Total anode current 8 mA, Plate voltage 80-120. As can be seen on the box top, the valve was manufactured by The Quadruple Valve Co Ltd of 1 Hood St, Northampton.

Actually the version I have has only three electrode structures in it, although the illustration on the box shows four, 3 is pencilled on the box top. If sold today would it contravene the Trades Description Act? One of the photos shows the twelve pin base. I have worked out which pins connect to the filaments which measure OK and glow dimly when 1.8 volts is applied, the offset pin seems to be common to all three filaments, the other ends are connected to the pins ninety degrees apart from this pin. The terminals on the holder pictured with the valve on the box show the four anodes (plates) connect to the two pins on either side of the offset pin, the grid connections are presumably to the four remaining pins.

On the three-in-one version I have there are no wires to the anode pin labelled P4 and the corresponding grid? pin. Twelve pins are not enough for all the electrodes of the four valve version to have been connected separately, even with one pin common to all four filaments.

Regards,
Mike Butt



Dear Editor,

During the recent renovation of a set I encountered a phenomenon strange to me as a part-time, amateur restorer. I wonder if it is more commonly known to those undertaking more regular servicing.

The set was a 1946 Goblin "Time Spot" fig. 682 in RR. Essentially this is a standard four valve plus rectifier AC superhet table model but with the addition of a synchronous time clock which can be switched into the circuit to turn the set on, so performing as an alarm.

In order to make repairs the energised speaker can be removed by sliding an inclined baffle board out of the cabinet, when the chassis can then also be removed. The connecting leads between speaker and chassis are of reasonable length, so that there is a good space between these items on the workbench.

Having gone through the basic repair procedure I tuned into a station, albeit with a weak signal but nevertheless distinctly audible. I then assumed I ought now to replace some more of the capacitors which were showing signs of their age. However, a surprise to me: I was alerted to the fact that the sound appeared not to be coming from the speaker but from somewhere in the chassis. Because of the distance between the speaker and the chassis I was able to confirm this as fact. On further examination I found the sound was coming from the output transformer, which is located underneath the chassis.

The set incorporates the fairly standard wander plug lead from the output transformer with a choice of socket for internal or external spearker. I found this lead was disconnected from the transformer and on reconnection a normal, loud signal played through the speaker.I conclude that with a 60 year old output transformer the core laminations can become less tightly packed together so as to vibrate to the audio frequency which I was able to hear. Is this a not uncommon phenomenon which others have encountered from time to time ?

Yours sincerely,
David Bickerton

Fatherland TV

Dicky Howett writes, 'This snippet, written by Wilhelm E. Schrage, is from a pre-war US magazine called 'Radio News', and is a contemporary report on German Television in the mid 1930s'. Note that the cost of tv receivers is quite high,but according to most subsequent accounts, they were never on sale to the general German public. Initially, a tv receiver in the US, UK or Germany, cost as much as a small car.'

While America is still of the belief that television has not advanced sufficiently for general use, England and Germany are now endeavouring, through the aid of their respective governments, to make television as popular as sound broadcasting. Other European countries are following in their footsteps, and it can be truthfully said that Europe is now in the throes of 'television fever'.

Four hundred and fifty-three feet in the air, rising slightly above the top of the well known Berlin radio tower, with its famous restaurant, two copper rings appear to be growing in the sky. Each has a diameter of about ten feet, and their surfaces shine in the early spring sun like spun gold. They are symbolic of a new era--television is no longer a mere technical problem, but is being made available for the use of the general public. The golden rings are the antennas of the Berlin Television Station. From these high points, far above the surrounding buildings, radio waves of a special kind--ultra-short waves, as the technicians term them, are radiated into the air by a force of 15 kilowatts, covering an area of about 50 miles in diameter. Each of these television stations has two ultra-short-wave transmitters. One radiates the sound impulses, as usual, while the other one delivers the picture impulses to be shown in the home transmitter. The radio listener, or should we say the "television looker," uses a special television receiver to receive these transmissions. Pictures of home-movie size are reproduced. These receivers are of two sizes, one having a screen of about 4 inches by 6 inches and the other about 10 inches by 12 inches

It is simple to tune in on television programs, because there is plenty of space in the present wave range, which is about 7 meters. In other words, there are far less stations in this wave range than in the normal broadcast band, and the selectivity of the television receiver does not have to be as great as for plain broadcasting. Also, the "monkey chatter" does not occur, because of the stations being situated so close to one another. There is also no danger of two stations showing their pictures at the same time to the surprised listener. A great number of these new receivers have to be tuned only once. Later on it is brought into operation by turning only the small switch of the power line.

For the past 9 months, the Berlin Television Station has been radiating interesting programs, daily, on 7 meters. The picture appears, as stated before, behind the surface of a glass plate. Sometimes it is in black and white, but very often, has a slightly bluish or greenish caste. If the transmitter radiates the picture in the so-called "180 lines manner," as is done in Berlin, not only heads, but the entire body may be seen. Entire scenes with all movements are easily recognized

The average price range of the receivers is from $250.00 to $500.00 per set. A television receiver contains two complete receivers, one for sound reception, and the other for the reception and reproduction of the image. While the sound receiver is only connected with the loudspeaker, the picture receiver works with a cathode-ray tube which is the heart of the visual system. Another type of picture receiver uses a "mirror-screw" for reproducing the picture.

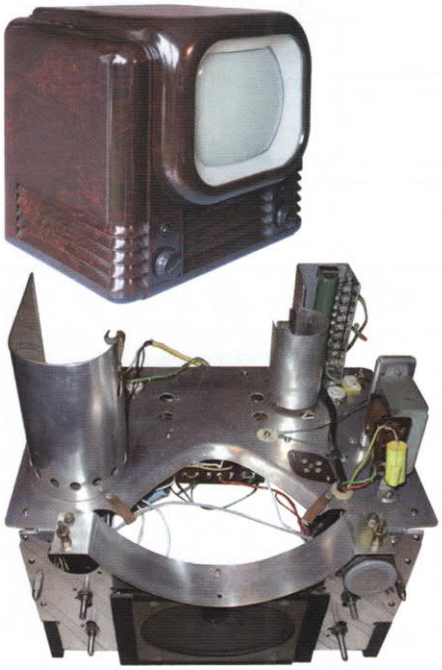
Recently, in Germany, there has been developed a television pick-up car. This car carries on its roof a standard motion-picture camera mounted on a cast-iron roof, allowing the camera to be moved in any desired direction. The hollow pillar of the camera support is used to convey the exposed film ribbon to the dark room which is in the interior of the car. By use of special apparatus and extremely fast-working chemicals, the film is developed in 1-1/2 minutes. The still-wet film ribbon is then sent at once through a so-called "Abtastgerat", which cuts the single-film pictures in 180 lines and transforms each line in a succession of strong and weak electrical impulses. The impulses are radiated from a transmitter into the air and the radio listener, receiving these impulses through the televisor, may see the broadcast scenes

Wilhelm E. Schrage, Radio News, July 1935

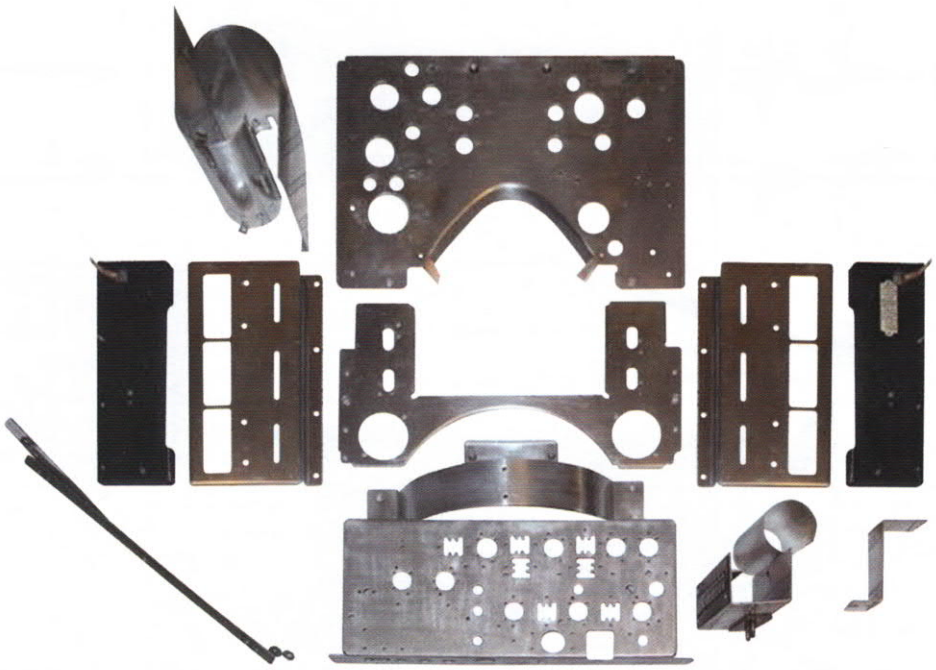
Reconstruction or reproduction? A TV22 for the 21st Century Part 1

by Ian Liston-Smith

For some years now I've wanted to build a 1950s-style television from scratch, using one of the designs for home constructors that were available at the time. I located a number of published circuits, but was unable to deicide which one to use. Anyway, I was told that such a project "would be doing things the hard way" since plenty of old sets of the period are just waiting for restoration.



Above: main chassis nears completion



Above: chassis parts after cleaning

Bearing this in mind, and as an admirer, collector and restorer of bakelite radios, particularly from the 50s, I thought it was about time I started on a classic television and so acquired my first Bush TV22.

To readers not familiar with the TV22 (or the earlier but externally almost identical TV12), it is perhaps the most iconic bakelite design of the mid 20th century, although at the time it was a relatively cheap-and-cheerful set for those not able to afford the more luxurious, bigger-screened, wooden-cabinet Bush TV24.

I had no experience of working with television circuitry, but am fairly familiar with the principles. Under these circumstances I was a little uneasy at starting such a task in case I found I had bitten off more than I could chew. But after cleaning the chassis and valve holders, replacing all the wax paper capacitors, a broken thermistor, a faulty speaker and flaky wiring, I got it working. Following slight adjustment to the focussing magnet and ion trap, it now works extremely well. The picture geometry is perfect and it has turned out to be an excellent set.

So there my story should end, but this successful restoration just strengthened my desire to rebuild something from scratch. How would such a set function if I completely dismantled it and cleaned 50 years grime from all the parts? Would modern components make a difference to its performance? It was beginning to look like this aspect alone would make a worthwhile project.

It would be pointless using this approach on a set in a reasonably good condition, so I started looking for one in a desperate state.

There will be those reading this that have repaired more of these sets than I have ever seen; who will have seen every model and repaired every conceivable fault. Nevertheless, I shall describe my experiences in what has been my most challenging vintage project so far.

Rebuilds

I have completely rebuilt DAC90A and Murphy A90 radios, both acquired in a condition well beyond that which would respond to the general capacitor changing routine. And to be honest I find this thorough approach to a dilapidated set very satisfying. Dismantling, comprehensive cleaning and use of new components virtually guarantees another 20 or 30 years' trouble-free service. (Whether any analogue transmissions will continue to be broadcast in a few years is a moot point.)

But such a challenge is not to be undertaken by the faint hearted. Good documentation is essential along with plenty of photographs and diagrams made as disassembly progresses. However, the cheat's way is to use another example and just use that as the template for reassembly.

Documentation

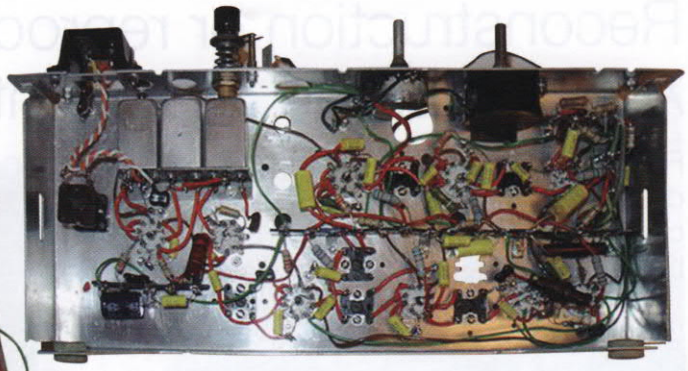
This was going to be a big project for me, so I gathered all the documentation for the TV22 that I could find, borrow or copy. This is important, as inevitably one version from one source is unlikely to contain all the variations and modifications that could be encountered. Additionally, errors in service sheets are not unknown, and any discrepancy can be checked against another version.

I borrowed a copy of the Bush service instructions. In the past I have found Bush's radio service sheets to be excellent and this proved (almost) to be the case with the TV22/24 service instructions. The main document covers the Mk I, with a supplement for the Mk II, describing the differences between the two models.

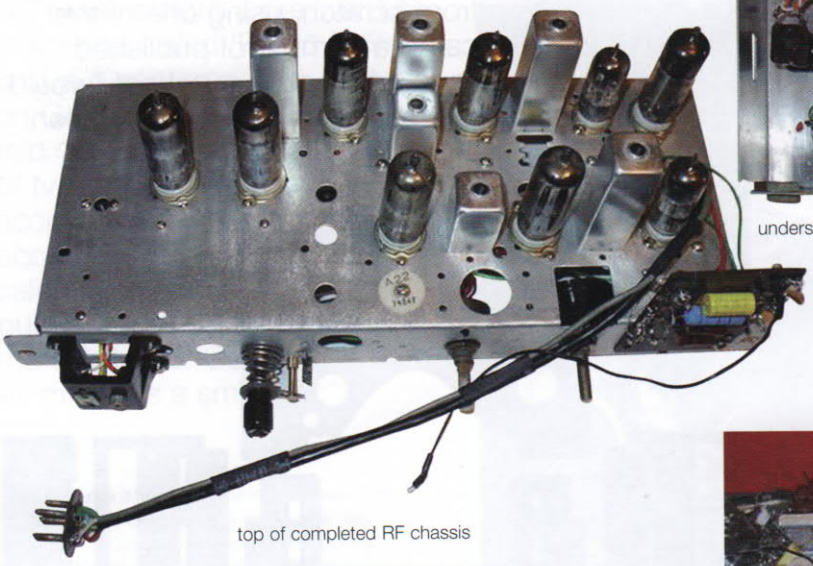
Unfortunately all the circuit diagrams were missing, which apparently is fairly common; a couple of BVWS members said they thought the circuits were often supplied separately. This seems to be the case as the service sheets' page numbering is complete.

I did find the full TV22A Bush service instructions on the web (available from http://www.thevalvepage.com/tv/bush/tv22/tv22.htm) including all the circuits which came in helpful later.

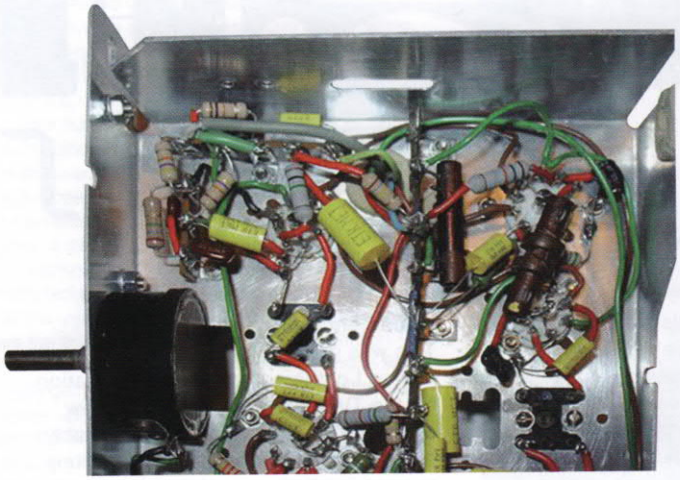
A look through all the volumes and versions of Newnes Radio and Television Servicing revealed some basic data that confirmed most of the modifications



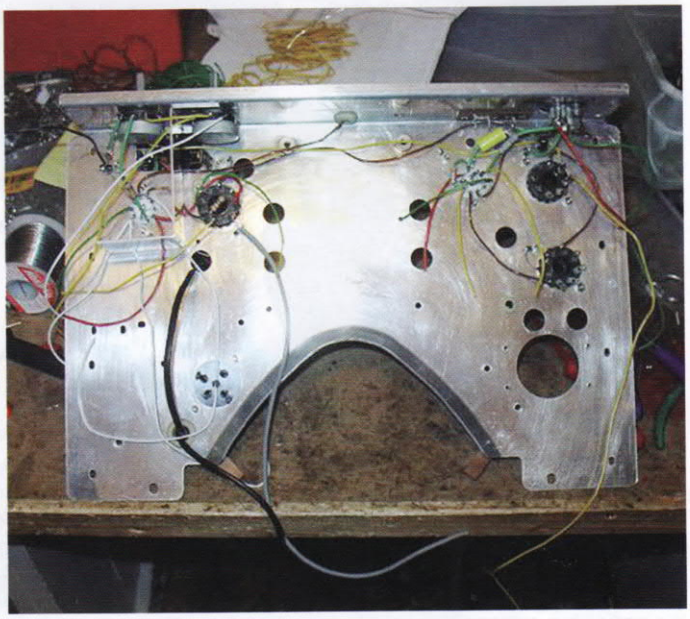
underside of completed RF chassis



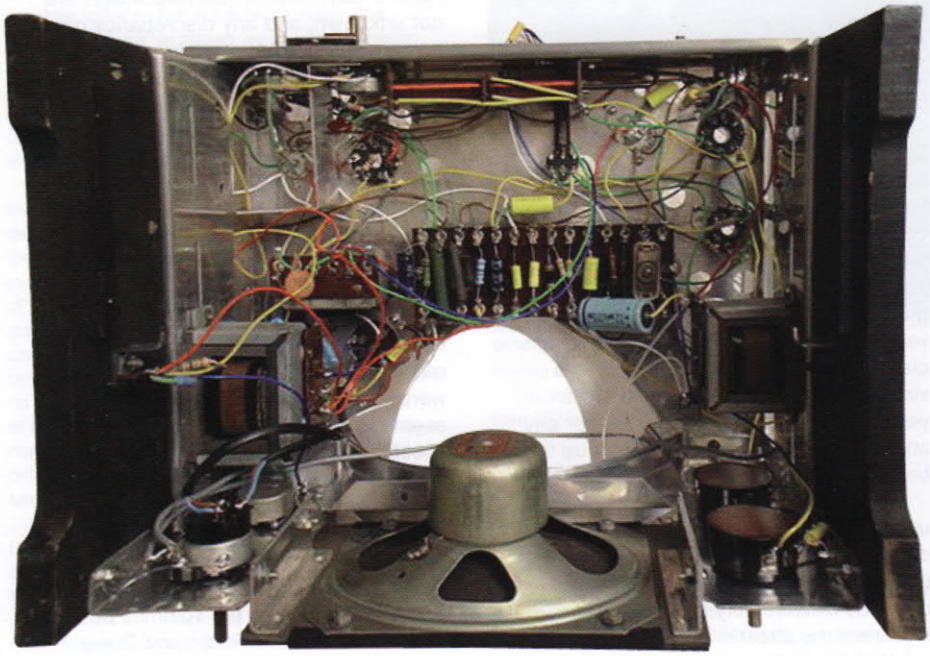
top of completed RF chassis



underside RF chassis close-up



main chassis assembly starts



main chassis almost complete

close-up of soldered copper straps

listed in the Trader Service Sheets.

The Trader Service Sheets were probably the most valuable, given the documentation I had to work with. The numbering of the components is logical, and completely separate sheets are published for each model. But their greatest weakness is lack of data on resistor power rating or capacitor voltages.

This is not a major problem as the component's function usually makes this clear, but one or two parts had been up-rated, presumably as production continued and the service trade reported re-occurring faults. For this data I used the Bush sheets and its list of common faults.

Variations

The TV22 television is a very compact design for its day, with the RF circuitry on the lower chassis and the sound, vision and power supply circuits on the upper chassis.

There are three basic models:

- TV22 Mk I (Trader Sheet 1003/T15) - This uses EF91 valves in the RF chassis
- TV22 Mk II (Trader Sheet 1091/T38) - This uses EF80 valves in the RF chassis. The sound and vision circuitry is basically the same as the Mk I
- TV22A (Trader Sheet 1130/T50) - This uses more or less the same RF circuitry as the Mk II, but has a redesigned sound and vision chassis.

Within these designs there are fringe and unsynchronized mains versions. There are also slight variations in valve biasing, and capacitor and resistor values. A quick check to determine whether a set is a Mk I or Mk II seems to be the design of the aerial input bracket; the Mk II (and 'A') have a more substantial bakelite moulding mounted with four screws on the RF chassis back plate. The Mk I is a thin bracket mounted with two screws on the rear-top of the RF chassis.

The TV22A also has a more substantial focussing lever and most (if not all) have a plastic dome covering the tube base attached to the fibre back rather than a folded fibre back protrusion.

Although the mountings of the Mk I, Mk II and 'A' RF chassis are identical, they are not functionally interchangeable.

In preparation for acquiring a TV22 wreck, I bought a backless, neglected and battered Bush TV24. I reasoned that any set that needed a total rebuild would probably have been stored in such bad conditions that many of the wound components would also be un-repairable, and any such parts could be salvaged from the TV24.

Electronically this model is identical in most respects to the TV22, but is bigger and comes in a wooden cabinet with a 12-inch rather than a 9-inch screen. Although significantly more expensive at the time than its smaller 9-inch sibling, the TV24 is now less collectable and therefore much cheaper – if you can find one.

I decided that the eventual rebuilt set should be assembled as a Mk II. This was the same as the first one I restored, so I could use this as the assembly template and for comparative voltage and waveform measurements for fault-finding should things not go well.

Components

As this was to be a "build from new" project, I was going to use new components wherever possible. I know some readers may consider this sacrilege, but this is not a particularly rare or special set. Doing this sort of thing to a rediscovered Baird Televisor (OK, a bit unlikely perhaps!), pre-war television or collectable radio would, I agree, amount to vandalism. A reasonable amount of grime in any old set is normal – this is part of its history. A bit of dusting, some switch cleaner and a few new capacitors are often all that's needed.

But I wanted to build a TV from scratch, and as I am rebuilding to the original circuit, without any "improvements" (other than Bush's minor modifications), the set will still function exactly as designed. Nevertheless, modern lower noise resistors and lower leakage capacitors may well give slightly better overall results. Would this project produce a mid-20th Century set with 21st Century reliability...?

Capacitors

I don't routinely replace mica capacitors as these don't generally deteriorate significantly. But as all parts had to be removed for the hardware and tagstrips to be thoroughly cleaned, I decided that there was no point painstakingly trying to remove salvageable components without damaging them. The exceptions were the capacitors in the IF transformers as these were all shielded (literally) from the rigours of the past 50-odd years.

Other exceptions were the wound components, wire-wound and variable resistors. All these were carefully removed, cleaned and tested. Any of these faulty parts could be substituted from the spare TV24 chassis if necessary.

There is a vast range of capacitor types available and it can be daunting to select an appropriate type when restoring a vintage radio or television. But there are only two points to consider. First, the working voltage and secondly the function.

A capacitor's working voltage is obvious, although there are occasions when unexpectedly high voltages appear – typical examples are across the tone correction capacitor of the audio output transformer and also around the line output transformer.

Mica capacitors should be used where their value influences the frequency of a filter or tuned circuit; these capacitors have low leakage, high stability and usually have a tolerance of 5% or better. Polystyrene capacitors can often be substituted here providing they have the appropriate voltage rating, although their construction makes them slightly inductive so are not really suitable for some VHF applications. I therefore decided to replace all the mica capacitors with new mica types.

One component which needs a special mention is the mains filter capacitor used in many sets. The ideal replacement here is a modern X-class capacitor for connection across the live and neutral. It is designed to withstand the peak mains voltage (240 x 1.414 = about 340 volts) and any voltage spikes. (Y-class capacitors have an even higher safety rating and should be used for any capacitor connected between either of the mains lead and the chassis.)

Substituting waxed-paper capacitors is easy – if a circuit will work with those it will work with anything! My favourite replacements here are metalized polypropylene and metalized polyester. They both come in axial form and are therefore suitable for wiring into a vintage chassis. They are usually bright yellow and rated at 630 V or higher. They are also slightly cheaper than other general high voltage types and come in a wide variety of values.

Resistors

Resistors are also easy to substitute, although the nearest preferred value sometimes has to be chosen. Most older types have a generously rated power dissipation, so some care should be used in replacing say an old 1/4-watt resistor with a modern 1/4-watt type which may end up operating at or beyond its limit.

For this reason I selected carbon film, 1-watt for the 1/4-watt resistors and 2-watt for the 1/2 –watt resistors. This is over generous, but the modern ones are much smaller for a given power dissipation and modern appropriately rated ones just looked too small.

Disassembly

I eventually acquired a TV22 "wreck" for the project. It had a smashed tube, no back and looked as if it had been badly stored for some years. Unfortunately it was a Mk I, and had its RF chassis in surprisingly good condition – too good to warrant stripping. So I looked at the "for spares" TV24 chassis. It was filthy and covered in a sticky mess underneath. I decided to use this RF chassis for the TV22 Mk II reconstruction.

The RF chassis was also the easiest place to start, but as ever, things just aren't that straightforward.

I noticed it had an extra screening can on the chassis. The TV24 turned out to be a TV24A and closer inspection showed that this extra can was part of the sound IF circuit which was not included in the Mk II. That seems to be the only difference between the Mk II and the A in the RF section.

According to Trader Sheet 1130/T50 the can contains a tuned circuit fed by a 20pF capacitor from the junction of L14/L16 and acts an extra sound IF rejecter in the vision IF. Although this is shown on the chassis layout and alignment instructions of the

Bush TV22A sheets, it is not included on my version of the same sheet's circuit diagram. It is therefore presumably a late addition that didn't get added to the diagram.

Anyway, time to strip the RF chassis, taking care to record the positions of each IF can as they are not interchangeable.

It soon became clear that the valve holders were badly corroded so new ones were ordered. I found the best method to clean all the small metal parts was to put them in a large mug with a tablespoon of washing powder and zap the whole lot in the microwave oven for a few minutes, then use an old toothbrush and clean water to remove any remaining stubborn grime. (This is not recommended for dirty control knobs unless you want to permanently remove the shiny patina.)

I opened each IF can and inspected the contents. A Brillo pad polished up the aluminium cans like new. The coils were wound with fairly stout wire with no signs of corrosion and the capacitors also looked in good condition so I just gently brushed them over.

While I had the IF inductors off the chassis, I decided to ease their wax seals for later realignment. With hindsight I would suggest that these are normally left untouched, as any drift due to ageing is unlikely to change their values too much, and any slight drop in gain will not be noticeable when the set is fed directly from the output of a modulator. But after my rebuild, I thought it likely that complete realignment would be required so the wax had to be removed.

I found the easiest way was to lay some tissue paper over the waxed cores and press with a hot soldering iron. The wax then melts into the paper leaving the cores free to move.

A session in the dishwasher for the RF chassis (this is a tip for cleaning all larger aluminium parts) followed by a going over with a Brillo pad brought up a shiny metal surface.

Quite dark areas were revealed on the underneath of most of the tagboards. It wasn't due to scorching, but looked more like an accumulation of dust and possibly soot. If left after a basic restoration of just changing the capacitors, it is quite possible that this could become conductive (if it isn't already) and affect performance.

The undersides of these tagboards are not easily reached without disconnecting various wires and components and such a condition may not otherwise become apparent. But the hot water, washing powder and microwave treatment cleaned these and the tagstrips nicely. These paxolin components did not absorb significant moisture during this process, but I suspect a long soak is ill–advised.

Some of the pots were either open-circuit or very erratic when measured. After I opened and cleaned each one, they all measured correctly.

Two inductors (L17 and L18) had accumulated a sooty goo, so I dipped them both into hot wax to clean and reseal them.

RF chassis assembly

Once the IF cans and new valve holders were fitted, I started with the components and wiring. This went quite well, but I should have started more logically by adding all the heater wiring and earthing first as it's too easy to get carried away and then find an earth connection to a valve tag has become almost inaccessible once it's surrounded by other components.

As I wired each part I traced it out on the circuit diagram, checking component values as I progressed. Then I checked resistance at various points against the chassis that worked and found the resistance from the HT line to earth too high. This turned out to me missing a couple of wire links.

The RF chassis now had to be tested in the working TV22 that I already had. The heaters all came on, and audio output present but weak. The raster was present but completely blank.

It turned out that the link from L14 to V4 anode contained a dry joint. A poke with the iron and the TV screen showed signs of life, with faint diagonal lines showing the vision signal was getting in somewhere.

A bit of inductor tweaking brought in Test Card C beautifully!

The sound was much lower than it should have been, and this turned out to be due to one of the sound IF cans from the TV24A wired differently internally from the TV22 Mk II. A minor correction was made and the sound peaked up properly.

It had some sound-on-vision (as demonstrated by the ripples down the picture), and there was more vision-on-sound (vision buzz through the speaker) than on the RF strip from the good set gave. These symptoms suggested that thorough alignment would be needed, but at least my rebuilt RF chassis now worked.

Main chassis assembly

This was very time consuming, although not as tricky as I had expected. As with the RF chassis, I checked against the circuit diagram as I went, but having another set to confirm point-to-point wiring made this much easier.

One thing did strike me as a bit odd; some of the interconnecting leads are very long. Most of these only carry DC, so are unlikely to be a potential cause of instability from unwanted coupling. But there are also a few unscreened wires which carry various video waveforms for some distance. Judging by the set's performance this is not a problem, but to me this looked more like luck than good design!

Some of the earth connections are also surprisingly meandering, running for six to eight inches when an extra near-by earth tag would have reduced the run to an inch or so. Sometimes such wiring is intentional to prevent instability, so any temptation to make more "logical" connections should be considered carefully.

There is a pair of copper straps connecting the RF chassis to the main chassis through the mounting bolts. The straps are only pressed into contact, so I cleaned and soldered them to ensure a good connection as shown in the photograph.

The line output transformer looked in a bad state (although this is not necessarily a cause for concern), but the heater winding for the EY51 EHT rectifier was open circuit, so I decided to get the whole transformer dismantled, cleaned and rewound by Mike Barker for long-term reliability. Assembly was completed as far as possible without this part.

One more careful tracing of the components against the circuit diagram revealed two wires I'd omitted, but no other errors as far as I could tell. The resistance across the HT line with a set of valves fitted was the same as the working set, as was the resistance across the mains input pins.

Initial power-up

Time now to test the heater circuit, HT and audio circuits. As I'm inexperienced in television circuitry, I was now operating a little beyond my "comfort zone".

With the RF chassis in place, I attached the modulator to the aerial input to test the audio section. A 20-ohm resistor replaced the tube heater to maintain heater chain continuity. I connected the set (through a mains isolating transformer) to a variac.

I know many vintage equipment restorers consider the use of variacs to be a waste of time, preferring to use a 60-watt bulb in series with the equipment to be tested. The use of a series mains bulb does ensure that full mains voltage does not appear across the equipment, giving it a fairly gentle start (at least once the bulb is glowing) and should limit any potential damage. But, if there is a serious problem, I feel less damage can be done by seeing what happens as the voltage is wound up gently. Not all faults will be revealed with just a test across the mains input or HT lines with a test meter.

A variac won't be much use if an electrolytic smoothing capacitor needs reforming as the HT won't appear before almost full mains has been applied and the rectifier diode has warmed up and started to conduct. But the smoothing capacitors were new, so this wasn't a problem.

At about 50 percent mains voltage all heaters were glowing dimly. At 80 percent, tone came from the speaker and increased in volume until the mains input was 235 volts. The HT measured a bit high at 225 volts, (Trader says 195 volts), but I put this down to new HT smoothing capacitors and no full HT load since the line-output transformer was yet to be installed.

Then whiffs of smoke appeared...

To be continued.

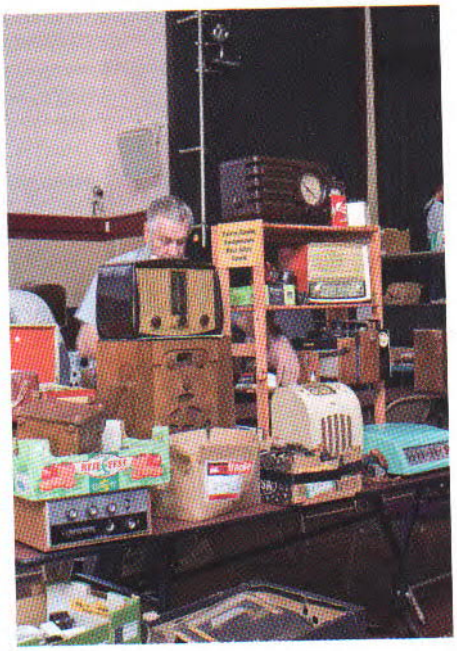
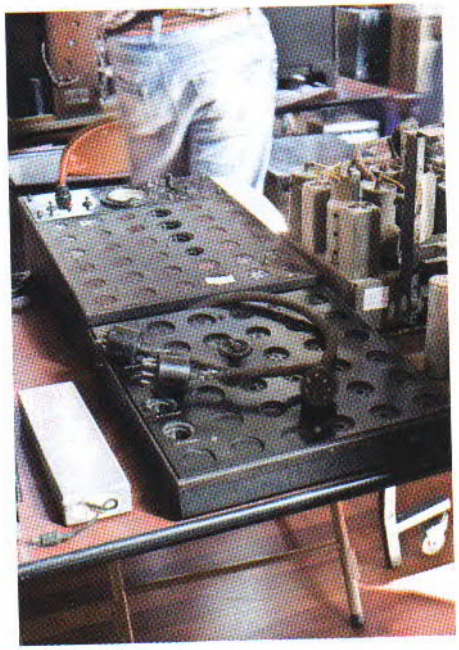
Harpenden!

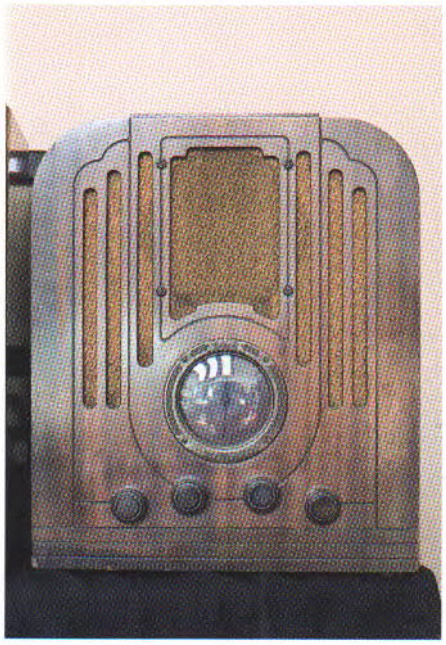
June 3rd 2007

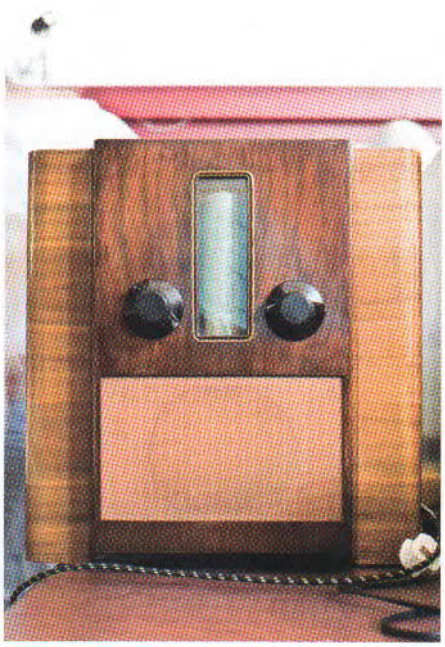
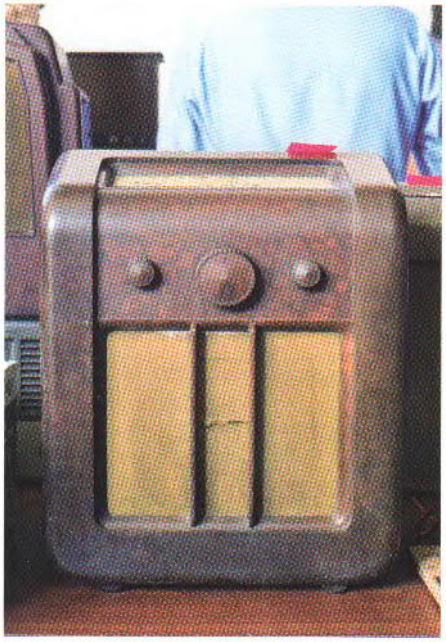
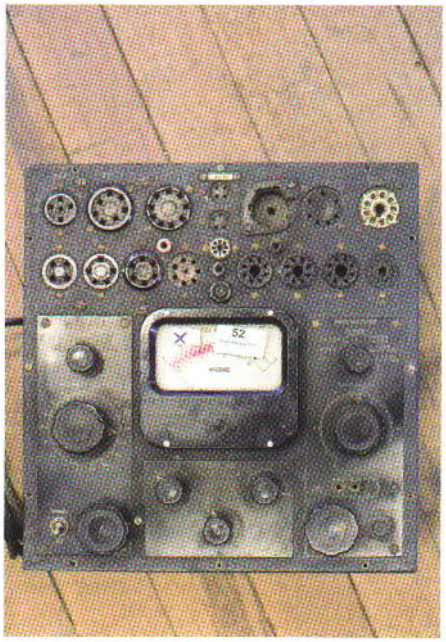
Photographed by Carl Glover

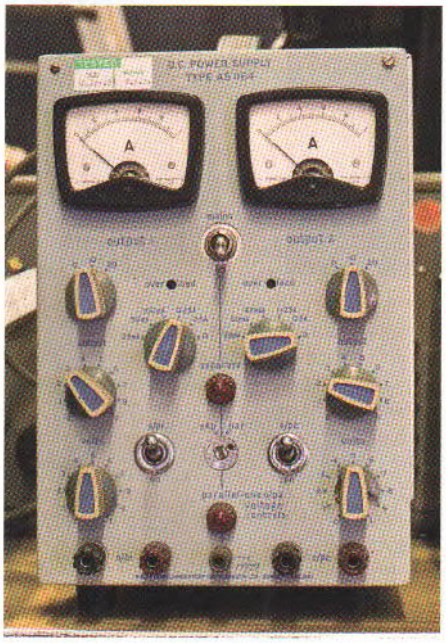


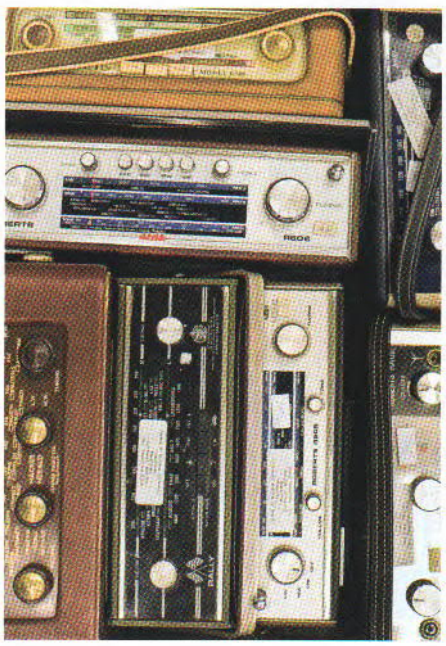








A brief resumé of British (and several overseas) finished goods & component manufacturers (as at May 2005) continued from page 32

Pye (W G) & Co Ltd, Granta Works, Cambridge (in 1953). In 1964, P O Box 60, York Street, Cambridge (also the home of Pye Unicam Ltd). Maker of laboratory instruments.

Pye Business Communications Ltd, Cromwell Road, Cambridge (in 1973 and 1979). Established in 1970, to market (mainly Philips) industrial and commercial audio and video products. In 1972, at Orchard Road, Royston, Herts.

Pye Connectors Ltd, Hitchin Street, Biggleswade, Herts (in 1972). e.g. the "modulo" range.

Pye Dynamics Ltd, 459 Park Avenue, Bushey, Watford, Herts (in 1972 and 1979). Defence systems, medical electronics, security devices, professional radio equipment and precision transducers. Merged with Graseby Instruments, circa 1981, to form Graseby Dynamics.

Pye Electro Devices Ltd was formed in 1976, when certain Pye & TMC component manufacturing operations were merged. Renamed PED Ltd in 1983.

Pye Electro-Devices Ltd, Controls Division, Exning Road, Newmarket, Suffolk (tel 0638 5161) (in 1978). Relays, solenoids, switches, process timers. etc.

Pye Electro-Devices Ltd, Capacitor Division, Hardwick Trading Estate, Old Medow Road, Kings Lynn, Norfolk (in 1979). Paper foil, metallised paper, plastic film and electrolytic capacitors.

Pye Ether Ltd, Park Avenue, Bushey, Herts (in 1970). Maker of RF/microwave equipment and transducers. Prior to 1970, it was previously known as Ether Engineering Ltd. In 1975, Pye Ether Ltd, Caxton Way, Stevenage, Herts.

Pye Industrial Electronics Ltd. In 1956, they announced the manufacture of a range of power transistors.

Pye Laboratories Ltd, St Andrew's Road, Cambridge (in 1965). Calibration house.

Pye Ling Ltd, 7-8 Dalston Gardens, Stanmore, Middx (in 1961). At Heath Works, Baldock Road, Royston, Herts (in 1968). Set up in 1961 to market the vibration systems of W Bryan Savage (a Pye company) and Ling Electronics (of the USA) – a part of the Ling Temco Vought Aerospace Corporation (USA) - "LTV". Later known as Ling Dynamic Systems and then (?) LTV Ling Altec (same address). Maker of vibration exciters, power amplifiers, etc. In 2003, Ling Dynamic Systems Ltd - LDS Group Headquarters (in 2003) Heath Works, Baldock Road, Royston, Herts, SG8 5BQ, England – a subsidiary of SPX Corporation, USA. Tel: 01763 242424; Fax: 01763 249715.

Pye Marine Ltd (in 1954). Sales admin at Oulton Works Lowestoft factory. London area sales and service at Galleons Works, Yabsley Street, London, E14. HQ at 157 Regent Street London W1. Formed in the early 1950's as a result of the Pye takeover of Rees Mace Marine.

Pye Printed Motors Ltd. Formed in 1963, in association with Technograph & Telegraph Ltd. Set up to manufacture servo motors under licence from a French company. In 1966, the company relocated to Upper Street, Fleet, Hants and changed its name to Printed Motors Ltd.

Pye Records, ATV house, 17 Great Cumberland Place, London, W1 (in 1970-2). In 1960, Associated Television Ltd (ATV) had a 50% holding. They later took full control. In the 1970s, the company was renamed Precision Records & Tapes Ltd (PRT).

Pye Scottish Telecommunications Ltd, Martin Street, Airdrie (in 1957). A new factory ready for March 58. In 1967/8, at Victoria Place, Airdrie.

Pye Telecommunications Ltd, Ditton Works, Newmarket Road, Cambridge (in 1955 and 1975). Established in 1944. In 1966, Cambridge Works Ltd (a Pye company), Haig Road, Cambridge – VHF Tx & Rx manufacture. In 1969, Pye Telecommunications Ltd, Cambridge Works, Haig Road, Cambridge. By 1969, also a factory in Colne Valley Road, Haverhill, Suffolk. By 1972 a factory at Cambridge Works, Elizabeth Way, Cambridge. In May 1977, the new HQ, with R & D and the main production unit complex was opened at St Andrew's Road, Cambridge (– also still at Haverhill).

Pye TMC Ltd, Dunthorpe House, St Dunstans Street, Canterbury, Kent (in 1970).

Pye TMC Ltd, Victoria Place, Airdrie, Lanarks (in 1979). Manufacture of parts for telephones and public telephone electronic switching equipment.

Pye TMC Ltd, Houston Industrial Estate, Livingston, West Lothian (in 1979). Manufacture of FDM, PCM telephone and telegraphic transmission systems and data systems.

Pye TMC Ltd, Swindon Road, Malmesbury, Wilts (in 1979). Development of advanced telecoms equipment, incl. transmission and switching products. Also a small electromechanical switching products factory. Originally an E K Cole Ltd site. Later sold to AT&T after an initial Philips/AT&T joint venture.

Pye TMC, Controls Division, Graham Bell House, Roper Way, Canterbury, Kent (in 1975). TMC Components Division in 1966.

Pye TMC, Transmission Division, Sevenoaks Way, St Mary Cray, Orpington, Kent (in 1971 and 79). Just Telephone Manufacturing Co Ltd in 1966 & 68. In 1979, manufacture of 60MHz FDM telecoms transmission equipment. In 1974, Pye TMC Components Ltd, same address but also now making electrolytic capacitors (the former CCL range?).

Pye TMC Ltd, Capacitor Division, Oldmedow Road, Hardwick Industrial Estate, King's Lynn, Norfolk (in 1971). This site and products later moved into Pye Electro Devices Ltd.

Pye TVT Ltd, PO Box 41, Coldhams Lane, Cherry Hinton, Cambridge (in 1974). Maker of broadcast studio and transmitter equipment (also OB vehicles). In 1969, also the Philips Sound and Vision Division, at Addlestone Road, Weybridge, Surrey (the former Peto-Scott location?). Established as a separate company in 1960.

Pye Unicam Ltd, York Street, Cambridge (in 1975). Scientific equipment and Philips T&M distributor. There was a Manor Royal, Crawley office and lab (the M.E.L. site) - relocated to York Street, Cambridge in 1969.

TV Manufacturing Ltd, Oulton Works, Lowestoft, Suffolk (in 1967 & 68). The TV factory of Pye.

Unicam Instruments Ltd, Arbury Works, Cambridge In 1961). Later renamed to Pye Unicam Ltd.

Varelco Ltd, Exning Road, Newmarket, Suffolk (in 1968 & 75). Connectors – UK outlet for Elco USA (jointly owned?).

Pygmy. Brand name of a French radio manufacturer in 1966.

Geoffrey Dixon–Nuttall 1927 – 2007 continued from page 3

most classical pieces and was competent on the piano even though in his youth he had lost a finger of his left hand.

Geoffrey was born in Huyton in 1927. After schooling and college, he was turned down for national service because of poor eyesight. He joined the Roberts Radio company in 1949 where he worked for nearly 40 years applying his talents to radio design and manufacture.

He always found action in the factory more satisfying than the office and was well liked and respected by his colleagues. In 1960, he became Technical Director in control of production and continued in that role until retirement.

He married Ruth in 1957 and were soon parents to Tim and Carolyn. His greatest delight was the arrival of four grandchildren.

After retirement, Geoffrey remained very active in radio restoration which he enjoyed. He was always keen to tackle the next problem, or write the next article for the radio press. He was a mine of information for his friends.

He would tackle the most difficult preservation work. The complexities of a Scott radiogram or peculiarities of a Philips simply presented him with another challenge.

When one congratulated him after he had completed a particularly difficult job, it was inevitable that he would say "Oh well. it makes a cheerful noise" as though the radio did not sound quite as good as he would have liked. In fact, it would have been as good as anybody could have got it.

Geoffrey was 80 on May 19th and had organised a family lunch at a country pub for the following day. He suffered a major stroke on May 24th but did not regain consciousness. He passed away on June 4th.

He will be greatly missed by his many friends. We extend our sympathy to his wife, Ruth, Tim and Carolyn and family.

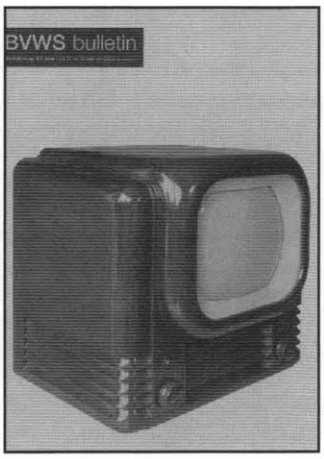
Ken Tythacott

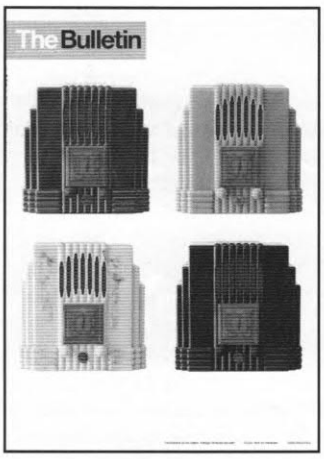
Minutes

Minutes of BVWS Committee meeting held on Tuesday 26th June 2007 on the conference telephone starting at 7.30 pm.

Present: Mike Barker (chair), Graham Terry, Guy Peskett, Paul Stenning, Jon Evans,

1. Apologies for absence: Ian Higginbottom, Carl Glover, Martyn Bennett, Terry Martini, Jeremy Day, although all had made representation by e-mail or short periods on the phone.
2. The minutes of the meeting held on 17th April 2007 were approved.
Matters arising: Item 6, no progress so far in finding a CAD engineer to make drawings of CRT masks.
3. The Membership Secretary, GT, reported that the membership stood at 1549 including 94 complimentary and 6 honorary. Data on non-renewals has been archived.
4. The Treasurer, JD, reported a satisfactory state of affairs with the Societies account balances standing at £33,859 (deposit) and £3,567 (current).
5. NVCF: MB summarised the accounts for the 2007 NVCF prepared by JD. The total income was £13,334 and the before tax profit was £3,363. The "Bring and Buy" stall made £34. At the door 905 tickets were sold and 275 canteen vouchers were claimed by members.
It is expected that the 2008 fair will be on Sunday 11th May but this remains to be confirmed. Jeffrey Borinsky has proposed that an exhibition of Mechanical Music be mounted. This was welcomed by the Committee.
6. MB reported for the Bulletin Editor, CG that the summer Bulletin had been picked up by the Post Office. There is still some space left in the autumn issue.
7. BVWS parts: The Society has now received 1500 0.1µF high voltage polyester capacitors and part of an order for 0.01µF high voltage polyester capacitors. These can be purchased from the Membership Secretary and at the BVWS stall at meetings.
A representation had been made to the Committee from a member having mail order facilities to act as an agent for the sale of the parts, but it was felt that the Membership Sec. already had everything necessary to carry out mail order. The Committee wished to thank Ken Bailey for his very kind offer of help. An advertisement will be placed in the Bulletin. A decision on extending the range of parts to include dual electrolytics will be made at the next Committee meeting.
8. MB proposed that the Society make a donation of £2,000 to the BVWTM to support the production of a DVD of the film "Valveman" based on "Obsession". These would be sold by the Society and at the Museum for a sum of £9.99 +P&P.
9. Following discussions between MB and CG about the Editors commitments overseas it became clear that help is required to ensure that all significant activities of the Society are photographed.
This requires that the Society obtain a quality camera. It is the Editor's opinion that even the latest consumer type digital cameras are inadequate and a professional camera is needed. Discussions are continuing on what to get and who would use it.
10. The chairman announced the passing of Geoffrey Dixon-Nutall, ex-Managing Director of Roberts Radio and a much valued long time member of the Society. An appreciation is being prepared by Ken Tythacott and will be published in the Bulletin. The Committee was asked to come up with suggestions for a more permanent memorial in time for the next meeting.
11. Advertising and Recruitment: Not much progress so far. Updated advertisements for the Society will be sent to Radiophile and Radio Bygones.
12. AOB:
MB responded to a question from PS about (external) problems with the Committee email system. (All is now well.)
JE suggested that Geoffrey Dixon-Nuttall's collection be photographed before it is dispersed.
13. The next meeting will be held on Thursday 20th September on the conference phone. The meeting closed at 9.26 pm.





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 Ekcos.

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.

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

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News and Meetings

GPO registration Numbers

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

Martyn Bennett, 58 Church Road, Fleet, Hampshire GU13 8LB
telephone: 01252-613660 e-mail: martyB@globalnet.co.uk

2007 meetings

2nd September Audiojumble at the Angel Centre, Tonbridge
16th September Table top sale, British Vintage Wireless and Television Museum
16th September "Murphy Day" at the Mill Green Museum Midday – 4pm Mill Green, Hatfield Herts AL9 5PD
23rd September Radiophile Swapmeet Shifnal
30th September Swapmeet at Harpenden
21st October Gerald Wells Workshop British Vintage Wireless and Television Museum
21st October Radiophile Swapmeet, Cowbit
28th October Manchester BVWS radio meeting. Sale Moor Community Centre, Norris Road, Sale, M33 2TN 2pm to 5pm.
2nd December Wootton Bassett

Workshops, Vintage Wireless and Television Museum:
For location and phone see advert in Bulletin. 11:00 start.
Harpenden: Harpenden Public Halls, Southdown Rd. Harpenden. Doors open at 10:00, tickets for sale from 09:30, Auction at 13:30. Contact Vic Williamson, 01582 593102
West of England Vintage Wireless Fair:
Willand Village Hall (J27/M5). Doors open 10:30.
Contact Barrie Phillips, 01392 860529
NVCF: National Vintage Communications Fair
See advert in Bulletin. www.nvcf.co.uk
Wootton Bassett: The Memorial Hall, Station Rd. Wootton Bassett. Nr. Swindon (J16/M4). Doors open 10:30.
Contact Mike Barker, 01793 536040
For more details with maps to locations see the BVWS Website:
www.bvws.org.uk/events/locations.htm

7th December 2007 7pm-10pm

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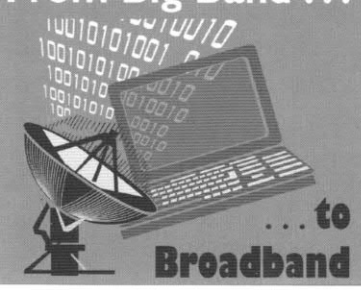

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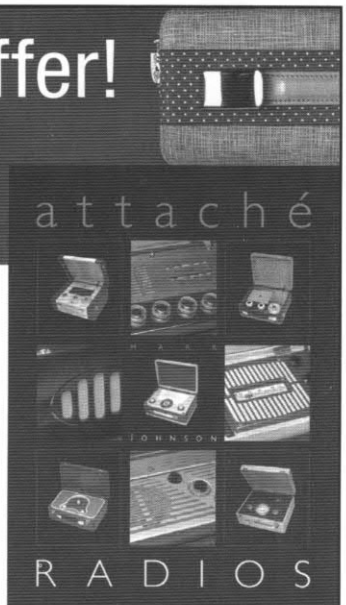

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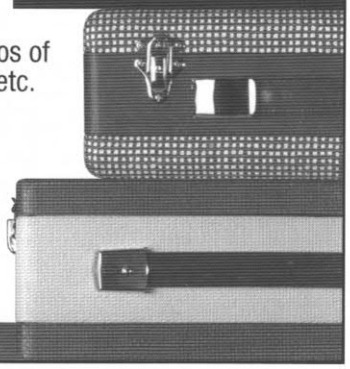


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