The Bulletin

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10th May 2009

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at The Warwickshire Exhibition Centre

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From the (festive) Chair

Bulletin of the British Vintage Wireless Society
Incorporating 405 Alive
Volume 33 No.4 Winter 2008

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It seems incredible to me that this year has gone by so quickly and just how much has happened in such a short time. A frantic start to the year, moving house and Murphy collection and still now only having half of the new workshop in any recognisable state. I find myself at the end of 2008 and laying plans for the New Year ahead.

Looking at the enclosed BVWS events diary, you will see a change in the timings of the major yearly Harpenden auction and AGM. We have decided to move this to increase the time between the NVCF and the auction.

The September Wootton Bassett Special auction was a great success with many members coming long distances from the Europe and the USA.

The quality and rarity of the items certainly surpassed anything we have seen for a few years. The bidding at times was frantic and I could hardly keep up with the numbers of hands trying to place bids on some of the items.There were a good number of members attending just to view the lots in the flesh as they thought it was unlikely that they would be seen again for many years.

This appears not to have been the case with the Coherer, which reappeared quite quickly with a newly gained provenance.

A special feature of the October Harpenden which was a great success was to set up the small hall as a components and spares area where everyone could have a good rummage through boxes and trays of small treasures. I know I found several arms full of useful bits. We intend to repeat this setup at the autumn 2009 event. As has become the norm in recent years, no nominations for Committee elections have been received. Therefore no ballot papers have been included with this Bulletin and the Committee will continue next year unchanged.

You should have, by now found this years DVD if not, check your envelope. It contains another interesting selection of material as described by Terry Martini on the back cover of the DVD sleeve.

Lastly, don't forget to send your renewal form back to Graham Terry as soon as possible; it makes life very difficult when they are returned after the end of January.

It just remains for me to wish you all a Merry Christmas, and a prosperous New year.

Mike...

Marconi RB10 and a selection of V24, DEQ valves

It's Those Men Again! Steve Sidaway and Russell Atkinson duet in typical BBC style.

A History of Clarke and Smith – The mighty pygmy in electronics

Terry Martini MIET

"If we ever get out of this alive, let's start up a business together" Those were the immortal words spoken by Major John Frank Edward Clarke to Warrant Officer Alec Smith in one of the darkest years of the Second World War, 1942, when virtually all of continental Europe was under Nazi Domination.

Clarke, 23, having joined the Territorial Army in 1939, was a young subaltern in The Royal Electrical and Mechanical Engineers (REME) would reach the rank of Major the following year and also the officer in charge of the command workshops. By 1945, he held the substantive rank of Lieutenant Colonel when commanding No 3 Battalion REME. It was here that he was to strike up what would be a lifelong friendship with Alec Smith.

A marvel of post war miniaturisation, the Clarke and Smith design of portable two way radio supplied to the Metropolitan Police in the late 1940s. The battery supplies are located in the lower compartment.

Frank Clarke's background before the war had been in electronics and had at an early age displayed his talents by building a crystal set housed inside a matchbox. He spent much of his teenage years studying electronics and wireless communications.

Before the beginning of the hostilities, and at the age of just 20, Clarke had set up a small electrical company dealing mainly in audio equipment. This had to be abandoned when he was called up for military service. Regrettably, with the passage of time the detail of these early business ventures has been lost. It would be fair to say however that this acumen for business along with the leadership and the management of operations during the war would prove to be a valuable asset with the setting up of a new company in the post war Britain of the 1940s and the subsequent industry competition that went with it. Frank Clarke would subsequently become a well known and respected figure in the industry and was often referred to as the "Major" in general conversation, by staff and those he did business with. You had to be on very good terms to be able to call him Frank, and few people it would seem would get that privilege.

Whilst Clarke's background is fairly well recorded, that of Alec Smith is sadly lacking. All that is known about Smith is his posting with REME, his management of the radio and communication workshops and his early association and friendship with Clarke born from their love of all things electrical and electronic. As is often the case the engineer, and in this instance a highly gifted one, gets consigned to the backroom. It is however recorded that Smith had advanced "hands on" ability and his skills would appear in many of the company's early products. Anecdotally it has been suggested to the author that Smith was at his happiest smoking a pipe and winding transformers in a corner of the workshop or sketching out a new circuit. Smith however was instrumental in developing many of the firm's designs and many of these will be found in the early products subsequently marketed by the firm. It was the early designs produced by Alec Smith that would see the new firm quickly prosper and initially supply an educational market with an almost insatiable appetite for audio equipment of the highest quality.

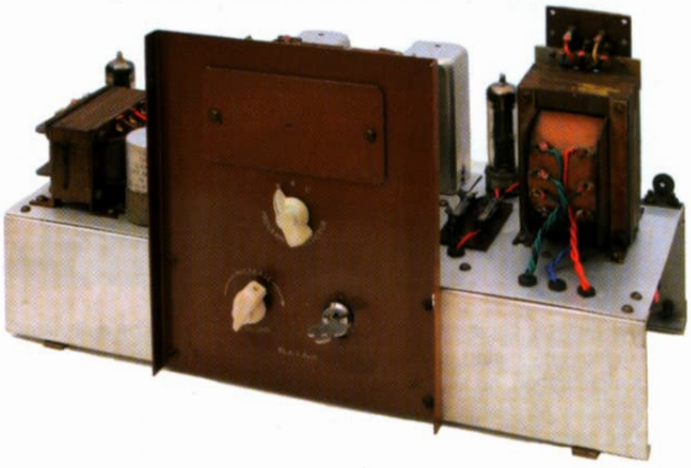
Wallington, the formative years

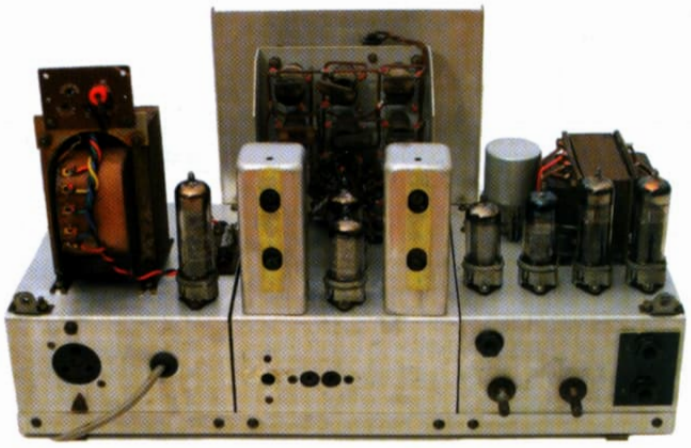
They did get out alive, and together, and started up Clarke and Smith in 1946 with just £100 of capital. The first premises comprised a simple corrugated tin hut on land located on the Melbourne Road in Wallington Surrey. It would be here that the company was subsequently incorporated on 4th June 1947 as Clarke and Smith Manufacturing Co Ltd. The location was allegedly chosen because it was equidistant between the partners' homes. As we shall see in the history of the firm, they were to become a force to be reckoned with, spanning many areas of engineering and electronics. They would also buy out or control many concerns, including some well known in recording and

Hi-Fi, a subject to which we shall return in detail later. In fact at the firm's height, there would be very few areas of electronics and light engineering in which it had not been involved in some form or another.

With insufficient capital to start manufacturing, the fledgling firm started out by repairing sets on a contract basis supplied by some of the local wireless concerns. Their first employee was Clarke's first wife, Olga who worked part time, as the firm's secretary. Business flourished for a little while, but once the major wireless manufacturers returned to the production of new sets, the repair work started to tail off. As a result of this Clarke and Smith, for a brief period, started to manufacture high quality radiograms. These were destined for a few of the well known department stores of the period. The venture was in essence killed off by the doubling of purchase tax on luxury goods without warning. As for these Clarke and Smith produced radiograms, no examples appear to have survived nor have any early sales or technical information.

By 1948 with production at a near standstill, and by then with 12 employees to support, the firm had little alternative but to seek out other work. 1948 was also the year that the BBC made it known that they were the approving authority for schools broadcasting equipment, and on hearing this Clarke and Smith began telephoning all the local councils in the South East. They struck lucky, as from these phone calls they found out that Kent County Council was about to seek tenders for such equipment. The two partners visited the council to obtain the details of the specifications and were subsequently invited to participate in a three day competitive demonstration at the Maidstone Technical College. Unbelievable as it may sound; they had just two weeks in which to design and produce from scratch the four pieces of equipment the tender called for. These were a radio receiver amplifier, record player, classroom loudspeaker and an auditorium loudspeaker enclosure. With such little time in which to act, the firm had to hastily recruit additional staff, with a local joinery firm engaged to



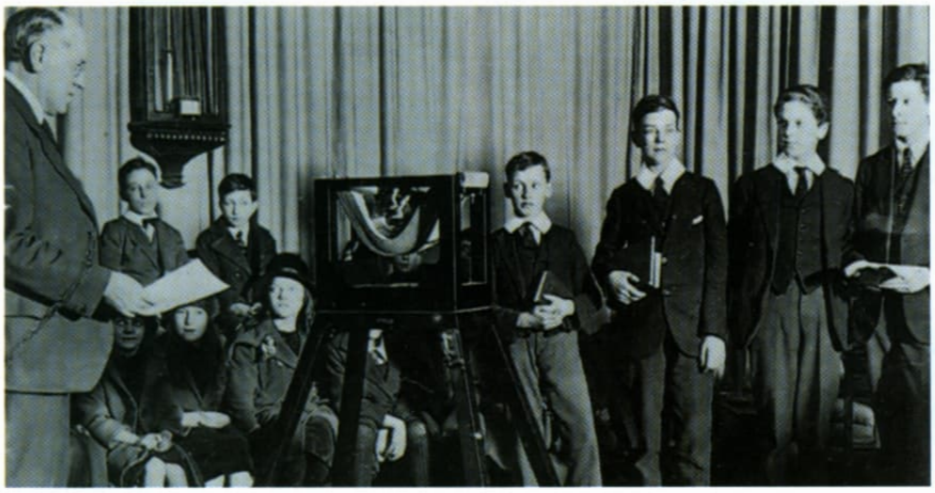


Above: The model 12 talking book gramophone first designed and produced by Clarke and Smith in 1950. The unit featured the novel method of housing the pickup in the lid, simplifying the replay process for the visually impaired. Initially the player was introduced with the original talking book standard of 24rpm. Later versions of the machine also accommodated the 16 rpm speed.

Top right: The SB4 AM only Receiver amplifier designed for portability between classrooms and capable of driving two loudspeakers. The stations are of the preset type. This particular example probably dates for the early 1950s and features a Bulgin key operated on/off switch to prevent tampering.

Centre right and right: The chassis of the SB4 showing the neat and modular layout of the set, a feature that would be retained on many of the later designs. The valve line up is typical of a period superhet with the B8A range of valves being employed these being EZ40, ECH42, EF41, EBC41, ECC40 and two EL41s. A 4 Watt output is claimed from the set. A gram socket is located on the rear along with the bass and treble controls.

The 88-10 AM receiver amplifier dating from the very early 1950s and featuring the standard Mullard range of octal valves available at the time. This set has an abundance of EBC33s, three of which are strapped as triodes. As there appears to be no technical advantage it has to be assumed that these valves were obtained at such a low price that it worked out cheaper to produce like this. Provision is made for gram and for feeding into further amplifiers. The output pair are EL33s. Note the use of a moving coil meter to indicate signal strength. The set still has its previous owner's badge declaring it Equipment Number 4, Surrey County Council. The cabinet is made of solid oak. The similarly designed later series were manufactured from oak–faced ply.



The BBC commenced its first broadcast for schools on the 4th April 1924. The broadcast was presented by Sir Walford Davies, the corporation's first director of BBC radio choral broadcasts. Davies was already a well known composer arranger and choirmaster, but it was in radio that Davies made his great mark on the nation until his unexpected death in 1941.

Right: A rare example of a Clarke and Smith Television receiver in use in a classroom environment, the picture dates from 1960. The receiver featured is thought to be the problematic SBDV2/A which, when first introduced in the mid 1950s, featured the then largest CRT available on the market.

produce suitable cabinets. The prototypes were in fact only tested on the morning of the demonstration, so tight was the deadline. Unfortunately no details survive of these very first items but it is highly probable that the later schools equipment was based on these early, and what would become almost instantly recognisable, designs in later years.

Nevertheless, despite the near impossible deadline, the Clarke and Smith equipment was tested against three other well known competitors and accepted by KCC. They were also subsequently approved by the BBC Schools Broadcasting Council. The firm was offered a five year contract subject to an inspection of its premises at Wallington.

This posed an immediate problem for Clarke and Smith; with little resources in place and based in a tin hut, would the Council want to do business with a firm that had such a short history in manufacturing the type and quality of equipment that was demanded in the tender? To pre-empt what could be a disaster, Clarke cleverly came up with an agreement whereby Clarke and Smith should be engaged on a trial basis for a three month period, delivering the required equipment to the value of £2,000 all to specification. The trial period was successful and over the coming years, some 300 authorities were subsequently approached, with Clarke and Smith eventually becoming one of the biggest suppliers of electronic equipment in the UK to schools, colleges and local authorities only finally relinquishing their grip on this lucrative market in the 1970s.

Schools Broadcasting

The origins of the BBC broadcasts to schools can be traced back to April 1924 when Sir Walford Davis gave the first educational broadcast, which paved the way for regular schools transmissions. A number of firms supplied suitable receiving equipment and amplifiers to satisfy the demands placed by the educational sector. These include Sound Sales, Burndept and later, Goodsell, Trix, Ambassador and Coomber and Son, a firm that started life in the early 1900s and is still active in the educational markets today. Clarke and Smith were by no means the first in this field. What was to set them apart from the rest was the rugged but straightforward, reliable designs of equipment that would have to endure rough handling in the school classroom and be easily operated by non–technical personnel.

An example of this ruggedness is one that was recounted by Clarke in connection with a visit to Shrewsbury Council in the very early days. Access to the audio visual aids office was by a narrow spiral staircase. Clarke slipped and dropped the wireless taken along for a demonstration shattering one of the output valves. To the amazement of both parties, the set still worked with apparently little loss of efficiency. The council officials were so impressed that an order for 12 sets was duly placed. Back at the factory, the

Top: The original factory complex at Wallington taken during the 1960s the later additions are also believed to have been added at this time.

Above: The first company premises consisted of a slightly run down tin hut. In the back ground the new purpose built factory can be seen rising from the foundations. The firm would eventually own much of the property on the surrounding land.

Top, right: Alec Smith and Major Clarke putting the finishing touches to the purpose built factory block that they had designed from scratch. A fifth floor was later added to the existing building due to the rapid expansion of the business.

Right: The three tradesmen who built the entire Melbourne Road factory block. Peter Bushnell, bricklayer, Peter Chucki, labourer and Thomas Russell who carried out the carpentry and structural work. They were all Clarke and Smith employees. It is not recorded how long they took to construct the factory.

set underwent a small modification resulting in fewer valves, a worthwhile cost saving and, little if any difference in performance. Of course, the simple explanation for this is probably the fact that only one of the push-pull output valves was broken in the mishap, with the other simply carrying on with a slight reduction in output, unknown of course to the official concerned.

In 1949, the Home Office communications branch, who at the time were responsible for specifying communications for the police and fire service, made it known that they were tendering for a portable "walkie talkie" unit. This came to the attention of Clarke and Smith through one C.O. Fletcher, the firm's first salesman. Fletcher was a 70 year old retired businessman with a decidedly Victorian approach to selling but an excellent propagandist for Clarke and Smith, happily telling all and sundry about the outstanding talents of the two young gents who had started a business on a shoestring.

It is apparently recorded that on Fletcher's first meeting with the then director of the Home Office communications branch, Commander Best, he swept into the room saying "I bring you the compliments of Major Clarke and Mr Smith" To which the commander replied, "Thank you very much. But who is Major Clarke and Mr Smith?" The sales pitch must have worked as the firm won the subsequent contract to supply the two way radio with evidently many hundreds eventually being manufactured. There is also anecdotal evidence to suggest they were still involved in this area of communications up to the late 1950s.

With so much work now rolling in, the company went through considerable expansion which appears to have got underway in the early 1950s with the original tin hut disappearing, being replaced by a four (later five) storey factory block, offices and a stores building. Clarke and Smith acquired much of the surrounding land in the process including property that was detached from the main site. One of these was a house which provided the accommodation for the service department located on the main road. The remarkable thing about the construction of the new factory is that it was built over a few short years almost entirely by the company itself under the direction of Major Clarke. The drawing office produced all the plans with the construction being undertaken by a team of just three men who were direct employees of the firm.

Such was the local interest generated in the construction work at the time that the local paper covered the story. This is how it was reported: "Near Wallington Railway Station is a large red-brick building. From the roof shoots a giant radio aerial. It is a familiar sight to the hundreds of people who travel daily along that line.

But how many people know the story of that building – which consists






Some of the faces behind the early success of the firm. (Left to right from top)
Major J.F.E Clarke, Chairman, Alec Smith, Head of Research, Mrs Olga Clarke the Major's first wife and part time secretary in the early days of the firm, later becoming a director. W.A. Boggia, managing director and chief executive who remained with the firm for many years. Donald Pettit, Clarke and Smiths first factory employee, seen here in a picture taken during the 1980s.

Far right: Above: Clarke and Smith produced this wireless operator training set, model STR/3 presumably for training military personnel during the 1950s. This would have been part of a larger array of equipment possibly including a tape tutor system that was centrally controlled. Note the circuit diagram stuck on the inside of the lid.

of nearly a quarter of a million bricks, all laid by only one pair of hands, those of bricklayer Percy Bushnell!

That in itself is remarkable, but woven round it is an even more remarkable story, which started with an idea during the war and is now a thriving industry in Wallington, employing hundreds of local people and with an annual turnover figure running well into six figures...

Much of the firm's success is their self-sufficiency. That is where Percy Bushnell comes in. He joined the staff in the early days and brick-by-brick has built the Melbourne Road factory, which has a floor space of many thousands of square feet and is four storeys high.

He was assisted by his labourer, Peter Chucki, a Pole, with Thomas Russell doing the carpentry and reinforced concrete structural work. It is to be hoped that in the future this team of three proud men, who now have good positions with the firm, will erect additional buildings in the same way. The work they have so far completed has been in addition to converting a stable for offices, which adjoin the Melbourne Road factory, and helping to build the cabinet making plant in Clyde Road."

Talking books

Another of the technologies that Clarke and Smith were involved in at the start of the 1950s was the development and production of the then gramophone based talking book. The method had been well established since the early 1930s as a means of providing recorded material to the visually impaired, when the RNIB had introduced a specially modified machine capable of replaying discs at a non standard industry speed of 24 rpm. The development of this system dates back to work carried out in the U.S during the 1920s. With the advent of broadcast radio and the first talkies of the late 1920s, engineers developed a disc capable of replaying at 33⅓ rpm to be able to time shift a radio programme for subsequent replay in a different time zone by another radio station.

These recordings were known as electrical transcriptions that could play continuously for 30 minutes. The discs were 16 inches diameter and made of aluminium or a semi flexible cellulose acetate compound. Similar in nature to the direct–to–disc recording systems (or acetates) as used later by the BBC, and remaining the method employed today. The Vitaphone Co in the US also introduced a similar system in 1926 which was operated alongside a film projector. The disc and speed were ideally suited as they were capable of running for the same length of time as a reel of film. The 33⅓ speed did not appear on the domestic markets as the LP until 1948 by which time considerable improvements had been made to the recording and replay processes.

One person who followed these early disc developments was a blind American by the name of Robert Irwin. In 1924 he was visited by John W Dyer a young man whose father Frank L Dyer, had just applied for several patents covering variations on existing recording methods. Principally these were turntable speeds slower than the current standard of 78rpm and much narrower groove pitch of the then current standard of 90 to 100 grooves to the inch.

Irwin immediately saw the potential of the Dyer patents which resulted in a letter to a friend in the spring of 1924 stating that there was "a scheme simmering in which I am tremendously interested for making phonograph records which will contain 15,000 words on the side of a 12 inch disc, which could be manufactured

The GP3 (3 Watt amplifier) and GP7 (7 Watt Amplifier) based record players were produced for a number of years also later to be known as the PGS Series and were fitted with a combination of decks such as the Lenco or those produced by Garrard and Collaro and with or without an internal loudspeaker. This equipment was advertised as being suitable for music and movement, country dancing and physical education. The amplifiers were also general purpose in nature and available in a self contained portable, metal cabinet, with the GP7 featuring a microphone input.

cheaply and played on an inexpensive playback machine. If we do not die too young, you and I may both live to see some revolutionary changes in books for the blind"

Later, the Dyer patents would be the subject of a court case which he subsequently lost on the grounds "that they were not original principles but merely a difference in the degree of existing processes".

The American Foundation for the Blind subsequently adopted the system in the early 1930s. The discs replayed at 24rpm and could hold 25 minutes worth of a recording per side (about 4,500 words). In the UK the RNIB had been experimenting it would appear, completely separately as early as 1920 but did not adopt the system that had originated in the US until the early 1930s. The first recordings in this format appeared in late 1935.

By the time Clarke and Smith had entered the market, the talking book service had been long established with a relatively reliable system of reasonable audio quality that could hold a complete novel on ten double sided 12 inch discs. Frank Clarke's interest in this medium stemmed from the fact that his grandmother was blind and also through a friendship with Lord Fraser, a blind member of parliament and head of St Dunstan's, an organisation first set up in 1915 to help blind ex servicemen and women. Clarke was acutely aware of the difficulties experienced by the visually impaired and contact was made with the RNIB (a relationship that would subsequently play a large part of the business for many years and be very lucrative for Clarke and Smith in the process) resulting in an improved record player (the first in fact) that could be used by a blind person completely unaided.

The improvement was so simple that you wonder why it was not thought of before. The record player that was subsequently designed and manufactured by the firm did away completely with the conventional pick up, housing it instead in the lid of the equipment, the idea being that as soon as the user closed the lid the record would be ready to play without any further intervention by the user.

The record player known as the Model 12, using a modified Garrard deck would see use right up to the end of the 1950s when the first proprietary magnetic tape cartridge would appear, rendering the gramophone disc obsolete. Later versions of the Model 12 could in fact replay both 16 and 24 rpm discs, to take advantage of the then alternative commercially produced talking book records issued by VOX.

With the emergence of practical magnetic recording after the war and the subsequent appearance of the magnetic tape recorder in the UK in the latter half of the 1940s, the RNIB started looking at the possibilities of using the medium for the talking book service. By 1960 several articles and editorials had appeared in one form or another, most notably in Wireless World and The Tape Recorder Magazine. The development time appears to have been a long one with the RNIB claiming that they had developed the system after several years of research. It is not entirely clear therefore exactly how much involvement Clarke and Smith actually had in the research and development side of things, as they appear to have made not dissimilar claims. The fact remains however that the talking book tape cartridge was a truly revolutionary development at a time when multi track, magnetic tape was still considered a bit of a novelty. The development work appears to have been carried out under the direction of Alec Smith

Far left: A small selection from the range of loudspeaker enclosures available to schools and various institutions during the 1950s and 1960s.
Centre: MK1 Talking Book: The first magnetic tape based talking book produced for the RNIB from around 1960. The development period appears to have spanned nearly ten years.
Top right: The fairly complex internal mechanism of the talking book magazine, using a stacked spool arrangement and ½ inch magnetic tape.
Far right: Major Clarke, Freddie Bellis and Alec Smith seen here examining the MK1 talking book player by this time in production form.

with one of the firm's engineers, Freddie Bellis, also being involved in the project.

The cartridge had a number of salient features; these were the ability to contain up to 18 tracks recorded across a ½ inch magnetic tape and the cartridge could contain up to 20 hours worth of recording, considerably more than the disc based system. The deck did not replay at a conventional tape speed, which was non–linear. This was dictated by the driving spindle on the deck, rotating at a constant 15rpm. As the tape played out, it's diameter in relation to the take up spool increased and with it the tape speed. As the replay process is the reverse of the recording conditions, the pitch remained constant.

In fact this method was ideal for speech recordings and was employed on some of the early Grundig Stenorette dictation machines of the 1950s. The weight of the new cartridge was 6lb and earned the nickname of "talking bulk" in some circles. Nevertheless by late 1960, the first recordings started to be issued in this new format with the disc version gradually being phased out. Clarke and Smith, as the sole manufacturer, made thousands of these along with the special deck and tape cartridge, not just for the home market but for export as well. The tape cartridge housed the complete mechanism, track change linkages, replay heads and tape spools which were stacked on top of one another within the housing. Interestingly the firm gets no mention at all in any of the technical press apart from being referred to as the "major manufacturer" involved in the production of these, even though it is obvious from some of the accompanying pictures that it was.

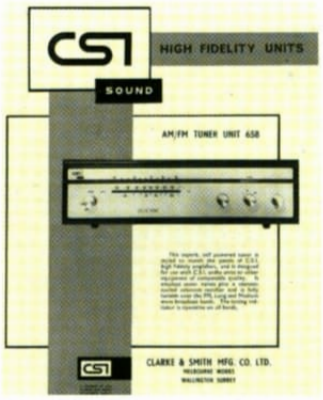
The early duplication processes were somewhat complex. The master recording was dubbed at high speed from a standard ¼ inch tape on to 12 copies of the talking book media at a time. With other attendant complications such as the instruction announcements, the 18 tracks were initially dubbed over one at a time. The resulting recorded tape was then wound into the cartridge and sealed. Although this process may appear very time consuming today, this was state of the art technology back in the early 1960s. Tape also gave the producers relative freedom over the number of copies required at a given time and this could be varied to suit the demand; the new medium could also be reused and saved on costs. A typical production onto disc could have taken up to 18 months to reach the listener from inception to completion: with tape it was reduced to the same number of days.

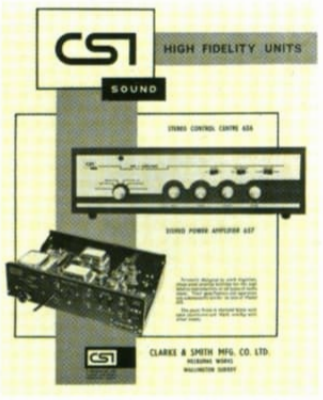
The educational market

From the 1950s onwards, Clarke and Smith also designed and produced a large range of equipment for the wider educational market; some of these were almost certainly based upon the original Kent County Council equipment of the late 1940s. The earliest of these ranges comprised the portable SB4 classroom AM receiver amplifier consisting of a three position pre-set station selector and a push–pull output comprising a pair of EL41s' to give a 4 watt output, capable of driving two classroom loudspeakers. A larger receiver designated the 88/10 was fully tuneable across the AM band along with a provision for a microphone or gram input and using a pair of EL33s' in a push pull arrangement designed to work with a larger number of speakers of the type installed across a medium sized school. On the early installations the equipment was generally terminated in each classroom or hall, a special Belling Lee, 3 pin socket, with the speaker fitted with an appropriate matching plug. The equipment was housed in a solid oak cabinet with the metalwork finished in a smooth gold paint. Many of the early receivers featured a lockable front flap or a key operated on/off switch to stop any interference equipment by inquisitive fingers.

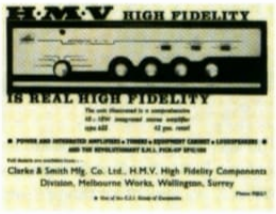
The cabinet and cosmetic finishes would change very little, although the later equipment adopted oak veneered ply cabinets to cut down on cost. Subsequent developments also saw the receivers designed with much larger outputs, and the introduction of the VHF waveband on certain models, from the mid 1950s onwards. Apart from that little was changed electronically until the adoption of transistor based equipment from the early 1960s when the solid oak cabinets eventually gave way to cheaper timbers and plastics. The later valve based range was developed into the 88/12 (EL84s) the 88/20 (parallel push-pull EL84s) and the 88/25 (EL34s). In the FM

Above: The STR 4 tape recorder from 1959 featuring the Ferrograph Wearite Series 4 deck was a good performer in terms of facilities and overall quality. This equipment was also made available to the general public.



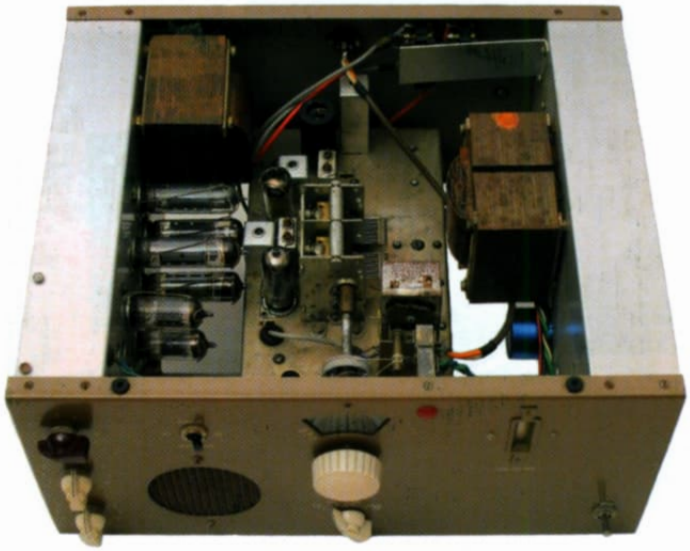


Above and below: Clarke and Smith manufactured a number of high quality hi-fi amplifiers from 1959 produced under Scientific Technical Development Ltd a division of the firm headed by Alec Smith. These were also produced until the early 1960s for EMI and also appeared with the HMV badge. With Major Clarke's departure from the EMI board this arrangement lapsed. The firm did for a short period produce cut down versions of these products such as the CS1 655 series of amplifiers and tuners.



Below: Major Clarke is seen here with Herbert Weisberg President of the American company who imported the Clarke and Smith/EMI Hi-fi products, seen here alongside one of the firms loudspeaker enclosures. The picture is thought to date from around 1959.

Below: An advert from 1963 for the then recently acquired Associated Electrical Maintenance division that Major Clarke had secured from EMI as part of the buyback deal. The picture suggests that it was quite a sizable operation although it was reportedly a loss making division of EMI at the time of the acquisition. It was to eventually disappear in the early 1970s.



The later 88-20 AM/FM receiver amplifier. This example dates from the mid 1960s and followed the well established cabinet tradition with the drop down lockable flap. This example features EL84s in a parallel push pull arrangement and a semiconductor based FM tuner. Various versions of the 88 series were produced over the years, the second generation AM only equipment for example, and originally featured B8A valves throughout with parallel push pull EL41s and a neon tuning indicator. EM34s or EM84s will also be found as the tuning indicator in some models. The earliest of the 88 series FM models featured a valve based "bought in" tuner utilising an ECC85 which was prone to periodic drifting.

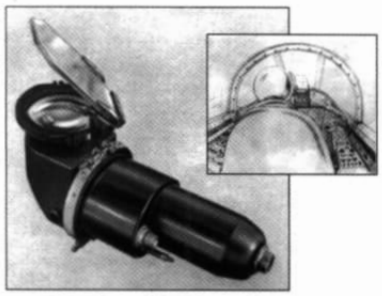
models, the tuner section featured a valve module fitted with an ECC85, which was prone to drifting; this was later modified to a Mullard LP1179 transistorised tuner module fed from the valve heater supply via a silicon diode. The 88 series was apparently still in production in the early 1970s.

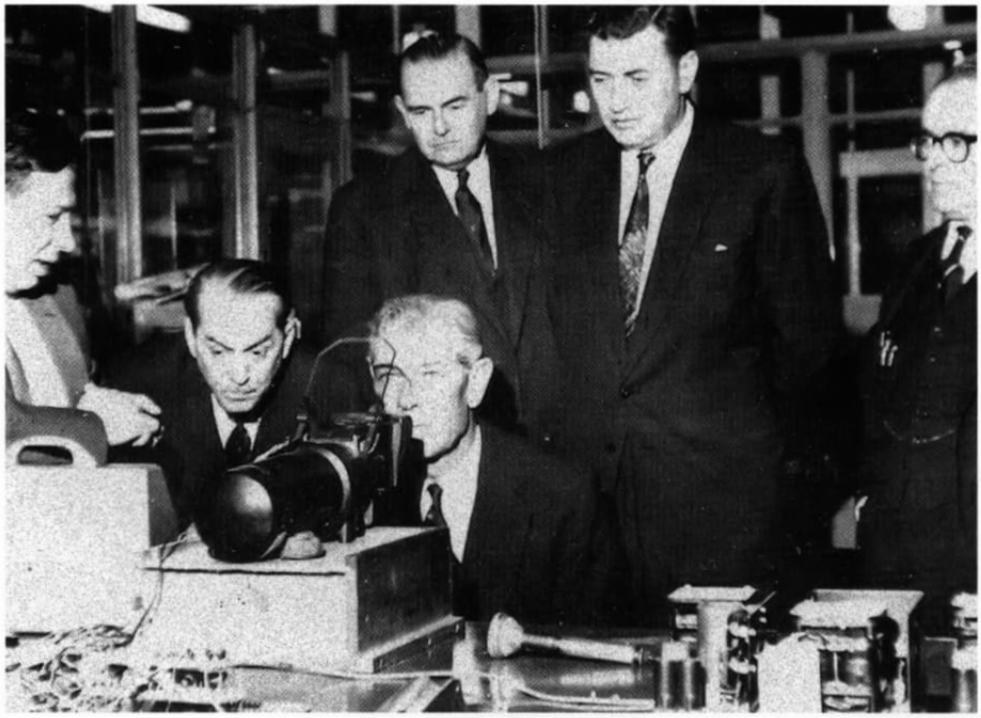
Another model known as the SB/FM series was introduced in three different versions each denoting the power output respectively. These were the SB/FM7, 12 and 25; the latter used a pair of EL34s and was capable of feeding up to twelve loudspeakers. The stations were of the preset type giving the user a three position selector for the Light, Third or Home services. Clarke and Smith also designed a special negative feedback arrangement in the tuners of these amplifiers to give a claimed "low radio frequency circuit distortion". The author has not however been able to establish what benefits this may have yielded in a noisy classroom. A mixer amplifier of similar appearance to the 88 series and known as the MX20 was also produced along with various small amplifier designs known as the GP3 with a single ended EL84 and the GP7 containing Push-pull ECL86s. The chassis of these were so designed to either be supplied in a self contained portable cabinet, or as is more commonly found, fitted into the various record player models available at the same time.
The internal construction of all the designs was to a very high standard and allowed easy servicing with in many cases the removal of just two screws needed before the whole receiver or amplifier could be slid out. The neatness and attention to detail is one of the things that stands out in all of these designs. Depending on the vintage, various forms of tuning indication were used including a moving coil meter, neon lamp or a miniature "magic eye" valve. Generous smoothing was employed and in some cases more than one rectifier valve may be found on the power supply chassis of the larger receivers. The amplifiers and receivers were in most cases designed to feed multi speaker configurations and were fitted with multi tapped, transformers. The American 70v line standard was adopted on safety grounds along with provision for low impedance working of 3 or 15 ohm selected by a rotary switch on the back of the equipment. The circuitry on this equipment was generally conventional and followed the design trends and valve ranges available to manufacturers at the time. The only let down was the use of sheet aluminium for the chassis which was prone to buckling under the weight of the anvariably large transformers used in some of the designs.

The supply contract to certain Northern authorities does however appear to have differed slightly. Some of these early classroom receivers supplied to the North were floor standing consoles fabricated entirely from steel and finished in a light grey. The amplifier was housed in the bottom of the console with the speaker in almost baffle fashion, and not dissimilar to the floor standing wireless consoles produced by Murphy. Why these differed so much in appearance could just be down to the individual contract requirements. The firm had operated a general policy of "you specify it and we'll make it," so this could well be how this came about. A large range of suitable loudspeaker enclosures were developed and produced over a number of years to suit almost every situation and these varied from the wedge shaped floor or wall mounted cabinets through to the wall mounted column designs for auditoriums. These were generally finished in oak or beech with a heavy duty weaved cloth or an expanded metal grille depending on the model. At the firm's peak, Clarke and Smith could justifiably claim that it had equipment in one form or another in every school across the country, manufacturing some 600 items in 25 categories with 60 types of loudspeaker alone.

With the arrival of the comprehensive school in the early 1960s, Clarke and Smith carried out many of the installations in schools located in London and the South East, and at one point had a team of two engineers solely engaged on the installation and fitting out work. Contractors carried out the main cabling throughout the various buildings with the firm's engineers dealing with the final termination to the purpose made rack mounted amplifiers and ancillary equipment. These high powered systems not only provided radio signals to an array of loudspeakers fitted in each of the classrooms and corridors, (in some cases the speaker and associated controls was an integral part of the blackboard), but also class change signals, fire alarm tones, master clock pulse generation, and public address facilities, with a microphone quite often housed in the headmaster's office.

From around 1955, the firm also produced its first magnetic tape recorder the GTR5 which used the early Truvox Mk3 deck. This was superseded by the CTR1 using the Collaro transcriptor and a larger output featuring ECL82's in a push pull arrangement and a separate bias erase oscillator and the STR4 introduced in 1959 using the Ferrograph





The head up display was one of the firm's success stories in the early 1960s. Seen here in the picture are Air Marshall Morris, Chief of Staff (seated in front of the unit) behind him left to right are Freddie Bellis, Major Clarke and Alec Smith. The two men to the far left are unknown but may have been connected with Specto. Above, left: Clarke and Smith produced a small range of laboratory grade equipment and accessories for schools during the 1950s and 1960s, The LT 4 variable low voltage supply unit seen here, supplied 2 to 24 Volts AC or DC in 2 Volt steps with a maximum current rating of 24 Amps, fully stabilised.

Wearite deck Series 4. The latter two were made available to the general public.

Television for schools and colleges

By 1957, Clarke and Smith had produced their first schools television receiver, the 405 Line SB/DV2A using 21, 23 and 27 inch picture tubes, to be ready for the first schools broadcasts radiated by ITV in that year. These sets used some of the largest cathode ray tubes available at the time, and were typically housed in a large oak cabinet with double doors set high, upon a special metal framed trolley. The manufacturer of the larger 27 inch tubes, RCA, made available a sample, which did the rounds within the manufacturing industry, passing through the hands of Clarke and Smith, Pye, Ultra and other television manufacturers of the period. This large tube had in fact been available in the US since late 1952 for luxury consoles. Evidently, Clarke and Smith had just two months of the summer of that year to get their first batch of receivers designed and produced around this tube, and installed in time for the start of the new academic year.

The development work was undertaken at such a pace that the design of line output transformer was overlooked, resulting in severely overrun components. By the Christmas of that year, most of the sets had suffered with burnt out LOPTs resulting in a Clarke and Smith engineer being hastily dispatched around the Kent area to upgrade the faulty component and make any necessary modifications. Such practices would be unheard of today. The later Clarke and Smith schools televisions appear to have fared better and at least two further ranges were produced in the early 1960s, with the last of these incorporating a dual standard (405/625 line) chassis. These models were known as the 733 which incorporated a 27inch tube and the 734 in which was fitted a 23 inch tube. To meet the safety requirements demanded in a schools environment, the designs featured a fully isolated chassis and a double wound mains transformer. The audio output stages of these sets were also larger and in one design, fed a loudspeaker that was actually fitted on top of the television set in a baffle arrangement.

For schools within the London area the Inner London Education Authority was planning the introduction of a cabled system which would eventually serve some 900 schools and colleges across the various boroughs. The project was first implemented in 1965 and was in full operation by the late 1960s. The first transmissions were from an old school in Laycock Street in Islington, London with the service later being transferred to purpose built studios in Battersea, London. The system was distributed by the GPO on special co-axial cable installed for the purpose and resulted in a vast array of cabling under the streets of the capital. The service which included the BBC and ITV programmes along with the ILEAs' higher educational channels originating from Battersea and remotely injected from other colleges was distributed at 625 Line VHF in the region of 40-140 MHz. The sets subsequently supplied for the system were specially modified Decca television receivers not entirely dissimilar to the Clarke and Smith manufactured ones.

Whether or not Clarke and Smith were ever invited to tender to supply sets to run on this system is unclear, as their sets were only designed to run on a conventional "off air" signal. Once the ILEA system was underway, any already installed in schools within the London area were probably consigned to the store cupboard as a standby. Suffice to say, it would appear that production of schools television receivers was probably wound down by the late 1960s, with the supply of these by then only to educational authorities outside the London area.

Apparently when Clarke and Smith sold off the land at the front of the site in the late 1980s to the Japanese multinational Canon for their new UK headquarters as a fundraising exercise, a house full of old schools television spares came to light, apparently long forgotten. Needless to say these probably all went into the skip. Due to the rarity of these televisions, none have turned up to allow further examination of the construction or circuitry.

EMI and High Fidelity

By the late 1950s Clarke and Smith had formed a subsidiary named STD Ltd (Scientific and Technical Developments) headed by Alec Smith which, despite the name, appears initially only to have dealt with the range of Hi-Fi the firm would subsequently produce for Electrical and Musical Industries (EMI) at Hayes in Middlesex. Evidently Clarke and Smith came to the attention of Sir Joseph Lockwood, the then chairman at EMI. Clarke was invited to join the board of EMI as a non executive director with a view to rationalise the operations of their sales and services companies. EMI bought a 49 percent stake in Clarke and Smith to cement the bond, this being effected in late 1959. This co-operation also saw the introduction of the acclaimed Hi-Fi products under the Emisonic and Stereoscope range and also

Above: The Specto 171 tape recorder was introduced in 1960 and was one of a handful of machines to appear on the market that would feature the ill fated Garrard tape magazine deck. Specto had already manufactured a small number of other tape recorder models and also produced a fairly short lived range of HI-Fi amplifiers also under the Spectone badge. Specto became part of the Clarke and Smith group in the late 1950s and was already in the business of producing 16mm cine projectors for education and industry. Here are two examples, The Specto Motion (top, right), designed for special applications including slow and stop motion and the Specto Sound (above, right), a fully featured projector featuring optical and magnetic sound replay. These were latterly badged CSI. (Clarke and Smith Industries)

included HMV badged models. The range was to include high quality amplifiers and loudspeaker enclosures and by late 1959, several products had been introduced on the market under the EMI brands. It would appear that most of these were destined for the American markets making them a sought after collectable in the UK due to their rarity. 1959 also proved notable in that Clarke was appointed chairman of the recently formed BREMA Audio group initially made up of Clarke and Smith, Lowther, BTH, Dynatron and several other well known high end audio manufacturers.

The models produced by Clarke and Smith included the STD 300 and 400 series which comprised a high quality stereo amplifier and control unit of different power outputs ranging from 2.5 though to 10 Watts per channel. A higher powered mono amplifier was also produced capable of delivering a power output of 25 watts. Whilst most of these amplifiers received good reviews in the press, the most unusual design would be that of the Stereoscope 555 first launched at the 1959 Radio Show. This equipment was unusual in that it featured a miniature 1CP1 cathode ray tube as a visual indicator for calibration of the amplifier. This was achieved by operating an appropriate switch, whereby the CRT would then provide an accurate visual measurement of channel balance, monitoring of the output level and the overall frequency response. Clearly the unit contained a number of salient features that were instantly appealing to the American market. Typical of the organisation, the same tube found its way into a simple oscilloscope supplied as part of a range made for Griffin and George, a well established schools laboratory equipment supplier. Clarke and Smith claimed many thousands of the Hi-Fi units along with the Hi-Fi speakers and integrated stereo systems were sold in the U.S. It is not entirely clear who actually developed the range but Clarke and Smith were producing them at the Wallington factory from the late 1950s through to the early 1960s when they were finally discontinued. Clarke and Smith also produced other models under the HMV marque. In April 1964 the firm announced to the trade that it was discontinuing the range of equipment bearing the HMV trademark but instead would be producing a range of equipment under the CSI Sound marque. The range produced comprised the Model 655 stereo integrated amplifier, priced at 42 Gns, the model 656 stereo control centre, at 26Gns, the model 657 stereo power amplifier and the Model 658 AM/FM tuner units priced at 24Gns and £31. 11.7 respectively. A number of EMI accessories such as EPU100 pickup and various loudspeaker enclosures were also available through Clarke and Smith. The Hi-fi range does not appear to have been particularly long lived and eventually disappeared from the catalogues during the mid 1960s. It does not appear that any transistor based models were developed or produced and the later CSI Sound equipment was the last in the range to be marketed. The STD name reappeared in the 1990's as a vehicle for an abortive attempt at producing a range of "whole house" remote control electronics targeted at the paraplegic and quadriplegic markets.

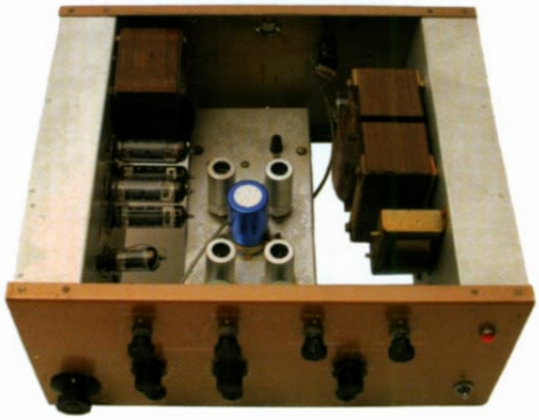
One other development that Clarke was involved in was as a co-patentee of the HMV Voice master reel to reel deck. The deck could also double up as a record player when fitted with an optional arm, although all the examples seen have this facility omitted. The specification for this was published in January 1963. The deck however first appeared in 1961 and was another one of those novel but unsuccessful ideas that were only taken up by one or two manufacturers including the one model produced under the HMV marque as the 'Voicemaster'. It remains unclear as to whether this was produced at Wallington or Hayes as no further manufacturing information has come to light.

The association with EMI also saw Clarke attain the position of chief executive of the HMV record label which was at the time employing around 3000 people and losing some £2,000,000 a year. Anxious to remain independent, Clarke offered to take on the position without remuneration and within two years the loss–making division was breaking even and making a good recovery. Lockwood was impressed with this turnaround of

Above: The 634 tape recorder first produced in early 1963 was a first for Clarke and Smith in that it was the first all British semi professional tape recorder to feature semiconductors throughout. A choice of tape decks was also available at the time of order. Such was the demand for these at the time, the factory struggled to keep up with the orders.
Below: The SBFM series was issued in three models this example features a pair of EL34s as the output pair and capable of delivering 25 Watts into an array of up to twelve loudspeakers. This was the largest in the range of semi transportable amplifier tuners. The FM stations are switch tuned with a limited range of adjustment via trimmers behind a concealed flap.

the ailing division and offered Clarke the position of deputy chairman. Clarke evidently declined the offer having seen the politics and bureaucracy associated with such a large organisation and resigned the position of chief executive returning to Clarke and Smith. By the mid 1960s, he had bought back the original 49 percent share from EMI at a reported premium price but also gained two of the ailing service companies that had been making losses. These were Associated Electrical Maintenance Ltd who were based in Hanworth Middlesex and the EMI office equipment division that had marketed the Emidicta magnetic floppy disc dictation equipment during the 1950s. These businesses became very profitable under Clarke and Smith. The experiences at EMI were not forgotten and during the late 1950s and through to the 1970s expansion was largely by acquisition. The subsidiaries were run in many cases autonomously. At one point it was said that if you did too much business with Clarke, you ran the risk of being bought out. At the company's height during the 1960s, it controlled some 17 different companies across a wide range of specialist sectors and employed in the region of 1600 staff, 450 of these were based at the Wallington factory against 250 in 1958 when there was just the one company. The estimated turnover annually was in the region of £100,000,000 at today's values. All of the subsidiaries were capable of, and did supply large contracts. As one example, the dental hospital and students' accommodation block at the Royal London Hospital, Whitechapel London, first opened in 1960, was supplied with public address and loudspeaker equipment throughout the various new buildings that were housed on the site.

In addition to the schools, Hi-Fi separates and RNIB sectors they were also manufacturing laboratory equipment including bench power supplies, cine and projector equipment, optical lenses, stock control systems, time control equipment, architectural wrought iron work, die casting, tool mould making, transmitter receivers and a host of other activities. At one point Clarke and Smith also had offices at Fenwick House in Holborn, London; this dealt with the office dictation equipment side of the business and was also described at one



Left: The RP2-5A high quality record player featuring the Garrard 301 turntable and designed for drama workshops and dance studios. This example probably dates from the early 1960s.
Right, top and bottom: The 718 MX20 high quality 20 Watt, mixer amplifier and manufactured in a similar style to the "88" series of receiver amplifiers. The equipment featured ECC83 double triodes throughout along with four EL84s in a parallel push pull arrangement. The unit featured two balanced line inputs along with a third high impedance input for gram. Provision to feed either a line source array or low impedance loudspeakers was provided along with high impedance, low level outlet for feeding further equipment such as a tape recorder.

point as being the group's headquarters. These offices appear to have survived into the early 1970s before they were finally closed and moved back to Wallington.

The "Head up" display

In 1960, the Ministry of Aviation commissioned Clarke and Smith through another of their subsidiary companies, and only recently formed, Specto Avionics, which manufactured highly specialised instrumentation such as flight recorders, deci-microsecond chronometers, printed circuit logic boards and central and early warning systems. This was to develop an advanced head-up display for high speed, low flying aircraft in association with the Royal Aircraft Establishment at Farnborough. The unit was to be known as The "Spectocom". The Ministry required this equipment for the Harrier "Jump Jet". In addition The United States Bureau of Weapons ordered samples for further trials and on their successful completion later adopted it as a primary instrument for all military aircraft. Not surprisingly, the American interest resulted in a US company allegedly reverse engineering the Specto Avionics prototype, losing the valuable US military market, as the US Military would have wanted to keep control of the technology in US hands.

The system was not a new one, having originally been developed by Rank Cintel for the RAE. Specto however, had introduced completely new transistorised circuitry allowing a considerable reduction in the size of the equipment, an important feature where space between the aircraft instrument panel and windscreen was of prime consideration. In addition to this equipment, Rank Cintel commissioned Specto to develop the optical units that were a vital part of the existing system.

The Ministry offered a contract with a value of £1.6 Million for one fully operational prototype. However, they would not validate it unless Clarke and Smith gained a bankers guarantee for technological performance, or amalgamated Specto with one of the large British companies already in the field. No bank would give such a guarantee of the kind demanded by the Ministry so the whole of the capital of Specto Avionics was sold to Smiths Industries with Clarke installed as deputy chairman. Specto Ltd of Windsor, a manufacturer of stop motion analysis recorders, film projectors, as well as tape recorders and overhead projectors and another of the Clarke and Smith subsidiaries, was not affected by the sale and remained in the group.

Into the transistor era

In 1963 Clarke and Smith had introduced their first all transistor based reel to reel tape recorder, the 634. In fact it was an industry first, as up until that point most of the semi professional category of recorders in which this machine fell, were still all valve based. One or two of the rivals had introduced hybrid circuitry, generally confined to pre-amplifier sections of the equipment concerned and the Simon SP5 tape recorder of the same period comes to mind in that respect. The 634 had three heads, comprehensive mixing and monitoring facilities and a 10 watt power output for low impedance or for 70V line working. Although primarily designed for schools this was also available to the general public and was priced at 103Gns. Evidently such was the demand placed on the factory for these that at one point there was a waiting list for them, due to the favourable reviews received in journals such as The Tape Recorder. Whilst this machine was a very good performer and could achieve an above average frequency response due to the use of Bogen magnetic heads, this was spoilt by the relatively high level of amplifier noise due to the early transistors employed. This generally manifested itself as an obtrusive background hiss. This was more noticeable in home settings than in a large hall where the noise would probably go unnoticed. Some school

Above: The compact all transistor 747 receiver amplifier from the mid 1960s was probably the last to be housed in the stout oak cabinet that became the trade mark of the earlier Clarke and Smith products. Many of these saw use in ILEA controlled schools and colleges throughout the London area. The unit is a fraction of the size of the earlier equipment and packs quite a punch in terms of facilities. The output is rated at 10 Watts, with provision for microphone, gram tape etc taken to P.O type sockets housed on the right of the unit. The VHF tuner is switch tuned for the reception of Light, Home and Third with user adjustment behind a concealed flap on the main control panel. The receiver actually has a conventional tuner covering 88-108 MHz which is only accessible when the receiver is completely removed from the cabinet, with a narrow band of VHF frequencies being adjustable in conjunction with the switch tuning. The loudspeaker output is on 100V line only with no provision for driving low impedance only speakers.

Right: The 835 portable AM/FM receiver amplifier was first issued during the mid 1960s and appeared in various configurations until its demise in the mid 1970s. The early sets were well specified, with a ten inch loudspeaker, and a 1 watt output sufficient for the average sized classroom. The tone controls and various outlets housed on the rear of the equipment. The early models' Achilles heel was the use of the infamous Mullard IF module which featured the unreliable AF series of transistors.

teachers also found the machine irritating and complicated to use when compared with the earlier offerings such as the STR4. The machine was issued either with a Wearite or Truvox deck depending on requirements at the time of order. The early recorders were finished in the Clarke and Smith smooth gold finish although more commonly, in the light green/grey normally associated with the Ferrograph Wearite deck of the period.

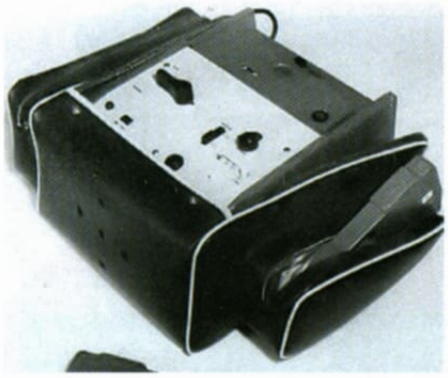
This would be the final semi professional reel to reel recorder produced other than one or two language laboratory machines produced around the same time and based around the Magnavox 363 tape deck.

The Tapete system

Clarke and Smith also took the opportunity to introduce a new type of tape cassette, known as the "Tapete" originally launched at the 1965 Olympia show. Clarke and Smith had seen the further potential possible after the introduction the original talking book cartridge of the late 1950s but lacked a patent on the design and therefore any degree of control. This was to change with the new design of cassette and the associated replay deck which would see a considerable reduction in size, weight and the introduction of transistorised based circuitry. Interestingly they choose to engage Laszlo Nameyni-Katz to carry out the design work on the cassette and a patent covering the complete specification was finally issued in 1968. Nameyni-Katz was well placed to carry out this work, having been instrumental in setting up The Epsylon Research and Development Co back in 1950. Epsylon will not be a name familiar to many readers but they were an early entrant in mulitrack magnetic recorders and several of these were marketed to broadcast, industry and the military during the 1950s and 1960s. They also undertook work on early computer tape drives. Nameyni Katz had many patents to his name as a result of this and was a prolific inventor in these areas of technology. This single move would ultimately see the RNIB locked into a deal that they would be unable to get out of for many years for, in addition to this development, Clarke had secured an international standard as well which would eventually be adopted around the cassette.

The Tapete cassette was a considerable improvement over the original system in a number of ways. It weighed considerably less, at just 6 ½ ounces, was a fraction of the size compared with the original and was capable of accommodating six tracks with a recording time of up to 13 hours. The housing being made out of a rigid plastic, was durable and a special mechanism was incorporated to stop tape spillage. The new format started to see widespread use in 1967 and a special adaptor was produced for users who had one of the old format based machines as an interim measure. Unlike the non linear way the original Mark 1 talking book player replayed the cartridges, the new cassette was based on conventional capstan drive, and due to its careful design, produced good wow and flutter figures.

The duplicating process comprised a one inch tape master each containing six speech and two index tracks. The speech tracks were recorded in alternate directions by a combination of turning over the tape and switching tracks on the master deck tape heads. These were one inch 4/8 interlaced format. ie: they were at eight track pitch but had four physical pole pieces. Originally, the recording was done direct to a one inch master tape in the studio. Later they reverted to using a ¼ inch master then transferring these to the duplication copies on one inch tape. The duplicators were built by Clarke and Smith incorporating modified Leevers Rich decks, later these were changed to Studer A80 transports. At one point, part of the Major's house was converted into a recording studio for producing master recordings for the format. Not all organisations had access to this type of technology and some of the overseas concerns resorted to banks of modified recordable Tapete based machines,



The later talking book cassette cartridge known as the "Tapete" was first introduced in 1965 with a 13 hour playing time using standard ¼ inch tape, and would remain the Clarke and Smith proprietary format for the talking book service until the demise of the firm in the late 1990s. Various versions were produced including a recordable unit for dictation purposes and language laboratory use.

requiring a controller, a conventional ¼ inch based master replay machine, and a lot of manual dexterity in the process.

By 1969 a number of variants of the Tapete system had appeared with the basic mechanism having been modified by Freddie Bellis, these were for educational purposes and language laboratories. An office dictation version was also made available. The modified systems comprised of a twin speed deck running at the industry standard 1.78 and 3.75 ips. Frequency response was a claimed 7 kHz and 12 kHz respectively. It would also appear that the possibility of a Hi-Fi version of the Tapete was also researched, and initial discussions were held with RCA, who were showing prototypes of what would become the "8 Track" format of the late 60's, about them adopting the format; nothing it appears, was to come of this and, with the gaining popularity of the Philips Compact Cassette at that time, (had it been introduced as such) it would have probably amounted to a marketing disaster. The Tapete system remained the standard for talking books until the late 1990s when the system went over to "Daisy" and we will look at this and the final demise of Clarke and Smith later on in the history of the company.

Jumping back a little to the mid 1960s and the era that Clarke and Smith were at their height, an article on the firm appeared in Electronics Weekly, penned by David McIlwian the Commercial Editor at the time. He was very enthusiastic about the company and this is what he said in his column about Clarke and Smith.

"The total floor area of CSI's factories amounts to about a quarter of a million square feet. In addition, the local cinema at Wallington was recently gutted and reconstructed internally with two additional floors to secure further badly-needed space. A substantial extension of factory accommodation is planned and approved on a new adjacent site at Wallington...

So far as research and development are concerned, the company claim to spend far more than many companies of comparable size in the industry. A subsidiary company, Scientific & Technical Developments Ltd was set up under the leadership of Alec Smith to co-ordinate the group's research and development programme.

CSI, as a matter of general policy, do not manufacture on a speculative basis. They ask potential customers what they want-'you specify it and we'll make it.'

The management believe that in conducting any business the two vital extremes are research and development and marketing, in that order. First you have to formulate the product; finally you have to sell it. But what goes on in between-the planning-production processes and budgetary and cost control-have an important bearing on profitability and must be handled by specialists.

Britain undersells herself in overseas markets, Major Clarke believes. He says: 'The future of the British electronics industry depends very much on efforts made overseas. We in the United Kingdom have so much to sell. Original thinking in the past, such as radar, penicillin, jet engines, hovercraft have not always been successfully exploited. We too frequently leave our inventions for others to manufacture because the government is not always able to give enough financial support to home-grown ideas...'

CSI are a manufacturing enterprise in the full sense of the word. They buy in very little from outside. They do their own metal work, make their own cabinets and manufacture a wide range of components, from transformers and discriminator coils to tape cassettes for talking books, from optical lenses to components for compasses, from projectors to measuring instruments.

Although this calls for high initial capital investment, it reduces overheads on short product runs (the company tend to manufacture in terms of 500 to 5,000 rather than 20,000 or more of a particular item).

Once the original cost of the capital equipment has been written off, 'in-house' component manufacture proves to be much cheaper than subcontracting, with a consequent improvement in profit margins.

One can't help feeling that the success of CSI is Major Clarke himself–a man of persuasive charm and courtesy but nevertheless single-minded. To use an American expression he is a 'T-shaped' man, combining vertical depth of experience (in time) with horizontal breadth of experience (in space). And on the evidence, CSI would seem to be very much of a T-shaped organisation."

The property slump

By the end of the decade, the Clarke and Smith group were in a healthy position and in 1970, were approached by Sime Darby a Singaporean subsidiary of R.G Shaw a publicly quoted company based in London. They were interested in one of Clarke and Smiths subsidiary companies, W.F Stanley, makers of scientific instruments and who were in terminal decline at the time of the original acquisition in 1965. W F Stanley had a subsidiary in Singapore, Motion Smith, who were ship chandlers. The R G Shaw group were interested in buying into Clarke and Smith and W.F Stanley, after seeing the recovery and profitability restored by Clarke. A key figure in the negotiations was Sir Charles Miles the deputy chairman of the Charter Bank. The deal struck was that R.G Shaw would take over Motion Smith and buy a third interest in Clarke and Smith, with Sir Charles also joining the Clarke and Smith board.

To avoid the possibility of a future reverse takeover, Sir Charles proposed that Major Clarke should have a seat on the board of R.G Shaw, in return for taking the financial control of Clarke and Smith. However before the proposals could be finalised Sir Charles died suddenly. RG Shaw unexpectedly saw a downward turn and was taken over by its subsidiary in Singapore, thus transferring the Clarke and Smith shares to the Singapore Company, Sime Darby, who by this time were only interested in property and finance in the UK.

As we have seen, Clarke and Smith had acquired substantial property in and around their Wallington factory. The new chairman of the takeover persuaded Clarke to sell these properties to a proposed new company 40 percent owned by Clarke and Smith and 60 percent owned by Sime Darby/R.G Shaw. It was on this basis that a new office complex for Sime Darby would be built at Wallington, with Clarke securing additional finance from the banks, greatly enlarging the existing property holdings.

Unfortunately for Clarke, although the board minutes refer to the agreement, it was never formalised through solicitors. Before the subject of a formal agreement could be reached, the chairman of Sime Darby in Singapore was arrested and charged over a number of irregularities involving business affairs conducted in the Far East and Canada. This threw the company into turmoil and most of the existing Sime Darby directors were either removed or had resigned. Clarke was put in a serious predicament because he had to approach the new board and ask for approval for a scheme previously put before a board that had now been by–and–large discredited.

With the prospect of a property slump in the UK at the same time, the new Sime Darby board decided not to honour the previous agreements. Clarke and Smith were immediately placed in a serious financial predicament with huge sums of money owed to the banks for property they could not now sell because of the slump. With large interest payments to make, cash flow became a problem. Sime Darby offered Clarke and Smith the option of a loan or the outright purchase of the Stanley Group. Clarke evidently chose the latter but the subsequent funds paid off very little of the debt.

Luckily for Clarke the firm's bankers remained loyal but from 1975 to 1984 every penny of profit went towards repaying the interest on the loans made on behalf of Sime Darby. It was during this period that Clarke and Smith made many of its subsidiaries dormant and these probably included A.E.M. Although the records from this time are very patchy, it would appear that any remaining profitable production was transferred to the Melbourne Road, Wallington Site, allowing the disposal of much of the rest of the property portfolio to help reduce the loans. This retained the

Above: How the duplication process was handled in Australia during the 1970s. A Ferrograph Series seven recorder provides the master source with an intermediate controller and recordable Tapete machines. This operation required a fair amount of manual dexterity on the part of the operators overseeing the process. Each machine had to be loaded manually although some of the remaining process does appear to be semi automatic. It is thought that the tape was duplicated across in real time.

Left: This image shows the two versions of the Clarke and Smith talking book tape magazines against a standard compact cassette to illustrate the comparative size of the products.

The Braille link was first conceived by Major Clarke during a visit to New Zealand in 1971, it was to take a further two years before work was started on the development and at one point there were reportedly eight engineers working on the project. The National Research Development Corporation provided funding to the tune of £75,000 but pulled out after a couple of years. It has also been suggested that Clarke's interest waned and the project was handed to Freddie Bellis. The machine did not appear on the market until 1982 and at a cost of £5000.00 put it out of the reach of most people

The 1068 radio cassette was launched by Clarke and Smith in the summer of 1974 and received favourable reviews. It joined the gradually reducing range of equipment still being manufactured for schools such as the 1047 record player and 1048 VHF portable radio receiver.

Above: Final Clarke & Smith Products: The radio cassette and TV Sound receiver were some of the very last products to be assembled at Wallington. Much of the internal electronics were brought in from the Far East and were fraught with quality control issues.

asset base of its largest properties which prevented the companys' insolvency.

In the late 1970s a court action was brought against Sime Darby for a breach of contract to the tune of £3 Million by Clarke. The deputy judge hearing the case, Sir Douglas Frank QC, dismissed Sime Darby reluctantly, adding

"There must be judgement for the defendants, he said, notwithstanding that their Board had behaved in its corporate capacity in a way in which it would not, he felt sure, dream of behaving in their private affairs".

The judge also said, "I am forced to the conclusion, reluctantly, that the parties did no more than agree to agree, and at no time reached agreement on matters fundamental to the proposed contract so as to constitute a binding contract".

During these troubled times Clarke formed a new company, East Cheap Finance Ltd, subsequently selling the patent rights of the Tapete technology to this new concern. The idea was that should the group collapse, he would still have control of the very lucrative talking book rights and be in the position to continue the manufacture of the Tapete and associated equipment.

Vortexion

Throughout the financial crisis and the resultant closures of some of the subsidiaries, Clarke still managed to keep an eye open for a bargain, acquiring at least one further well established firm, that being Vortexion Ltd of Wimbledon. The firm was a notable manufacturer of high quality public address amplifiers, mixers and later tape recorders having been formed in October 1936 by two brothers, Sidney and Edward Brown. Vortexion was born out of a small shop trading under the name of Brown and Salter, who had been a supplier of components, later specialising in transformers. Nothing further is

known about Mr Salter who does not appear to have featured in the later history of the firm or in the formation of Vortexion Ltd.

The firm originally traded from 182 The Broadway, Wimbledon and expanded a little further along the road into premises at 257-263 The Broadway. With the unexpected death of Edward Brown in the February of 1942, Sidney's wife Dorothy assumed the position of a director, with the husband and wife team being the driving force behind the firm for many years. Although never a large concern, at their peak in the 1950s, Vortexion products sold in relatively large numbers as evidenced by the survival rate of some of this equipment today. By 1937 their first portable amplifier was introduced under the Vortexion brand name, capable of operating from the mains, or off a 12V battery, drawing some 6 amps. The CP20 could deliver a 15W output, and received a favourable review in the October 1st issue of Wireless World of that year.

By the outbreak of war the CP20 had been joined by an amplifier chassis featuring a pair of 6L6s in the output stage. Vortexion claimed that many hundreds of these were in use by the ARP and government. The claimed output from this amplifier was 50W. Post war they produced a recording amplifier type AD47 for disc recording purposes and interestingly a Magnetophon recording and replay amplifier in the summer of 1947 specifically to drive the German originated magnetic tape recorder deck of the same name. This development makes them an early, if not indirect entrant into the tape recording field as the UK did not see magnetic recording commercially introduced until a little later with the professional EMI BTR1. The domestic markets would have to wait until 1948/9 before the emergence of a complete home tape recorder such as those produced by Ferrograph and the Thermionic Products "Soundmirror". Vortexion did not produce their own self contained recorder for these markets until early 1953 a subject which will be returned to shortly. In early 1949, the firm announced a stereophonic amplifier using as the output valve in each channel, a single PX4. Unfortunately, nothing further is known about this development although the equipment continued to be advertised in one form or another throughout the early 1950s. Much of the post war design work was carried out by George Ferriman who joined Vortexion in January 1946 after being demobbed. Ferriman remained with the company until shortly before the Clarke and Smith buyout.

Probably though the best known of the Vortexion range which appeared around this time was the "Wimbledon" also later known as the "Super Fifty". This used as the power output, a pair of 807 beam tetrodes in class AB2; at first glance these may appear to be a slightly unconventional choice of valve as they were more often found in the RF or driver stages of transmitters and examples will be found in the No19 set and various amateur radio transmitters of the period. Vortexion got them to work well enough in the amplifier and the 807 based model was produced for a number of years until the change to EL34s in the early 1960s. The decision to use the 807s was probably down to the large numbers of these that appeared on the surplus markets in the immediate post war years and the fact that they were renowned for their robust construction, ideal in fact for the punishment they probably received in the process. The "Wimbledon" was a substantial piece of electronic engineering fitted with high quality transformers, on a substantial chassis designed and produced by Vortexion themselves. The reputation for reliability was supported by a number of popular features, such as a wide range of output tappings on the output transformer, and the reputed ability to drive a 30 ohm microphone input with a hundred meters of twisted unscreened cable without interference, due to use of balanced line working.

Throughout the 1950s and early 1960s the amplifier equipment was joined by a small range of high quality mixers. Some of these were produced with 3 or even 5 identical channels for low impedance microphones of the balanced line type while others allowed for the mixing of a gram input and microphones. Another type, marketed as the 3/PPM and first introduced in the very early 1950s, featured a peak programme meter for accurately monitoring the resulting signals. Much of this equipment was designed for professional applications with the basic design behind these remaining virtually unchanged for a number of years. Vortexion eventually entered the tape recorder market in 1953 with their first "A" model, followed by the WVA and WVB series. The design changed very little until the final model, the stereo CBL6 of 1967 which was considered

VORTEXION 15W

Type CP20 AC and 12-VOLT DC AMPLIFIER

THIS small Portable Amplifier, operating either from AC mains or 12-volt battery, was tested by "THE WIRELESS WORLD," October 1st, 1937, and has proved so popular that at Customers' demand it remains unaltered except that the output has been increased to 17.2 watts and the battery consumption lowered to 6 amperes. Read what "The Wireless World" said :—

"During tests an output of 14.7 watts was obtained without any trace of distortion so that the rating of 15 watts is quite justified. The measured response shows an upper limit of 18,000 c/s. and a lower of 30 c/s. Its performance is exceptionally good. Another outstanding feature is its exceptionally low hum level when AC operated even without an earth connection. In order to obtain the maximum undistorted output, an input to the microphone jack of 0.037 volt was required. The two independent volume controls enable one to adjust the gain of the amplifier for the same power output from both sources, as well as superimpose one on the other, or fade out one and bring the other up to full volume. The secondary of the output transformer is tapped for loudspeakers of line impedances of 3, 7.5 and 15 ohms."

AC and 12-volt CHASSIS with valves, etc. £12 12 0

Or in Rexine Case with Collaro Motor, Piezo P.U. and Mike Transformer..... £17 17 0

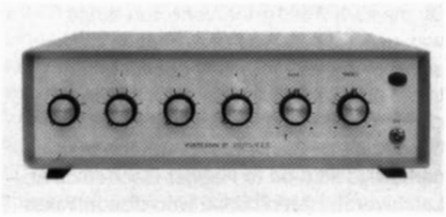
AC only CHASSIS with valves, etc. £8 18 6

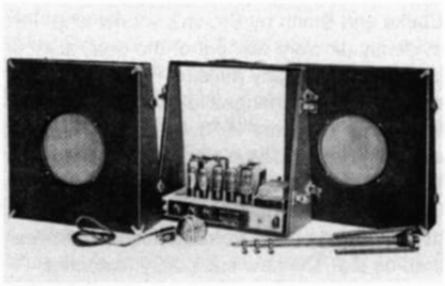
Or in Rexine Case with Collaro Motor, Piezo P.U. and Mike Transformer..... £14 0 0

Gauze Case for either chassis 12/6 extra.

SEND NOW FOR FULL DETAILS.

Vortexion Ltd., 182, The Broadway, Wimbledon, S.W.19. 'Phone: LIBerty 2814.





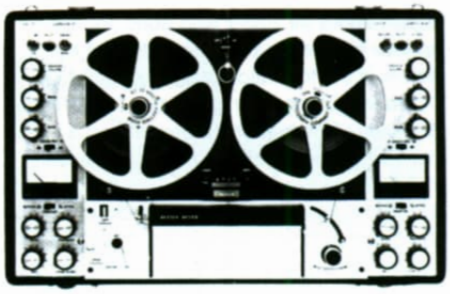
Top: The Vortexion 50/70 transistorised amplifier as available in 1970.

Above: The famous Wimbledon Super 50 this early example dates from an advert that first appeared in 1946 and remained little changed for a number of years.

Left: The CP20 15W AC Mains & battery amplifier as advertised in 1939 and remaining in the companies catalogues for a number of years. The early versions featured an American range of valves which included a pair of 6B5 double triode valves.

Top: Vortexion specialised in a range of high quality professional mixers. The Type 3-PPM first appeared in 1950 and was still being advertised as being available as late as 1970.

Above: The Vortexion self contained dance band portable P.A. system available during the 1940s.



Left: When Vortexion entered the semi professional recording market they had already gained some experience with the design and manufacture of amplifiers for magnetic tape and direct to disc recording. A rare example of an early WVA tape recorder outfit pictured here on the left, first appeared in early 1953 and features the Series 2 Wearite deck, although it was also briefly offered with the Truvox deck as an option. Vortexion continued their range of recorders based on this design until the demise of the Wearite deck in 1968. A new model that briefly appeared featuring the Ferrograph Series 7 deck, and known as the CBL7T can be seen above

by some to be the finest stereo reel to reel tape recorder ever produced in the UK. All of the machines used the Ferrograph Wearite tape transport making Vortexion one of the largest users of the deck with Clarke and Smith a very close second. With the demise of the Wearite deck in early 1968, Vortexion briefly marketed the CBL7/T. This was designed around the ill fated Ferrograph Series 7 deck launched later that year. The new range was abruptly withdrawn after a considerable investment in the development of the new recorder, with the subsequent marketing yielding few sales. The late 1960s also saw Vortexion make the move into transistors and one of the first of the designs to appear was the CP50, a 50watt amplifier. This was still being advertised under the CSI banner as late as 1979. Vortexion do not appear to have attempted to produce any Hi-Fi amplifiers choosing it would seem, to remain in the more specialised markets of sound reinforcement.

With the death of Sidney Brown in early 1972, the firm was subsequently sold to Clarke and Smith by Brown's widow who evidently did very well out of the deal, also securing a company pension from Clarke and Smith. The changes in ownership were finalised in February 1973. Dorothy Brown also remained a director on the board of Vortexion well into the late 1970s, anecdotally Clarke was once heard to bemoan years later that she made more from Vortexion each year than he did! The new subsidiary remained largely autonomous until the January of 1974 when the entire production was moved to Wallington, although adverts appearing in the trade press were still showing the old Wimbledon address as late as July 1975. The original Vortexion factory on the Broadway, Wimbledon was finally disposed of in early 1976. The amplifier range continued to be made alongside the Clarke and Smith schools equipment, with development work and production already in progress on the CSI Vortexion System 2000 and an early announcement in the Wireless World of July 1975 proclaimed that the new amplifier "combined the aesthetics of design in the domestic field with the near flexibility of a modular system". This range was joined in the summer of 1979 by the VTN30 a 3 channel 30w amplifier, and later the VTN5a, an early induction loop amplifier. The final designs introduced were the Series 3000 during the 1980s with the final development appearing as the Series 4000; these were to include induction loop amplifiers such as the model 469, and a return to the battery powered amplifier in the 455 50 watt mixer amplifier that harked back to the CP50. By the early 1990s, the Vortexion range was generally starved of resources with some of the last company accounts from the middle of the decade showing the division as being completely dormant. With the demise of Clarke and Smith the brand name was sold off to Hagger Electronics of Letchworth, Hertfordshire who discontinued all but the induction loop amplifier range. This legendary brand name still survives today (just) in this specialised market.

The 1970s also saw the loss of Alec Smith who died unexpectedly in late 1972 at the age of 66. The loss to Frank Clarke of a close friend and long time business partner was incalculable. As we have seen, Smith's development and design work was the lynch pin of much of the early success of the firm in the many areas of the electronics engineering it had been engaged in and later as the head of research of the STD division, this role would be given to Freddie Bellis. He assumed the position in early 1973, a post he subsequently retained until 1985.

Braille Link

There was however one development in the doom and gloom of this period that was the brainchild of Clarke. This was Braille link, a system of soft Braille, and was the first invention ever in this field. The idea was conceived after a visit to the New Zealand Foundation for the blind. Work was started on the device in 1973. He later went to the National Research Development Corporation for financial help; they provided £75,000 but pulled out of the project after a couple of years. Evidently Clarke also lost interest in it and put the braille link design work in the hands of Freddie Bellis. Its subsequent development enabled a blind person to interface with a computer. The design concept was eventually adopted and is still in use today. Briefly, when the equipment is interfaced to a computer, it turns its output into a stream of brialle characters that are created by a matrix of tiny pins in solenoids that create the Braille characters that are read by the user just as though they were printed on a page, and this can be done at high speed. The Post Office Prestel service also adopted it making their text based service available to the blind.

The first machine was sold in 1980 and by 1996 Clarke and Smith had sold 60 with a dozen of these sold to the US. The cost at the time was over £5,000 each with a development cost over ten years of some £500,000. Although the development was innovative it came at a time when the computer industry was still in its infancy. For that reason the system would never make any money for the firm, until computer systems such as the IBM PC and its compatibles first appeared in 1984 making the technology more practical and affordable. Nevertheless, in 1982, Frank Clarke won a Recognition of Achievement award for the work carried out on the Braille link invention. Freddie Bellis it appears received nothing for his efforts.

The New Scientist contributor, Peter Marsh wrote a lengthy piece in an early 1982 edition of the periodical and this extract typifies Clarke's outlook at the time.

Clarke is sanguine about the outcome of his work. He is by no means a struggling inventor; his company makes money from its other activities... he has a chauffeur driven car and wears expensive suits. But he confesses that if it had not been for his successes in these other areas of business, so giving him the money to pour into his pet project, the

Braille device would never have seen the light of day. Even though the gadget is a success, Clarke does not expect much in the way of financial reward. "This is why the leaders in technology will not consider the world of the disabled – there's no money in it".

Throughout the 1970s and into the 1980s the Schools ranges were still in production although investment in these products was now in terminal decline having been switched to other areas of the business, allowing the likes of Coomber to step in and take a fair chunk of the educational market. A court tape recording system was developed for Saudi Arabia that was marginally successful, along with a staff training system based on the Tapete for Lloyds Bank, and using modified equipment originally developed for the RNIB.

The group whilst considerably reduced in size due to the troubled 1970s still managed to hold on to one or two of the subsidiaries and even to acquire others. The number of trading companies had been dramatically reduced from 17 to just 5, the others held as dormant companies largely for tax advantages or future expansion. Some of these reductions included building and maintenance firms such as Siggs and Chapman. Those that remained included H.A. Gaydon which specialised in laboratory equipment for paper, packaging food and textile markets. The most notable product was the film gauge for cast blown film products, accurate to 0.1 micron. They also produced a one off special gold plated carousel tie rack for HRH The Duke of Edinburgh after he had complained about the difficulties of keeping a large collection of ties under control. Transtech Transformers, which was founded in 1977, joined Clarke and Smith in 1991 after being rescued from the hands of the receivers, Bletchley Engineering, a specialist manufacturer of precision die castings and the supplier of the die cast chassis for the final Tapete model the TB2000. The final company in the group was Oxford Welding Equipment a long established firm originally founded in 1936 and acquired by Clarke and Smith in 1991. The firm produced the Oxford AC/DC sets and a 180A petrol driven set. Whilst some of these acquisitions were a success such as Transtech, others were not, with Oxford Welding turning into a financial disaster reportedly costing a million pounds in the process.

Wireless for the Blind

It is a common misconception that Clarke and Smith always made wireless for the blind, in fact many other firms had at one point supplied sets bearing the 'British Wireless for the Blind' name. The more recent of these included Roberts Radio who had also supplied the TV sound only portable receiver, the TVS1. Clarke and Smith did not really enter the BWFB market until the early 1990s when they produced a TV sound tuner in a compact toaster style format. This was followed by an innovative radio cassette recorder. Frank Clarke only got the deal by supplying the equipment to the BWFB at very close to the actual cost of producing them, expecting to be able to sell the rest of the production run at a profit. The ploy did work after a fashion, but the problems of incorporating a mass produced tuner module from the Far East in relatively small orders of 5000 or so made it difficult for the firm to iron out the quality control issues that became apparent. The same issue plagued the similarly sourced cassette mechanism of the companion "toaster" cassette player. With this and the combination of the Wallington produced amplifier, control electronics and case and despite picking up awards, the BWFB radio cassette was never really profitable. A further abortive attempt to re-enter the schools market was also made with the appearance of an overly specified and similarly priced music centre that also featured the same problematic tuner as the BWFB series. Another unsuccessful attempt was the schools versions of the toaster cassette player, adapted for use with multiple headphones for language lessons. Other opportunities were also lost due to long development times resulting in the loss of contracts.

Clarke and Smith had become heavily reliant on the Tapete talking book contract with the RNIB and had been so since the 1970s. The format was now of considerable age and the RNIB had been looking at various alternatives for some time. Work had commenced as far back as 1982 just before the Compact Disc was launched. In 1984 in close collaboration with Philips, the first 12 hour audio CD was produced. Later work was done in collaboration with Nimbus and Rediffusion to develop a RNIB format. The audio parts of CD-I were tried out but this later shifted to ADPCM and MPEG. The RNIB were nervous about the investment which came in at around £20 Million plus. Once international agreement had been ratified the final phase of the development was with Labyrinten Data, Plextor and IFLA which resulted in the RNIB adopting the Digital Accessible Information System or "Daisy" digital talking book technology and this remains the standard in use today.

Clarke and Smith knew that they were unlikely to get a look in with the new format on the basis of "once bitten twice shy" and it is a matter for speculation as to how early they got wind of the fact. It was also in the late 1980s that the RNIB commissioned another company to reverse engineer the housings and manufacture the Tapete cassette. The move was designed to make the RNIB less reliant on Clarke and Smith and in doing so took a large element of the contract away from them. Estimates had put the talking book contract profit at some £500,000 per year and certainly more than enough to hide the problems elsewhere in the group. Orders came down from Frank Clarke to make the players unreliable with anything but the genuine CSI 778 cassette housings in use. This proved impossible to do without also affecting the replay and reliability of the genuine cassettes themselves. One of the CSI engineers at the time was heard to remark "It's exactly what we would have done, had they asked us".

In January 1997, Major Frank Clarke died unexpectedly at the age of 77, this and the final loss of the RNIB contract shortly after was the final combination of unfortunate events that would see the closure and winding up of the company by Mrs Frances Clarke, the Major's 2nd wife. In fact the company was subsequently listed at Cork Gully, Hill House in Bournemouth but was finally wound up on 15th February 2004.

The final account available from 1997 showed losses of over £86,000 on the year. The staff levels had dropped to just 49; compare this to the hundreds employed during the 1950s and 1960s. As we have seen, Vortexion ended up with Hagger Electronics with the only other survivor, Transtec Transformers surviving the closure. The thin film gauge, developed by H.A Gaydon was bought by Ron Hannah, a former sales manager of the group, from the receivers and it is still marketed by Hanatek Ltd of Worthing, Sussex.

The story of Clarke and Smith is in some ways quite remarkable and mirrors much of Britain's light industry and what we used to be good at. It would be fair to say that the fact that the firm managed to keep afloat until the late 1990s is no mean feat when one considers the market pressures and the tremendous resources needed for development with the constant threat of undercutting from overseas concerns who have the financial muscle and cheap labour to make just about anything you want in quantity. The impact the talking book had on tens of thousands of people worldwide cannot be under estimated and is very much a credit to Major Frank Clarke and his close friend and business partner, Alec Smith for helping to shape and develop the technology during the 1950s and 1960s.

Acknowledgments:

I would particularly like to thank Mark Walford, former Vortexion sales executive for Clarke and Smith, Brian Panton former Clarke and Smith engineer, George Ferriman, former Vortexion engineer, Mrs Frances Clarke, Director, Clarke and Smith and also BVWS members John Howes and Bill Milne for their help and support.

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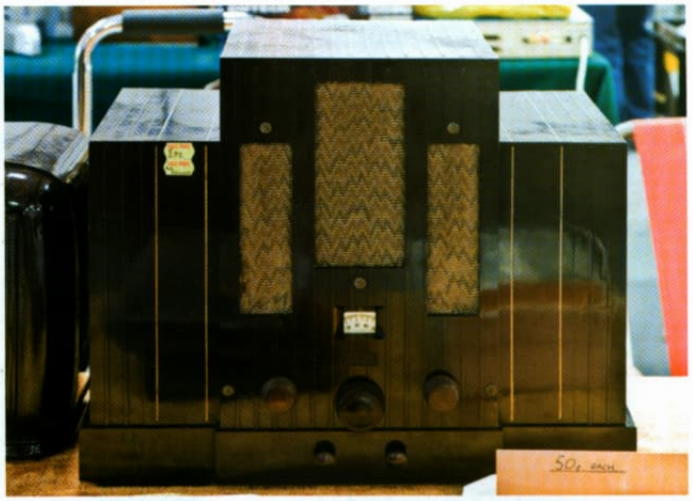
Images: All images are of examples of Clarke and Smith equipment from the author's collection except The Model 12 Gramophone and the RP2-5A record player. I would like to thank Jim Mc Lauchlan and Ross Muir of the Museum of Communication, in Burntisland, Fife for helping to arrange for these to be photographed.

NVCF!

photographed by Carl Glover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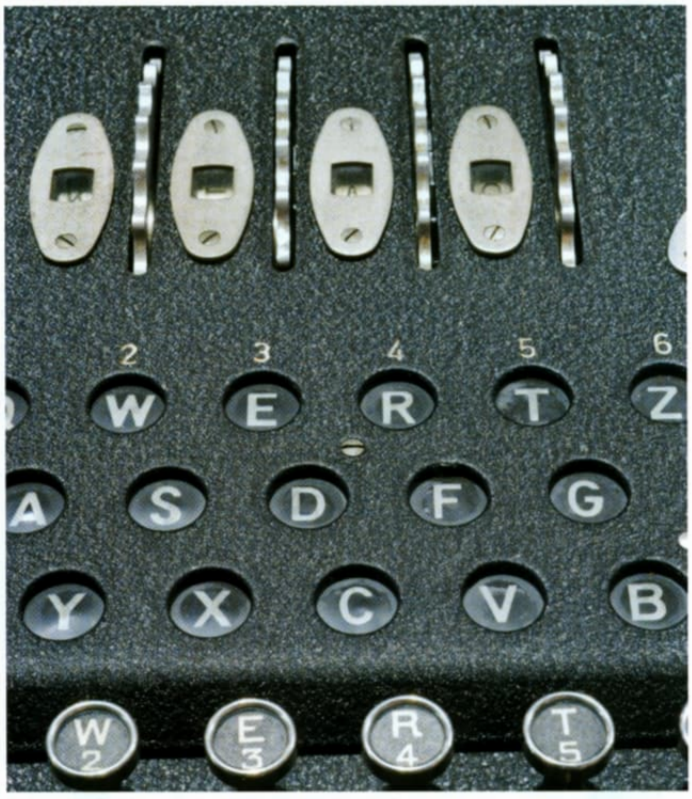
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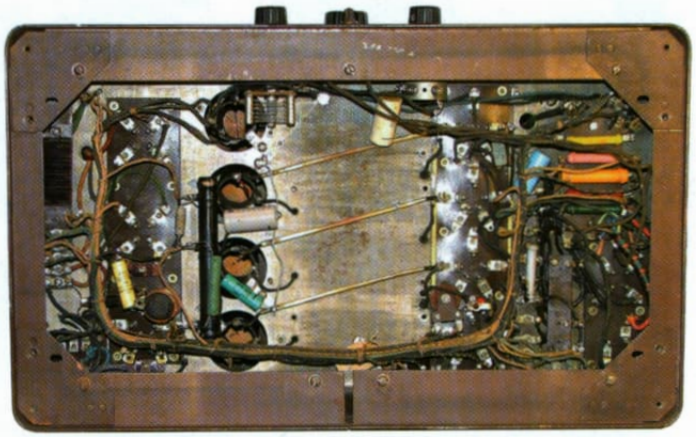
WATKINS COPICAT

Restoring a Stewart Warner 950 from 1930 by Gary Tempest

I was at the end of a Harpenden auction congratulating myself on not buying another radio that then and now I don't have room for. But this triumph was short lived, for out in the car park I spotted Louis Coakley with this radio, about to be loaded into a vehicle, for return to the wilds of the north. It hadn't sold and soon his silver tongue was working as to why I ought to buy it, why I was the right person for it and so on. Eventually a price was reached that I couldn't walk away from and the radio was then being loaded into my vehicle for a shorter trip south.

The restored set



Underneath the original chassis

The beautiful, ornate escutcheon of the Stewart Warner 950

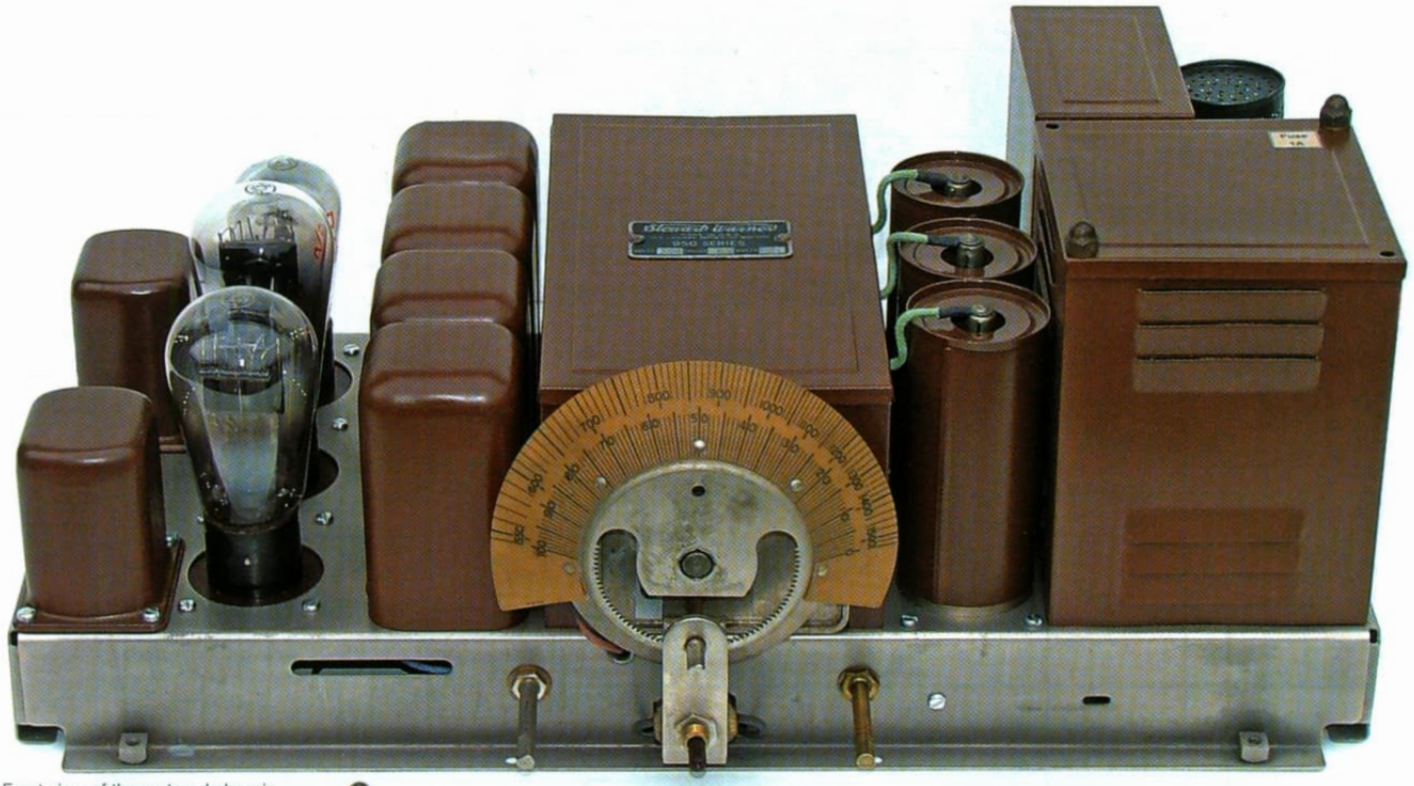
What tempted me was that it was 8 tube, obviously made in the USA but marked "200 – 260 Volts" (at a very non-green 130 W). It was different from the run of the mill stuff, having that elaborate construction that only US–made TRF's had. It was all complete with its fancy knobs, a decent dial and even had its tube shields. Better still no one else wanted it, even at a modest price, and so I wouldn't feel any "it's over restored" guilt. As you will see, if you read on, I had a lot of interest and pleasure from making this into a nice playing radio again.

It was made in 1930 at a time when metal cabinets were vogue and uses an inverted tray type chassis. Being a 'straight set' with three 24 tuned RF stages it has quite a lot of gain and so extensive shielding is used throughout. Following the RF tubes is a 27 anode bend detector, a 27 phase splitter and a pair of 45's in push-pull for the output amplifier. HT is derived from an 80 rectifier with extensive smoothing and filtering.

The front panel controls are an antenna tuning capacitor, mains On/Off switch, volume and tuning. This has a 3:1 reduction drive, via a gear wheel meshing with teeth in a drum mounted on the tuning capacitor. The drum carries the bulb illuminated scale calibrated with 0 to 100 and wavelength.

The downside of all the metal and shielding is that the radio cabinet alone weighs in at 45 lbs! The table, which houses the loudspeaker, is an easy lift in comparison. The two together were advertised, by Stewart Warner, as being the "Consolette Ensemble, comprising the Table Cabinet Receiver with Dyphonic Reproducer". "An arresting value at $113 less tubes." It arrested me, because it sounded like an awful lot of money. I made some enquiries and was told that it would have been 7 weeks of the average US wage at the time (including tubes). The two were finished in gold crackle finish with black detailing.

New Zealand member Peter Lankshear, who has an excellent appreciation of the early days of radio, explained that the USA



Front view of the restored chassis

Rear view of the restored chassis

dominated sales 'down under' up until the mid thirties. The reason for this was that their radio conditions were similar to those in America. Stations were far apart and in order to get reception in rural areas many more tubes were used than were found in British radios of the time. Over here there were more stations and receivers were relatively close to them so three or four valves was the norm.

Since I wrote the article on the Pilot Super Wasp and used some of his previous copy, Peter has become a good friend and mentor. I said to him (chatting via email) how much I was enjoying the 'old radio' hobby and that I had been back into it for 8 or 9 years after a long break. Amusingly he replied that he had the hobby for 67 years non-stop. Certainly upstaged there but he has been great to discuss my ideas of the workings of these seemingly simple radios (see Ponderings).

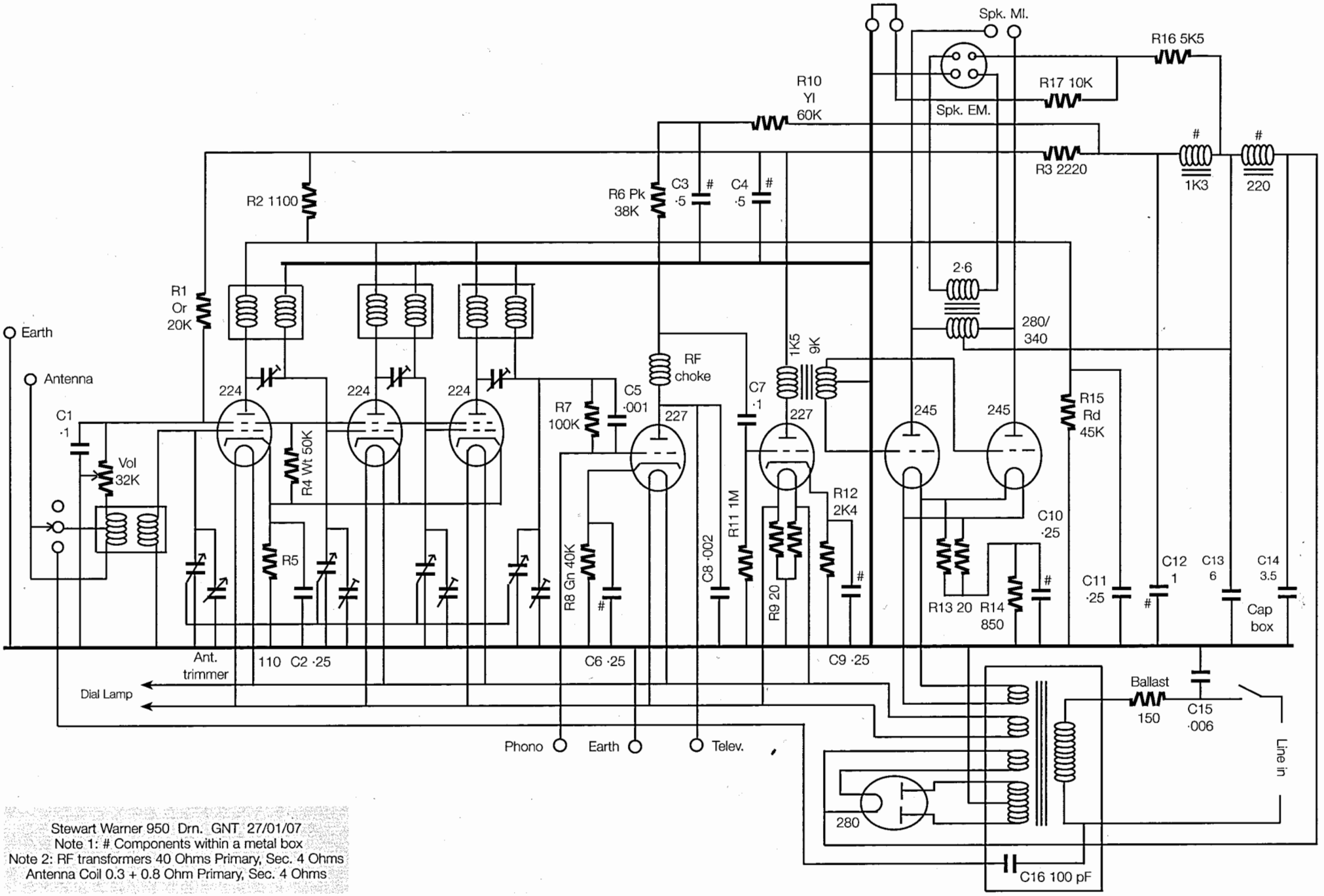
It was confirmed, when I removed the bottom cover, where this radio had come from. There were lots of add–on capacitors marked "Made in Australia".

I asked member Alan Douglas about it and he kindly sent me a copy of the detailed Service Manual.

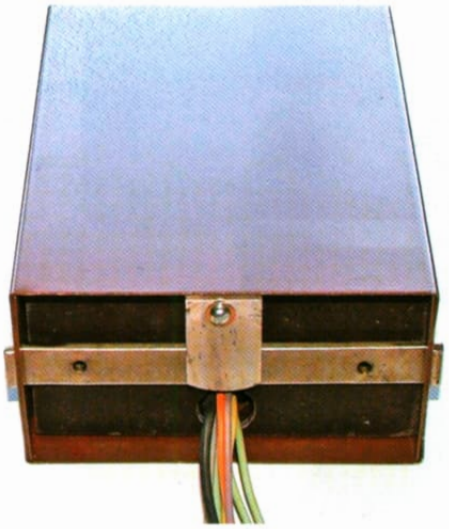
Getting Started

After a good look around, having taken off the metal bottom plate, it was remove the chassis from the metal cabinet. This is normally quite simple but here the problem was taking the weight of the chassis inside the confines of the cabinet. The only way, after removing all the tubes, was by laying the cabinet on its back and sliding it out. I put it back by lowering it with strong lengths of cord and pieces of protective cardboard over the internal paint.

One snag was that the tuning capacitor shaft fouled the bottom of the pretty dial escutcheon and there was evidence of this happening in the past. It would have been nice to remove it before taking out the



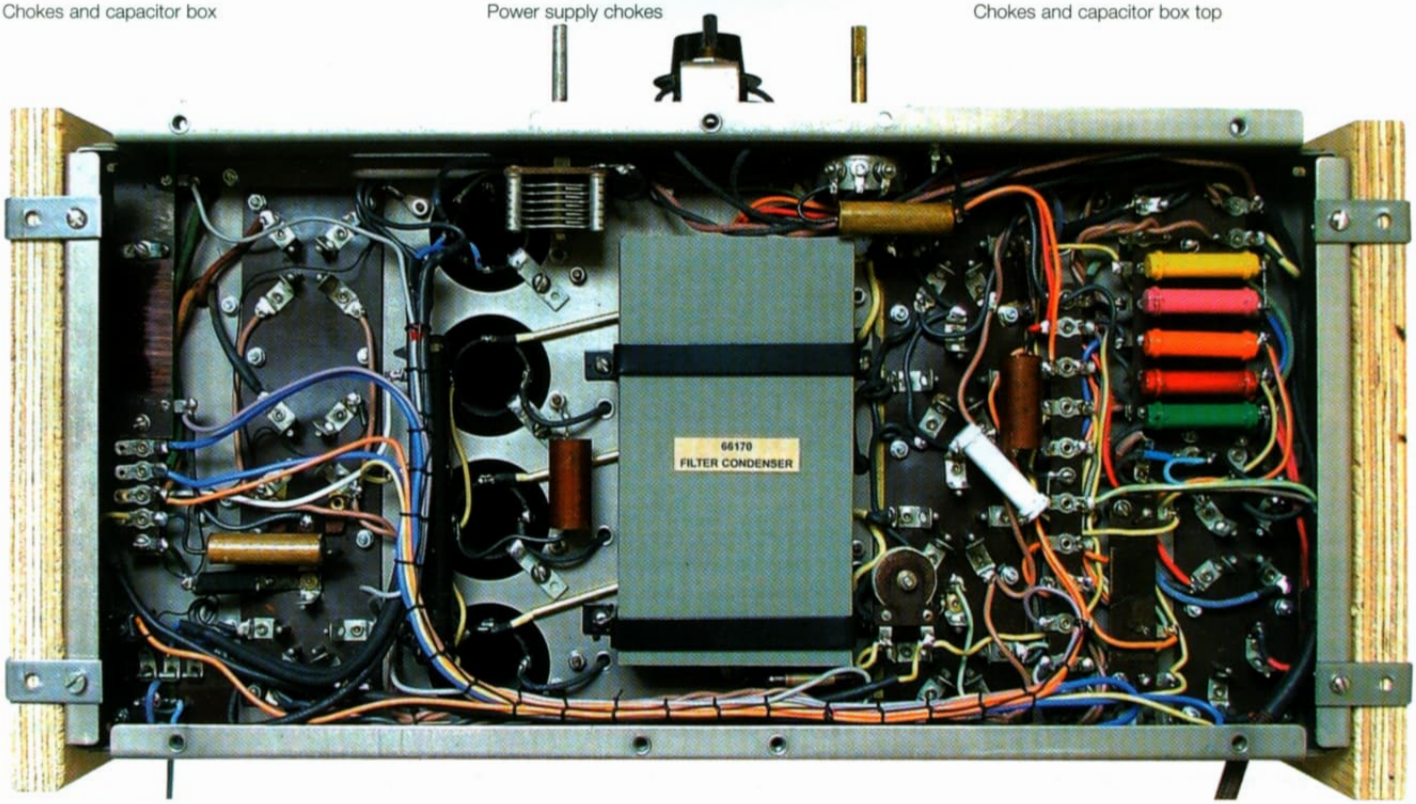
Stewart Warner 950 Drn. GNT 27/01/07
Note 1: # Components within a metal box
Note 2: RF transformers 40 Ohms Primary, Sec. 4 Ohms
Antenna Coil 0.3 + 0.8 Ohm Primary, Sec. 4 Ohms



Chokes and capacitor box

Power supply chokes

Chokes and capacitor box top



Underneath the chassis

chassis but the nuts for the fixing screws are not easy to get at with the chassis in-situ. For putting it back, after the chassis was in place, I made two bars from brass. These were tapped 8 BA so that it's possible to fit the top before swinging the bars into position for the bottom and much less accessible fixings.

The Chassis

Basics

I started to clean it and as I did so realised that items would have to be removed down at the power supply end. The two chokes and many of the decoupling capacitors were housed inside a metal can filled with pitch. Things had obviously got hot inside here and much melted goo had got into the tube bases and surrounding territory. The bases are built into Paxolin panels, one for the rectifier and ballast resistor, another for the RF stages and detector and one for the audio. In the case of the RF and detector, brass plates are used between layers, linking common tube pins.

The panels were secured by brass rivets and I drilled off the bottoms, whilst holding the heads by soldering a piece of 16 gauge wire to them. It worked, as not much torque was required.

Another riveted item, that had to come off, was the audio inter-stage and phase splitting transformer that had open circuit secondaries. Rewinding this was covered in Bulletin Autumn 2007.

I wouldn't be able to replicate the rivets and so everything was bolted back with pan head screws, nuts and washers.

There were many "Made in Australia" components used for patching out original items, sadly all gone including the main HT reservoir and smoothing capacitor box. I made a dummy item for this using the layout diagram in the Service Manual as a guide. It was fairly simple to make a block of wood, with the bottom routed out to take modern electrolytics. The block was covered with glued on grey half 'mil' art cardboard, given a label, and finally rubbed over with French Polish for a period look. It was fixed in place, as it would have been originally, with two mild steel straps.

The screened wires around the RF stage would need replacing as the rubber insulation was crumbling inside the exposed screen.

I didn't intend to do it but incrementally I arrived at half way to a total chassis strip. There was some chassis rust and not much plating underneath so the easiest thing was to remove everything and take the chassis, along with other small parts, for replating. It had been done in nickel and the man at the workshop said he would do it in the 'old nickel' as the modern would look incorrect. When I collected it, it looked much like the original except for a near perfect finish.

A nice touch - the original inspection label

Carbon resistor replacements

The Choke and Decoupling Capacitor Box

I decided to empty this because I wanted new decoupling condensors inside the box. Mounting them externally wouldn't look right to me. Of course by the time I had done this the high resistance second choke was open circuit. However, this was an easy rewind with 40 gauge wire, using side cheeks and random winding. What did surprise me was that it measured 85H on my digital LCR meter.

Interestingly the original used side by side winding, stopping short of the former edges by a couple of mm's, with incredibly thin interleaving paper between layers. This paper is essential for a tall winding if it isn't going to collapse. The book "Coil Design and Construction Manual" by B.B. Babani says that "... beyond say 36 gauge it is not possible to insulate the layers in this way ..." But they did it and must have been very skilled to handle such fine wire and paper. Possibly it was easier for them than making formers with cheeks. Certainly these do take time to construct and making up to lead out wires is more difficult. I'm told that a method called 'stick winding' was also often used, where several coils were wound along the stick, before they were taken off and all the ends made off.

The low resistance choke was fine and cleaned up well. I left it on a loaded soak test for some days with no ill effects.

To remove these items from the box I used my wife's oven on a day when she was out for the morning. I thought that if I left both front and back doors open and had the extractor fan on the smell would have gone by her return. Not so of course and she sniffed it as soon as she came in. Her eagle eye also spotted a few tiny pitch marks I'd failed to clean off the white paint of the cooker. I've said to her many times "you should have been in the police force". Then a few days later Sunday came around and in went the roast. "Come and smell this!" was the cry and I had to admit, even with my de-tuned nose, the odour of the 'black stuff' was definitely there. "I hope you're going to enjoy your roast potatoes now". "Yeah! I bet they'll be fine" which thankfully they were. Some of the best I've tasted so maybe a pitch glaze adds something. You never know this might be on a cookery programme one day.

I wasn't going to refill the box but as it was a likely chassis lifting handle it needed some reinforcement. Also, I wouldn't have wanted to drill holes, for mounting the choke and tag strips for components, directly in the box. The chokes, with aluminium bands to hold them securely together in lieu of pitch, were mounted on a base plate, made from 10 mm MDF. A sleeve made from the same material was used for the capacitors (see pictures).

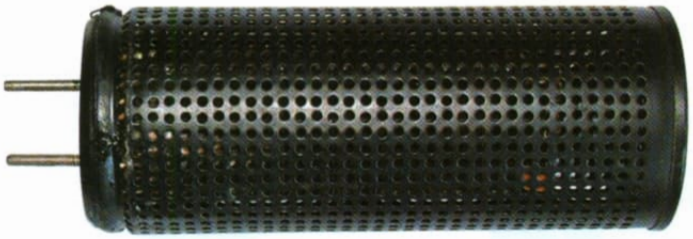
Front Panel Controls

A nice thing about these early sets is being able to take many items apart which later on may not be possible. The mains switch and volume potentiometer have interesting detail. The switch is rotary and has brass fixed contacts and a beryllium copper rotor, which is turned by a slot in the Bakelite shaft. It was high resistance and intermittent but cleaned up and well–greased seems reliable. As it may not come apart again, without the bent over tags breaking off, I decided to give it an easier life and included a mains relay in the transformer can. This had lots of spare room to hide it and a fuse holder for a supply fuse. I think the relay should be an asset as the switch can now go to several K Ohms before the relay doesn't operate. The down side is that the switch current will be very low and the contacts may not self- clean but maybe they won't need to with the grease.

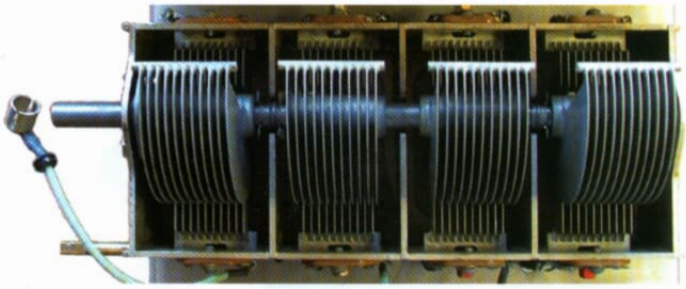
The pot has a carbon track with two large surface rollers rotating about it. It is open back but is still good after all these years.

Speaker

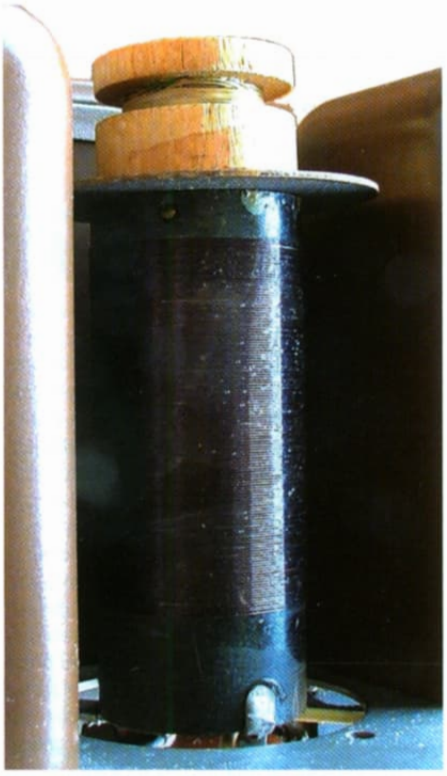
When I first took the speaker out of the table I was struck by the beautiful condition it was in, the cone was perfect as was the soft leather surround. The field coil was open and rewinding this was covered in Bulletin Summer 2007.



Ballast Resistor



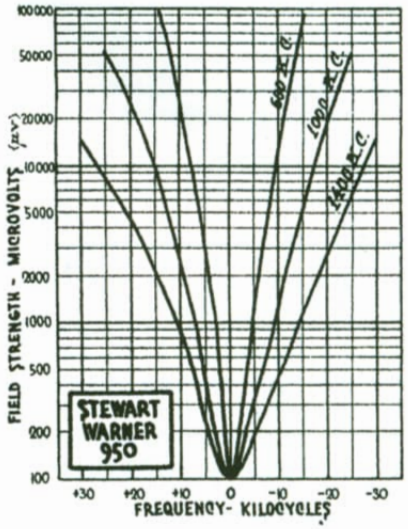
Tuning Capacitor



RF coupling transformer

Inside the cleaned up volume pot

Inside the mains switch



Selectivity Curves Taken of the Stewart-Warner

Reproduced from *Radio Magazine*, 1930

The speaker field is not used for smoothing. It is simply in shunt across the HT line via a 5K5 resistor. The radio had output connections, straight off the 45 anodes, for a magnetic speaker (high impedance) and the radio was available without the table with its internal speaker. When used like this a link is provided to place a 10K resistor across the HT supply as a dummy load. There was no cover plate over these terminals and I wonder how many, including me, received shocks from these 'hot' connections. I decided to leave out the wires for the anodes, including that from the detector, to a socket marked "Telev" which presumably was for a television sound input (back in 1930!). I left that for "Phono" and also the link for the speaker field dummy load. This is handy for use with a PM speaker, giving the same HT voltages, and I used it whilst getting the radio working. I did fit a small cover plate over the HT connection, for when the link is not in use, secured by a screw into the adjacent earth terminal,

Covers and Screening Cans

As always it's the cleaning and getting rid of rust that takes the time. The chassis was easy but there are an awful lot of covers and screening cans. Most were in good shape but some, particularly around the ballast resistor, mains transformer, and choke and capacitor box weren't. These items had got hot and the paint had fallen away to be replaced by rust of almost the same colour. Once I re-spray some parts I have to do the rest; even a paint of a close match 'grins' something awful. I over sprayed the acrylic paint with Krylon acrylic satin lacquer, to kill the too bright look; it's much better than the matt finish I've used in the past.

Resistors

Many of the wire wound resistors were open circuit and already had substitutes bodged across them. I did a neater job and hid items underneath. Most of the carbon resistors were too out of 'spec' to be left. They were of a type I haven't seen before being solid painted cylinders of carbon. I made replacements using Paxolin tube with either one or two 3W metal film resistors inside. These components were very under run but I did make tests with resistors temporarily sealed inside tubes. They soaked for days with no ill effects and quickly pulling them out of the tubes did not reveal excessive surface temperature. When the tubes were painted with Humbrol model paints they looked close to the originals.

The Ballast Resistor

This was intermittently open circuit and was cured by removing the crimped on perforated steel can and cleaning and tightening the mounting pin connections. Once I had given the can a good soak in phosphoric acid it was sprayed with black high temperature paint. This device really is a power eater soaking up 35 W.

I understand that these ballast resistors were used as an attempt to cater for the fluctuating supply voltage of the time.

Alignment etc

I asked Peter what sort of sensitivity I could expect from the radio: his reply was "... about the same as a Superhet, without an RF stage". This was a useful yardstick and matched what I was getting. I was down in the micro-volts (on the -80 range) whilst tweaking the only two trimmers you are supposed to touch. When the alignment is close then the Service Manual "phasing stick" (insulated hacksaw blade) method is quite sensitive and easy to do well with a large scale mV meter across the speaker terminals. I don't think I could have done it by ear as Stewart Warner suggest.

Having got it aligned, then as the earthed stick is moved close to the detector gang the meter dips by a few dB. This having no trimmer is the reference and when repeated for the second and third gangs (the ones with trimmers) then these dipped by about the same amount. This is bringing the stick up towards the end fixed plate at the manufacturers recommended frequency of 1 MHz (gang a little less than half open say). The first gang doesn't matter of course because there is

The radio before restoration

In the lounge

A detail of the cabinet

the front panel antenna capacitor and I kept this peaked. I had to tweak the two middle trimmers by a turn on one and a turn and a half on the other, so not a lot but it makes quite a few dBs difference to the overall gain. The earthed blade is just adding an extra tiny amount of capacitance and this was repeated with the gang opened a fraction more. Now the effect was to give a slight rise in the meter reading for the three sections in turn. Having to tweak the trimmers is to be expected as it had had a complete rebuild and I had changed the shielding on the connections from the RF stage anodes to the tuning caps. These were by running the wires in bent over pieces of brass that I changed to solid brass tubing.

There are top coupling capacitors to help even out the gain across the band. Stewart Warner say never touch these as they are adjusted at the factory to exactly 16 pF. But whilst I had the gang out I did carefully check them and made some tiny tweaks to two of them

The volume control (drawn upside down to convention for clarity) works by adding resistance to the primary of the antenna transformer and at the same time reducing the screen voltage of the 224 tubes. It was very 'twitchy' to use due to the 3V grid base of the tubes. Peter suggested I use, and kindly sent me, 35/50 tubes instead which came out a year later and were variable mu equivalents. On my valve tester these have a grid base of about 30V and so do make the radio a lot more tractable.

It suffers with a tendency to be unstable at the low frequency end of the dial but the Stewart Warner service notes make it pretty clear that this is likely to be the case. (See Conclusions)

Pondering

Stability

I wondered why the radio was less stable at the low end when normally the sensitivity is greater at the high frequency end of the dial.

This led me to read of some of the books in my small library. The best of these was the first I ever bought on radio, back in my teenage years, "Foundations Of Wireless" by M. G. Scroggie. He has a nice way of making the difficult and complicated understandable whereas with others the truth is often buried in too much mathematics (for most of us anyway).

Gain versus frequency

The first thing in my revision was should the gain rise with frequency and by how much?

Scroggie uses an example of a tuned stage and says with a tetrode valve, having a high anode resistance, the gain is approximately the mutual conductance (Gm) times the 'dynamic resistance' (R) of the tuned circuit. Assume for the moment that this is not a transformer with untuned primary. Exactly at resonance tuned circuits behave as a pure resistance equal to R. He goes on to show that R = L / C x r, where L is the coil inductance, C is the variable tuning capacitor and r is the equivalent (see Note below) series RF resistance of the coil. Clearly if little r were constant then, with C going from hundreds of pF's to say 50, the change in gain with frequency would be large. What limits the rise is, at the same time as C is reducing to tune to a higher frequency, little r is increasing. The increase in r means, according to the book, that "In practice the value of R varies over a range of about two to one across the medium-wave band" and the gain rises by about the same amount.

Note: It's equivalent because it includes the parallel losses from the tuning capacitor, valve bases and the like (these being greatest at high frequencies). These can be converted into an equivalent series loss to be added to the resistance of the coil.

But maybe the gain of this Stewart Warner does not rise with frequency as Scroggie suggests. He was writing in the forties (my copy is a Forces edition from 1945) when coil design would have been much better. For this Stewart Warner the coils are simple and the coupling would have been less and losses greater at the higher band end. The additional top capacitor couplings (see below) suggests that this is so.

The author goes on to say that a useful idea to improve stability in RF stages is to use transformers having untuned primaries and tuned secondaries. By having the transformers in step–up the signal on the anodes is smaller and so there is less signal fed back to the grid. At first sight you would think the step–up would give you increased stage gain but it doesn't work like that. It's actually lower because the reflected R, from secondary to primary, is less. Remembering that the impedance on one side of a transformer is transferred to the other in proportion to the square of the turns ratio, say a transformer with three to one step up is used. Now R and consequently the voltage at the anode will be reduced to one ninth. However, this is followed by the 3 to 1 step up and thus the gain, grid to grid, will only be reduced by a factor of three. So for a three times loss in stage gain the voltage at the anode has been reduced by nine times for much improved stability.

But Stewart Warner hadn't read Scroggie, which was published years later, and so made their RF coupling transformers step down. The ratio is approximately 4 to 1 and so R and the voltage at the anode will be increased theoretically to about sixteen times. This, followed by the 4 to1 step down, gives a gain increase of four times. The result is clearly not going to aid stability but was done because of the low Gm of the tubes available and the performance of the transformers at the time.

You might wonder, like me, why RF stages are bordering on being unstable when screen grid tubes are being used and there is excellent screening of all the other components. Scroggie shows that even with an anode to grid capacitance of 1000 times less than that of a triode there is still enough feedback to cause instability. An example is given of two stages, each using tubes of Gm equal to 2.5 mA/V and having a grid to anode capacitance of only 5 thousandths of a pF. The calculation shows that the tuned circuits need only be a little better than the average for instability to occur. So with three tuned stages, as this radio, albeit with lower slope tubes, the chances that the radio may be unstable is obvious.

The above is only my summary of what takes place over many pages in the book.

Selectivity across the waveband

But I haven't found an answer to my original question yet. So what happens to selectivity across the waveband? Perhaps it is this that is making the radio less stable at the low frequency end. Well the goodness of the tuned circuits and ultimately that of the coils governs this. The curves, reproduced from "Radio for March 1930" magazine, show that the bandwidth is much less at the low frequency end of the dial. The Q, the goodness of the tuned circuits, is determined by L / r and the higher the Q the sharper will be the bandwidth. Little r can increase by up to 4 or 5 times, from the low end of the band to the high, according to Scoggie, whilst L remains constant. It is this that causes Q to change and hence the selectivity across the band. Of course with the coming of the Superhet, in 1931, this problem went away as for these radios the selectivity is determined by the IF transformer tuned circuits which are operating at a constant frequency.

Selectivity versus signal level

Having studied the graphs in "Radio for March 1930" I had to stop and consider why the selectivity is so level dependent? With a signal of a few hundred micro-volts it is a lot narrower than for signals in the milli-volt region. Is it because of the front end volume control decreasing the output as the test signal level is increased? As the screen voltage and the current through the tubes decreases then perhaps the anode resistance Ra falls and this loads the tuned circuits. I made some measurements using an AVO valve tester and found Ra surprisingly constant down to a screen voltage of 20V. My only other explanation is that at higher signal levels there are greater losses, particularly eddy current losses, into coil screening cans. These increase r and so Q falls.

Top capacitor couplings

Because the transformers are step down the signal at the anode will always be greater than that at the following grid. From the picture of a transformer it can be seen that the coupling is very loose. Coupling no doubt falls with frequency and losses will certainly be greater. The capacitors from the anode to the following grid compensate for this if the signals are of the same phase.

F.W. Langford Smith in "Radio Designers Handbook" says that this is often employed and the exact capacitance value is best determined experimentally. "It should be noted that it will alter coupling, gain, selectivity, primary resonant frequency and circuit tracking". He obviously liked to cover himself.

The capacitors in the 950 are adjustable and Stewart Warner would have chosen the 16 pF setting by measuring ratios and that being the optimum. Some would have had falling gain, and others rising with frequency, as in the case of that tested by "Radio" magazine. Adjusting each radio for a flat response in a production environment would have been impractical and simply not worth it.

So this could well be the answer to my original question: why was the radio less stable at the low frequency end of the dial. Is it simply because it is one that has less gain at the high frequency end? To me it's a logical answer and fits with the performance. Unfortunately I don't have the test equipment and screened environment to allow me to verify it by measurement.

As usual Peter Lankshear had something enlightening to say about the picture of an RF transformer: "The jumble winding of the primary was common in earlier productions but in later years you will recall that the primaries were often honeycomb pies or similar. Actually, the extra self capacitance of the random winding wasn't too bad as it only contributed to the "tuning" of the primary".

There was no tuning of the primary, in a physical sense, however where it tuned had to be taken into account. It had to be resonant, with self-capacity and strays, outside the broadcast band. If not, there would have been large gain peaks and changes in selectivity. F.W. Langford Smith goes into the merits of it tuning above or below the band but for these coils, with more than 500 turns we can definitely say it is below.

I'm sure there are members who may be able to add something to my musings and correct wrong ideas.

The Cabinets

They were not in too bad a condition seeing that they had been at least once to the other side of the world and back. Fortunately the worm had only got to the back panel of the speaker table. This had some small delamination of the plywood, as always around the speaker grill. I was able to lift it enough to insert strips of glass paper, for cleaning, prior to PVA glue and clamping.

The metal cabinet apart from the lid was quite good. I used Epoxy and a cheap stiff artist's brush to fill in some small areas. Once set hard, and sanded level with a detail sander, I used an engraving tool to try to mimic the large crackle. This worked reasonably well for these ten pence sized areas but I didn't fancy my chances on the lid where the edges had substantial paint loss. The option I took was to sand these edges clean and just finish them in the flat, so to speak, and I doubt you would question this if you hadn't seen an original item first. For the centre insert this was patched as before.

I had to fix some rust on the inside of the cabinet, possibly caused by condensation when the set was switched off, before spraying with a good paint match followed by satin lacquer. This was then masked off and the outside sprayed with a gold paint that was spot on to the inside of the back for the speaker table. The black trimming for the corners and lid would have been done freehand with a spray gun. I've tried getting the effect with cans but for me it's impossible. The spray pattern and flow isn't right and then I'm too strict in wanting to get a neat appearance. But something looser than just using masking tape was needed and so I ended up making undersized masks, from cardboard, for each surface. These were spaced away, by about a quarter of an inch before detail spraying with satin black. The paint was applied with the can always moving to the outside but it's surprising how much paint still drifts inwards so a soft edge is created. Finally the whole item was sprayed with satin lacquer to ensure a uniform shine.

The art deco detailing, for the corners (see picture), is nice and subtly enhances the appearance. It was a devil to do though with gold paint and an artist's lining brush. No! I kid, it was actually done with a felt tip pen, that is available in three widths and in silver and gold. It did make it possible for my not so steady hand.

The speaker table was refinished in similar fashion after making good wounds with car body filler. Fortunately the crackle finish on the sides and front was almost undamaged but not so the top. This had been badly scored, over the years, by the radio bottom fixing screws that had long ago lost their felt covering. As this is not seen I filled all the damage and sanded it flat before spraying.

Once new grill cloth, the speaker and back panel were in place the job was done.

Conclusions

A long project, which included developing a coil winder along the way, and taught me a lot about winding coils as well.

I wouldn't do another 'tin box' crackle finish radio such as this. Refinishing is a lot more difficult and time consuming than any wooden cabinet I've done.

In the original the crackle would have been prominent due to black spray drift and being wiped over. Since the crackle on the lid left a little to be desired maybe it was best not to make this a feature. I did try a test area on the back, using matt black oil based paint, rubbed over with a cloth. The result was not very attractive and the paint didn't rub off cleanly from the high spots as I expected. Being wary about ruining what had already taken me a long time, plus a lot of aerosols, I wiped off the test area with White Spirit and left it at that.

It's a reasonably attractive and certainly eye-catching radio now, and the style has grown on me. For a short while it was in the lounge, I committed another sin by removing a book case and putting it in its place whilst my good lady was out once more. Well, I had to see how it might look didn't I? It works well with a large and powerful sound and brings in stations across Europe on a 20 foot indoor aerial. Even finally 'boxed up' it still goes unstable below 600 kHz if the volume control is advanced too much. I spent a lot of time, whilst the radio was on the bench, trying to cure this but never succeeded. It is better with the lower gain 35 tubes than with the 24's. The Stewart Warner service manual says that the radio will tend to be unstable and stresses the importance of a good true ground earth that I don't have. I did fit a new cloth covered 3-core mains cable, as it is good practice to provide an earth for so much metalwork.

When you bought this radio you also bought a room heater: Boy! Does it get warm down at the ballast and rectifier tube end. There is a cover over these that soon gets too hot to touch, maybe I will have to re-paint this with heat resistant paint.

So what to follow this up with? It will be very hard to find another radio to while away so many happy hours over about a year. I have an HMV 650, with eleven valves, to finish off but after that not much that will have similar interest and challenge. Now, if anyone has a Radiola 60 or a Scott that they want to sell?

Pye P160BQ - The first of the plastic cased sets

Pye P170BQ and also Pye P190BQ.

Early Pye Transistor Pocket Radios

by Henry Irwin

When Pye launched the P150BQ in May of 1958 over two years had elapsed since their introduction of the UK's first transistor radio. The P150BQ was what we would now call a Coat Pocket radio, referred to at the time as a "personal portable". Pye at this stage had lost their early momentum and were beaten to the post in the introduction of these truly portable radios the previous year by both Perdio and Cossor. They were still however in a fairly select minority because, although this breed of radio had become well established in the USA and Japan, in Britain these few companies still ruled the roost until the following year.

The P150BQ concept

This radio is interesting insofar that it reveals Pye's thinking about what form a personal transistor portable should take. From the start they eschewed the idea of a plastic case and conceived instead, something of a luxury item. If transistors were going to be expensive to produce then they might as well sell for a premium price to an affluent sector of the market. Consequently the P150BQ was clothed in smart black morocco leather with matching handle secured by ostentatious looking brass fixings. Whereas Cossor in their "Travellers Friend" had managed to make the same concept look dull, Pye enlivened the front of their case with a series of bold horizontal gold lines and an eye catching reverse painted dial.

The origin of one of these design elements is worth exploring further. Unless there is an incredible coincidence it is pretty obvious that Pye blatantly plagiarized the dial of Magnavox's first American transistor portable of 1955, the AM2. Have a look at the illustration and see what you think. There is of course a precedent for this. In the late 1920's someone at Pye saw a design on a cigarette case and adapted it to become the company's famous sunrise speaker motif. Similarly this iconic dial design became synonymous with Pye transistor pocket sets for several years thereafter. The dials aren't completely identical of course and I believe that Pye more successfully than Magnavox incorporated the idea into a unified case style coming, in successive designs, to make it very much their own.

The P150BQ had a companion model, the Pam Gayplay 111, which came in a cream leather case without the horizontal gold bands.

Mechanical

A consequence of choosing a leather covering, even over cardboard, is that the case has little strength. Some manufacturers chose stiffer card with a hardboard strengthener but Pye, with their production engineering commitment to metalwork, went the whole hog and provided the new radio with a substantial aluminium front plate and a bolt on bottom section bracket. This carried a new low profile 3 inch speaker and a "miniaturized" airspaced tuning capacitor. Terms such as low profile and miniature are relative of course and although this was not the type of radical component size reduction the Japanese were pursuing it was new ground for the UK radio industry.

Looking at the construction arrangements of the P150BQ in more detail, the front plate secures the printed circuit by means of spacing pillars so forming a sandwich with the components in the middle. At the top of this sandwich is a large ferrite slab antenna. At the bottom is a gap in the circuit board which allows the batteries, two 3 volt torch cells, to sit between the board components and the bottom chassis bracket. To keep these secure spring contacts on a paxolin strip reinforced by a rubber pad exert pressure at one end. At the other end the + and - terminals contact respectively a bent projection of the front plate and a metal flange bolted to the printed circuit. At best this was an awkward arrangement even with the ribbon pull provided. At worst, in the confined space, leaking batteries could play havoc with nearby components and speaker. Pye were never completely happy with this arrangement and modified it several times subsequently.

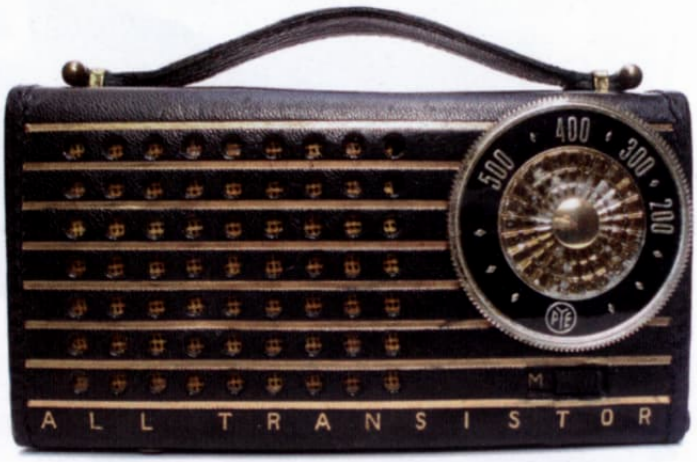
The metal and printed circuit sandwich was clothed by the aforementioned morocco leather sheath and secured to it by two screws hidden under the tuning dial and one conspicuous one next the volume control.

Circuit

This is a five transistor superhet (Fig.1) using Pye's own V series transistors. It has a conventional two stage 470KHz IF amplifier but, like its 1957 predecessor, the Perdio PR1, it saves a transistor in the audio stages by using a single output device operating in class A. The Perdio however has a strange volume control circuit which alters the IF gain. The Cossor Travellers Friend, on the other hand, has only four transistors and a reflexed IF stage. Therefore the Pye was a bit more sophisticated than both of these.

The P150BQ provides preset longwave coverage by switching a capacitor across the oscillator coil and by switching an extra winding on the ferrite slab in series with the medium wave winding. The general arrangement, where the main winding is fixed towards the centre of the slab and where adjustment is only possible by altering the end turns, is very reminiscent of American practice. It provides maximum signal pickup but requires that the inductance of the aerial

Pye P190BQ Mk 2.



Pye P150BQ - first in the series

Magnavox AM5, practically identical to the AM2

Early advert for Pye P150BQ

Advert for Pye P160BQ

with the tuning capacitor at full mesh is initially correct otherwise good tracking across the band becomes very difficult.

P160BQ

This was Pye's first plastic cased portable and was introduced in March 1959. It was also the first transistor radio I ever saw. My father brought one home, which a friend at work had bought, some time around 1959 or 60. I remember being intrigued by it and couldn't resist removing the back. Specifically I remember its closely packed components and the smell of the phenolic resin board.

For this radio Pye produced a neat cabinet with contoured corners. The front has a pattern of horizontal raised ribs running almost its full width. This plain horizontal thrust is offset by the single element of the large tuning dial which overlaps the edge slightly to allow thumb tuning. Along the bottom, with a touch of design flair, the line of the wave change switch is picked up by a long horizontal convex plastic window which displays, reverse painted fashion, the logo "All Transistor" in stylised lettering. In fact it isn't reverse painted at all but rather a strip of embossed metal foil magnified behind the convex plastic. Overall the presentation is restrained, well proportioned and with the effect of the three dimensional bright work just sufficient to create visual interest.

Behind this new casework however is the same metal front plate and internal construction, except for some fixing modifications, of the P150BQ.

Circuit

The circuit is identical to the previous P150BQ in all respects except one. That difference is important however because the P160BQ is a six transistor circuit with a full push–pull class B output stage. Pye had obviously decided that the five transistor design had served its purpose and the new push–pull output would give improved power and even greater battery life. The method however of achieving this transformation from five to six transistors was what can only be described as an engineering "bodge", albeit a well executed one! For whatever reason Pye decided that they didn't want to redesign the circuit board so they used the existing layout and strung the two new output transistors between component holes already on the board. The AF coupling transformer and output transformer locations were reused but now accommodated a push–pull driver and output transformer respectively. Since this arrangement required new components with no anchor points on the printed circuit, Pye had to join them together by soldered wire wraps floating in the general wiring. I'll bet the assembly ladies had some choice words about that arrangement!

The mystery of the Q1 and the P170BQ

By 1960 Pye had finally designed a dedicated six transistor board with printed tracks to accommodate all components. They stuck with a 6 volt circuit but added a tuneable long wave band with modified aerial coils on a ferrite rod.

So where is the mystery? Well, this requires us to make a slight detour. The Q1 was an oddity, not strictly a pocket radio but a cigarette box radio from a time before health concerns and political correctness. It is actually quite neat, its reflective alloy fascia picking up, in its pattern of indentations, design elements from Pye's valve "Jewel Case" portable the P114BQ.

The problem is one of dates of introduction. "Radio Radio", that indispensable aid to the transistor collector, lists August 1959 for the introduction of the Q1 and March 1960 for the P170BQ. However both, on inspection, obviously share a common chassis plate, designed to accommodate the frontal control layout of the Q1 and the edge mounted volume control of the P170BQ. If you examine a Q1 it has the holes on its printed circuit where the edge mounted volume control should be and if you look inside a P170BQ it has the holes on its chassis where its partner's frontal controls should be. So, since it is unlikely that Pye designed a new board and chassis for a pocket set, that could also be used for a cigarette box radio but didn't release the pocket set until seven months later, I have to conclude that they were both probably released quite close together. However as to actual dates, I have no access to Trader Sheets or sales brochures for the two sets, so these must remain for clarification.

P170BQ

For this radio Pye designed a completely new case. It is very slightly bigger than the P160BQ and with squarer corners. The back, top, bottom and sides form a single

Pye Q1 cigarette box radio

Pye P160BQ output transistors with wire wrap connections

wrap–around section into which the chassis and front plastic panel fit. In a clever piece of design, internal access is simplified by pressing a spring loaded catch immediately to the right of the tuning control and hinging forward the complete chassis and front panel. This is achieved by locating the spring assembly within the panel and a spigot on the opposite side to mate with a recess in the case. No more screws or snap–shut easy break cases; suddenly access could be easy!

The cream plastic front panel is moulded to form a waffle pattern of square speaker apertures behind which is a dark red cloth. To its right the iconic Pye reverse painted tuning dial is backed by a new chromed metal fascia panel. The turquoise outer case is thick enough to form a frame for the cream plastic front and is curved back at each side to further emphasise the projection of the front section. This is a more sophisticated presentation than its predecessor but is not as sleek or indeed as nice to hold.

Inside

The six transistor circuit for both the Q1 and P170BQ is essentially similar to the P160BQ and also uses the same White Circle 6 volt transistors. The front chassis plate is slightly modified with side pieces and lugs to secure the circuit board instead of spacing pillars (Fig.2). However the biggest physical difference is in the battery arrangements which Pye made a further attempt to resolve. Actually the Q1 uses a different battery holder design to the P170BQ. The two cells are meant to reside in a removable skeletal metal holder which springs apart. This was a seriously fiddly device and still didn't protect the components. The holder for the P170BQ is an improvement over this. It is a metal box, fixed to the speaker magnet by a clip and open at the back, which contains all the spring contacts. This better locates the cells and offers some protection to adjacent components but unfortunately still allows leakage corrosion to affect the speaker.

P180BQ

This is probably a good time to explain that the original morocco leather case design of the P150BQ survived through all the changes as the prestige model of the range but was given the new circuits of its plastic cased cousins as they arose. Thus there was a P150BQ available to partner the P160BQ although it too now had the new 6 transistor circuit. However when the P170BQ was introduced Pye gave its leather cased partner the designation P180BQ. Confused?

P190BQ and P191BQ

To confuse things further, during the early part of 1961 Pye changed the circuit again, this time to a 9 volt design, but used the existing plastic case. It was still essentially the 6 transistor superhet of its predecessor but now used the Yellow Circle 9 volt transistors and Pye, relinquishing their long battle with penlight cell holders, modified the chassis for a PP3 layer battery (Fig.3). Although the plastic and leather cases were the same as before, Pye gave them the new designations P190BQ and P191BQ and the only way to distinguish them from their predecessors is to look inside

P190BQ Mk 2.

The final case style in the sequence was introduced sometime during early 1962. The front plastic moulding was retained but it was now black and had a fine gold anodised speaker mesh over the previous waffle pattern apertures. To match this the adjacent tuning panel fascia was gilt plated. These changes brought the case stylistically into line with current fashion . It also represents the end of the sequence of radios that started with the P150BQ and brings us to that period of hiatus when Pye took over Ekco and began to re–package Ekco designs.

There were few circuit changes to the Mk2. Negative feedback was introduced in the AF stages and there was a new speaker. It may use Pye Newmarket series transistors or Mullard ones or both!

Restoration

Firstly let's consider the plastic cased sets and leave the leather versions for later since they have special problems.

Dials

The tuning dial is common to them all and is a good place to start. It is held out from the case by one or two spacing washers. These are often lost with the result that the rear of the control can rub against the case removing the protective rear paint and sometimes the silvering. I usually wash them carefully in detergent and I try to retouch small areas of missing silvering with silver enamel. This of course is never reflective enough and only works with small areas but is better than the backing paint showing through. I then re–cover missing bits of the protective backing with cream enamel paint and a fine brush, taking care to treat the rear of the serrations since this will prevent progressive deterioration of the reflective back painting.

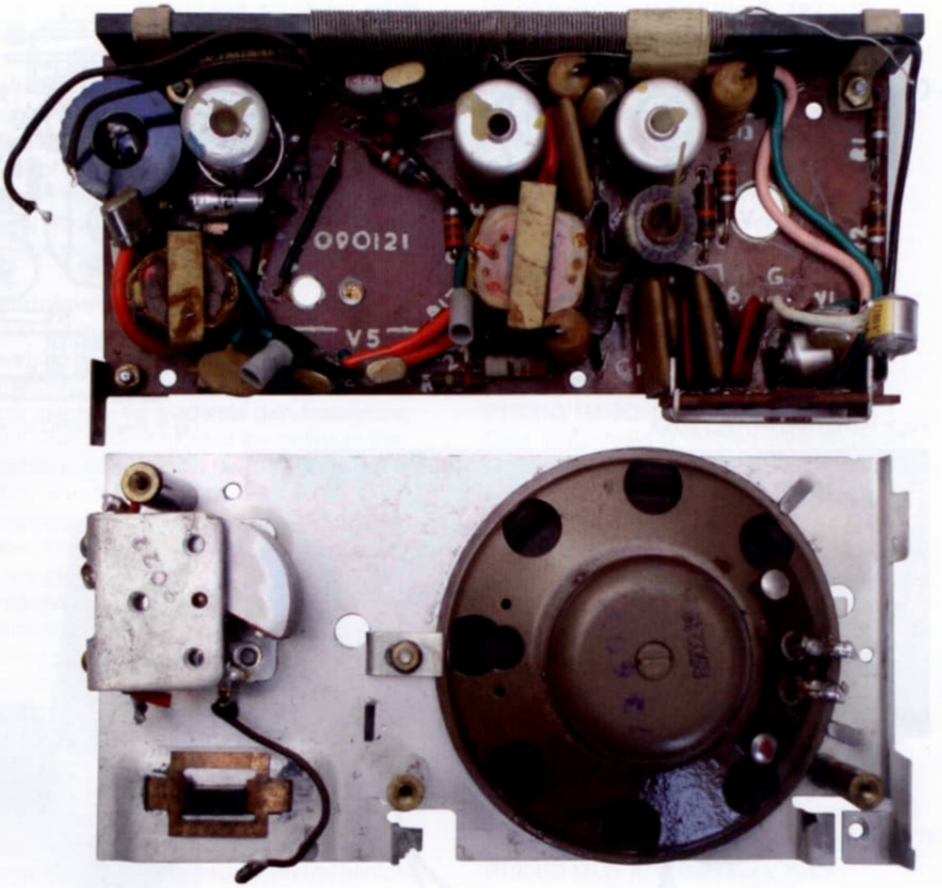
Corrosion

The next problem common to most of the early sets is corrosion of the lower edge of the speaker caused by battery leakage. A replacement speaker may be the only option but these can be very slightly larger than the original and there can be difficulty subsequently fitting modified batteries. The speakers in the P150BQ and P160BQ have a nice dark bronze hammer finish and to maintain originality I have successfully treated these by my usual technique of scraping off the rust with a suite of jewellers screwdrivers filed to a blade edge and magnetized. The metal was then passivated with Hammerite rustproofer and finally painted with Hammerite dark brown metalic finish paint.

The aluminium panel near the batteries can also become pitted and covered in a white deposit. I have removed this with kettle descaler, then a final wash in WD40 and distilled water.

A problem particular to the P160BQ is the embossed metal foil logo behind the plastic display window. It may exhibit a form of corrosion that looks like creeping tendrils spreading across the foil. I have seen this also on the dial of early Dansette radios so it may not be related to battery leakage and I hope that it is not endemic. I have soaked the foil in a solution of kettle

Pye advert from 1959



Pye P150 and P160BQ 6 transistor chassis

descaler and then washed several times with distilled water. Hopefully this has halted whatever the process is. Afterwards the areas of surrounding black where the tendrils have broken through are carefully over–painted with black enamel

The disintegrating Sellotape which originally secured this card backed foil should be replaced with an archival tape such as Scotch Book Tape and its ends given a little extra security with some non solvent glue. It must be flat since the chassis plate will press against it.

Plastic Cases

All the plastic cases will respond to foam cleaner or judicious use of methylated spirit, however, some detergents can dull the surface of the outer case. The P160BQ is the most fragile. I cleaned mine with meths, small bits of tissue and very gentle use of a child's tooth brush. There may be cracks around the fixing screws so these should not be over–tightened.

The P170 and early P190BQ are usually in the worst state since dirt accumulates in the deep speaker apertures and the speaker cloth discolours. The best method is to proceed as follows.

Separate the plastic front panel from the chassis. Now remove the chrome backplate to the tuning dial. The plate on mine had bad abrasions and needed to be re chromed at

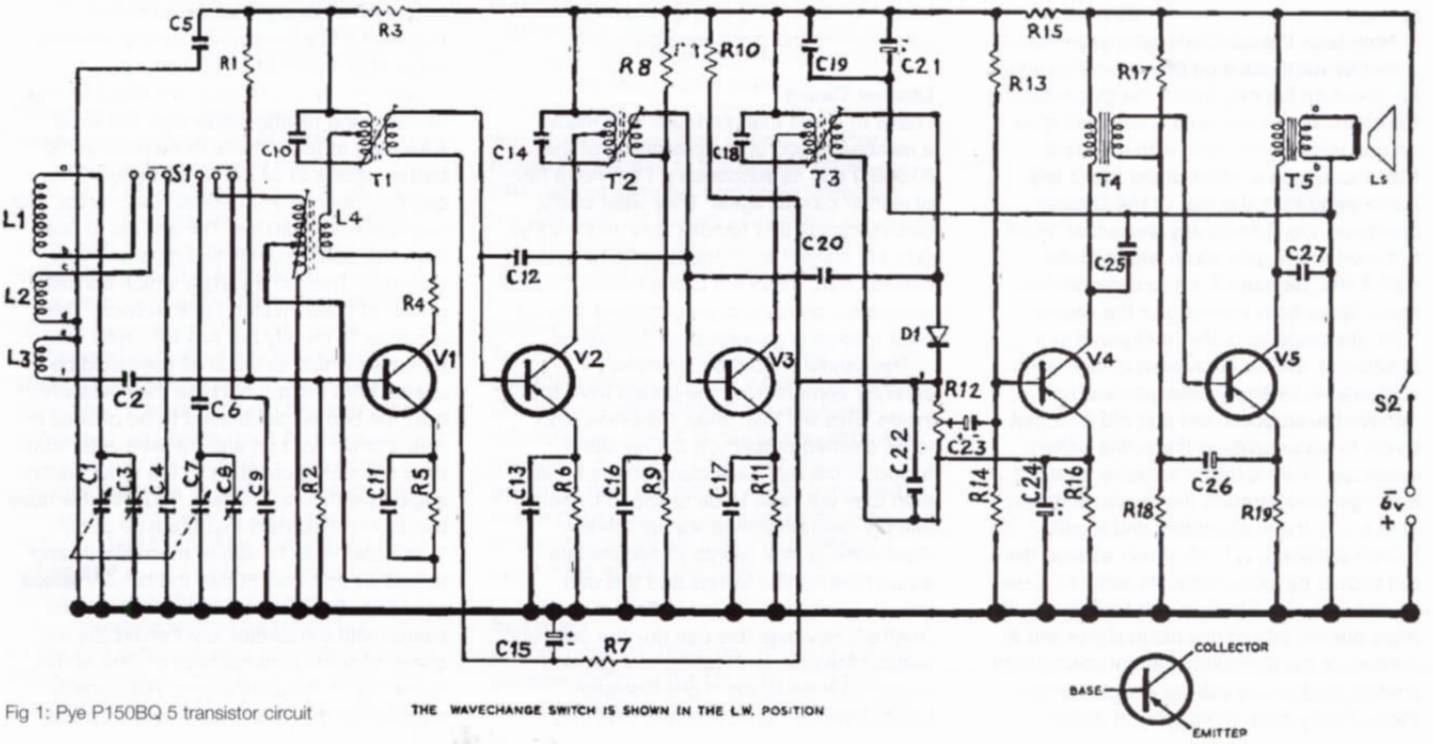


Fig 1: Pye P150BQ 5 transistor circuit

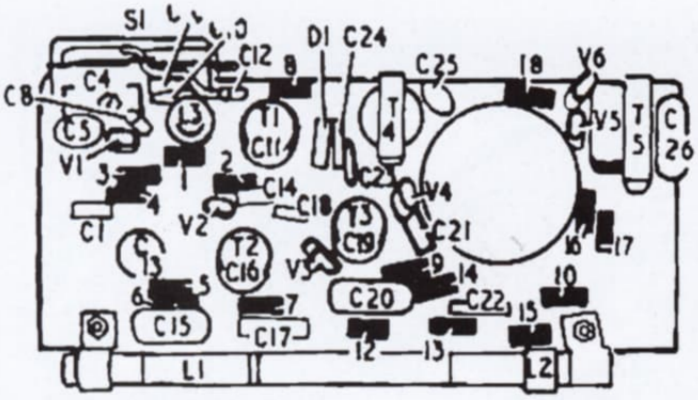


Fig 2: Pye Q1 and P170BQ layout

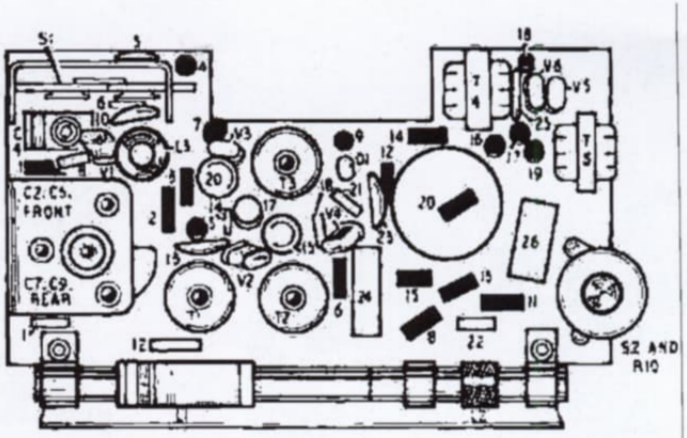
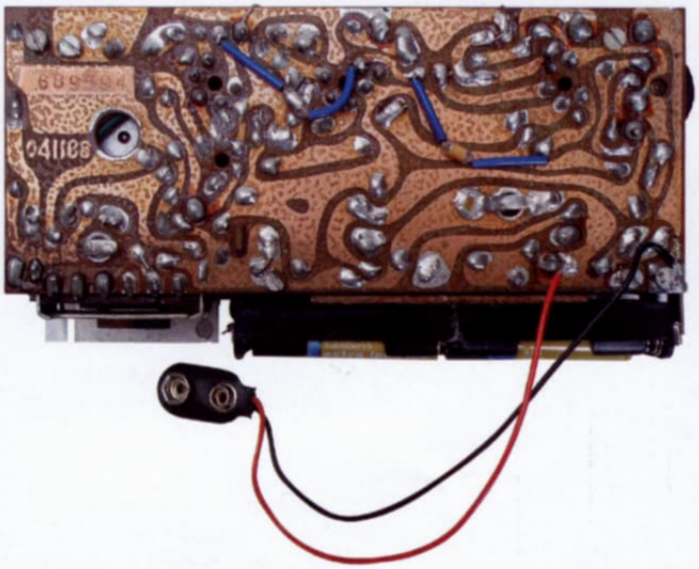


Fig 3: Pye P190BQ layout



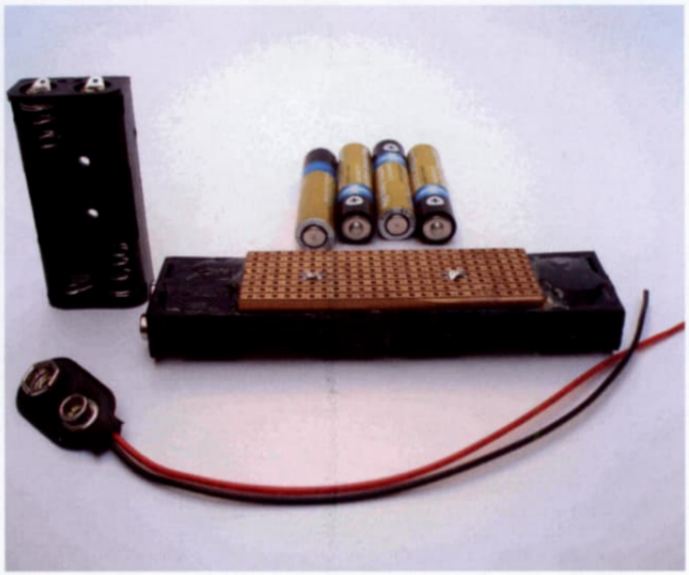


Fig 4: Alternative methods of using AAA cell holder on 6 volt radio, card circuit cover not shown

Fig 5: New AAA cell holder

a local plating firm so it had to be removed anyway. Carefully force up the lugs at the back using a jewellers screwdriver and fine pliers. Do this slowly and gently. If they do break, the stubs remaining can always be glued in from behind so all is not lost. Remove the plate and carefully store away the front release button and spring which is in a cavity underneath.

Now soak the complete front assembly in a slightly warm solution of washing up liquid for about an hour to soften the glue retaining the cloth. Then prise up the softened glue on one edge of the cloth with a scalpel blade to loosen it. Most of the fabric will come away from the rear of the speaker apertures. Don't force any areas that resist, but prod at the glue again with a blade until it lifts. Be careful not to separate too many fibres from the edge of the weave.

At this stage soak the front panel in a solution of "Cif", a household cleaner with surfactants. Ordinary detergent will not remove the stubborn dirt and old glue that tends to accumulate in the waffle pattern apertures. "Cif" is mildly abrasive so don't rub it generally around the plastic surfaces. That's why the soak, soften and locally loosen approach is best. When soaked the dirt should be loosened sufficiently to allow its removal with a baby's soft toothbrush. If there are still bits of discoloured glue left in corners of the apertures, careful poking with a small bladed screwdriver should remove them. Finally rinse thoroughly in water.

Give the fabric a further soaking in washing up liquid and re–stick with a non solvent glue like UHU. The rest is a reversal of disassembly. Place on a padded surface to protect the metal panel and reinstate the lugs by slowly but firmly flattening them down with the handle of a big screwdriver; hopefully they wont break. Don't forget to reassemble the spring and locking catch before the plate goes back on!

Leather Cases

I have to admit that, although Pye made a reasonable job of the cosmetics of the P150BQ and its successors, I am not a fan of leather cased radios. They wear badly, distort, clasps and handles fray and the Pye sets are subject to all these defects. I also confess that I have not carried out a full case restoration on my morocco clothed sets so what follows is general and incomplete.

The handle should be removed by carefully compressing the clasps from the inside. This will then allow the brass work to be cleaned properly. If the handle is frayed or the rear case clasp straps broken then they will have to be replaced by your friendly neighbourhood leather worker. Congealed gunge seems to accumulate around the handle fixings and this can now be removed with the judicious use of "meths". However this can dull the case and remove the gold embossing. For general cleaning I have found "Lord Sheraton Leather Wipes" to be effective and they appear in moderation not to affect the gold figuring. I have retouched small areas of missing gold with a "Pilot Gold Marker".

New batteries for the 6 volt radios

These sets originally used two long cells designed for penlight torches. Nothing like this is available today and attempts to use AA cells are doomed to failure. However it is a shame not be able to bring these little radios back to useful life.

With this in mind I have devised a method of modifying plastic holders for the small AAA cells to allow these to be used in the battery space of all the 6 volt radios. They can be obtained from Maplin Electronics and two types are suitable. The easiest to use, Item No. JB83E, holds two cells and has tag ends. There is a variant which consists of two of these riveted back to back. This is harder to modify but has PP3 type end terminals which as we shall see could be useful. With the double type the rivets which hold the two sections need to be pushed out with a small hot iron and the wire extensions from the spring contacts to the other section snipped with small cutters. You will now have two twin cell holders just like type JB83E.

The idea is to fix two of these rigidly end to end so that they fit into the battery space provided. To achieve this, cut through the plastic with a hacksaw just behind the end cheek with the external tags on one of the holders and discard the end. Repeat this process for the other holder only this time

remove the end cheek opposite the external tags. There should now be two open ended sections 4.9mm long. These are butted open end to open end and held in alignment by a rigid backing plate formed from a piece of veroboard 20 x 65mm. The veroboard has small sections of stiff wire soldered into holes that line up with those in the holders and the excess is cut as flush to the board as possible. A good solvent free glue such as Woolworths All Purpose Adhesive is now liberally applied to the back of the holders so that it seeps through the holes, the assembly is finally aligned and the four wires projecting through the holes are cut to about 5mm and pushed down flat tight against the plastic on the inside. Excess glue is wiped from the copper side and in 24 hours the result should be a rigid holder.

The illustrations (Figs.4 & 5) indicate how the holders work and how they can be used. There are two possible ways. Holders with PP3 style terminals can be pressed in to mate with the original contacts on the leather cased 6 volt radios if dimensions have been adhered to. Alternatively, if the chassis spring pressure plate is removed, leads can be soldered directly between the circuit and the holder with enough slack to allow it to be removed. In fact this is recommended for the P160BQ as it puts less strain on the case.

Circuit repairs

A systematic approach helps. A gentle hiss from the speaker and a certain amount of noise from the volume control will indicate that there is at least some gain through the audio stages. Lack of signals should then focus attention on the RF section. The fault area can be narrowed further by listening for the local oscillator on another radio and if this can be heard then suspicion must fall on the IF stages. If the radio is completely defunct check that corrosion hasn't damaged a connection or printed circuit track and also be aware that early boards are prone to hairline cracks.

The volume controls in these radios become notoriously noisy so a squirt of cleaner helps, however, leakage in the coupling capacitor to the wiper can exacerbate the problem and cause weak distorted audio. I have had to replace one of these.

A couple of transistors in the 9 volt radios have needed replacing, one was a defunct IF transistor, the symptoms being lack of gain and a signal generator was needed to pinpoint the stage. The other was a very noisy audio driver. Transistors from the Newmarket 152 / 252 range can be used to replace any of the 9 volt Yellow Circle devices and of course the Mullard equivalents can also be used (the neutralizing capacitors must be reduced to 56 and 18pf respectively). The 6 volt sets may not work as well with the above transistors. I am lucky since I have not yet had to replace any six volt transistors and also because I have a stock of these devices retrieved from scrap sets.

An interesting fault occurred on my P160BQ. It exhibited very low sensitivity and it appeared initially that an IF transistor was to blame. However with a dud transistor the transformer in its collector will exhibit some degree of peaking however broad. In this case it did nothing. I suspected a broken winding but, out of curiosity, I bridged a small value capacitor across the relevant pins. Eureka! The signal went up. With a 220 pf polystyrene wired across the printed circuit the stage peaked perfectly and the set now works well so the small tuning capacitor inside the can must have had a suspect joint.

Performance

Without the various ploys used in the early larger Pye radios, such as AF matching transformers and a 315 KHz IF to compensate for moderate gain transistors, the sensitivity of most of the radios in this series is what I would describe as adequate. This wasn't such an issue in the late fifties as expectations for small personal radios were low. These sets were still a novelty and if they pulled in the "Light" programme, a few regional stations and Luxembourg after dark then that was a bonus. As the sixties dawned other small radios using diffused base RF transistors or extra stages began to out perform them. It may be tempting to lay the blame on Pye's own transistors, but even late models with Mullard OC44/OC45 transistors, perform, in my opinion, little better.

Assessment of sensitivity without full test equipment is always a subjective undertaking. I try to assess several samples after a full alignment. A "Which" report on a P191BQ in 1962 marked it highly for sensitivity after a "lab test". Unless this was a late model with different transistors, of which I am not aware, I regard it as an anomaly and it does not correspond with my experience of these models.

On the positive side the selectivity is good for a radio with single tuned IF stages and they would have held stations like Luxembourg well in the presence of stronger adjacent signals.

Audio from the early sets lacks body. It improves through the model range as new speakers, increased value bypass capacitors in the AF driver and negative feedback were introduced. In my opinion late models sound quite pleasant.

The biggest failing of the 9 volt variants was probably their poor battery life. Pye belatedly changed to the slightly larger PP4 cell but samples with holes drilled in the rear case for battery eliminators are not uncommon. Today, long life alkaline PP3 cells make this less of a problem.

Colour variants

This is one of the things that make collecting these radios so interesting. Pye unlike some other British manufacturers offered many colour combinations although not all are common. Often with the dial colouring they seemed to adopt a mix and match approach. The appendix offers the known combinations but others may turn up. It does not list the Pam variants.

Summary

Although the P150BQ, one of the first really portable radios in the UK with a useable transistor design, had some interesting early circuit features, those that followed were fairly conventional and subsequently did not keep pace with new circuit techniques. The range however does represent a single line of development from the early sets and displays some innovations in packaging design. They are generally well built and for the collector are attractively styled, displaying an exuberance in colour combinations and finishes not typical of UK manufacturers. Correctly aligned and restored, providing you don't require extreme performance, they are perfectly useable little sets.

Appendix

P150BQ/180BQ: Covering; black leather. Dials; black /gold or mottled silver and gold.
P191BQ: Covering; black, tan or red leather. Dials; as above plus tan /silver and red / gold.

P160BQ: Ivory, turquoise, red with ivory back, ivory with red back. Dials; generally black /silver but red /silver with red /silver logo and red switch surround found on red back version.
P170/P190BQ: Turquoise back, cream front surround. Cloth; red. Dial, red /gold. Grey back, cream front surround. Cloth; yellow. Dial; black /silver. Black case, silvered front surround. Cloth; red. Dial; Red /silver. All fascia plates chrome.
P190BQ Mk2: Turquoise back, black front surround. Grille; gold. Dial; blue / silver. Grey back, black front surround. Grille; gold. Dial; grey /silver. All fascia plates gilt plated. Some late models may have a detachable handle. Styling of these models reflects a range of smaller pocket radios, P200 series introduced 1961, which is not covered in this article.

My thanks to a particular BVWS member, who wished to remain anonymous, for help in compiling the above.

John Logie Baird's last projects

Douglas Brown and Malcolm Baird*

Baird Television Ltd (BTL) was a large company in the 1930s, owned by the Gaumont British Picture Company and employing several hundred people. After its defeat in 1937 by Marconi-EMI, in the competition for the BBC television camera, BTL continued as a leading manufacturer of quality television receivers. Figure 1 is taken from the 1938/39 Baird Television Receivers brochure.

Figure 1

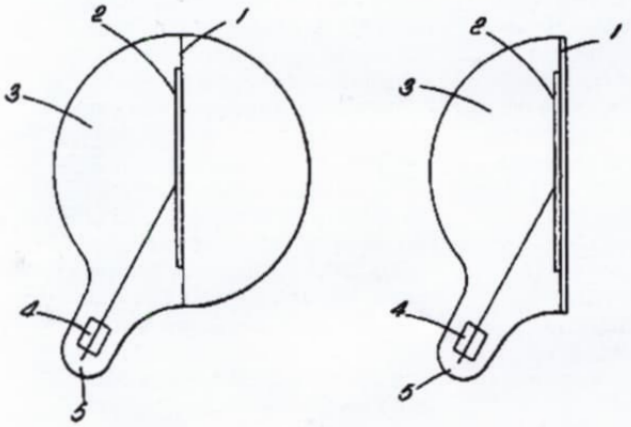


Figure 2

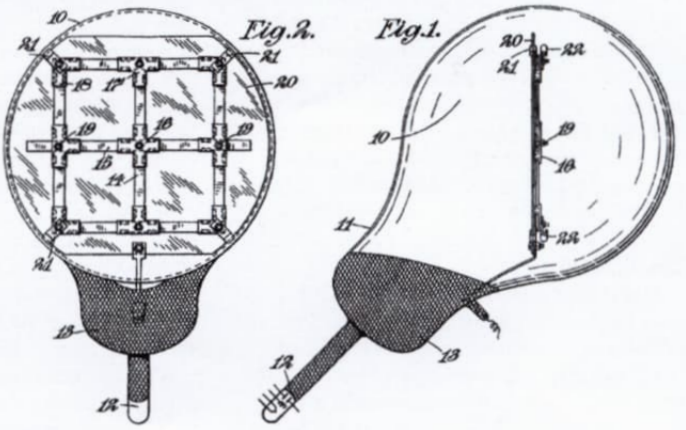


Figure 3

With the outbreak of war and the cessation of television broadcasting, the market for receivers disappeared and BTL went into liquidation. Parts of it transferred to Cinema Television Ltd (Cintel), later to be absorbed by the Rank Organization. Now privately owned and still proud of their roots in Baird, Cintel technology is used worldwide in the making of the major blockbuster films, television dramas, episodics, music videos and adverts seen in today's media.

Between 1933 and 1939, John Logie Baird (JLB) held the nominal position of Managing Director of BTL and by 1939 had accumulated savings of £15,000, a very substantial sum for those days. During the reorganisation JLB drifted apart from the company he created. Undeterred by the change in circumstances in 1939, he decided to continue research at his own personal expense, on colour and stereoscopic television. He moved his family to the safety of Cornwall while he continued to work at his private laboratory next to his house at 3 Crescent Wood Road in Sydenham.

JLB's research was highly successful in the technical sense, and he looked forward to the resumption of television after the end of the war. Early in 1944 he had started talking to financiers about setting up a new company. One of his backers was the film and theatre star Jack Buchanan, whom JLB had known since their school days in Scotland. The new company was called John Logie Baird Limited and its initial focus was to be the manufacture of receivers for the domestic market and for export. The company set up its offices in the west end of London at 4 Upper Grosvenor Street. Some space was available there for receiver development, while JLB's laboratory at Sydenham was still in use, although the adjoining house was unfit for habitation due to air raid damage. Early in 1945 JLB and the family moved to a rented house at Bexhill on Sea, just across the road from the railway station.

The war years took their toll on JLB. He suffered a minor heart attack in 1941 but continued with a heavy workload. By 1945 his old friends remarked that he seemed frail and older than his years. He spent January 1946 in London, suffering from worsening bouts of flu, meeting with fellow directors (J. Donaldson-Hudson, Jack Buchanan, Norman Letts and Kew Edwin Shelley, K.C.) and planning the development of what was for those days an exceptionally large receiver, with a 28-inch screen.

He returned to Bexhill and then on 2 February, he sustained a stroke. This confined him to bed. Despite electricity shortages, his room was kept warm and somehow a supply of fresh fruit (mainly grapes) was found. The year 1946 was not a happy one for the Baird family and none of them had much recollection of JLB's technical work in the last few years of his life.

Despite ailing health JLB's large receiver project was meticulously covered by British Patents:

GB562433 Applied 23 July 1943 accepted 30 June 1944 (figure 2)

Abstract:
"This invention relates to television and has for its object to provide improved apparatus for producing pictures which will permit of an unobstructed view from both sides thus enabling a larger number of people to see them."

GB579482 Applied 28 April 1944 accepted 6 Aug 1946 (figure 3)

Abstract:
"If it is desired to provide a large screen, say for example, of the order of two feet square or more, the flattened end of the tube must be made very thick to avoid breakage under atmospheric pressure when the tube is exhausted, and since the image is viewed through glass, distortion of the image results. For still larger sizes it becomes quite impracticable to provide a flat glass surface which will withstand the atmospheric pressure.

If a spherical bulb is used in the cathode ray tube, and the screen is formed by coating part of the spherical surface, distortion of the image again results. The object of this invention is to provide a construction whereby a large screen

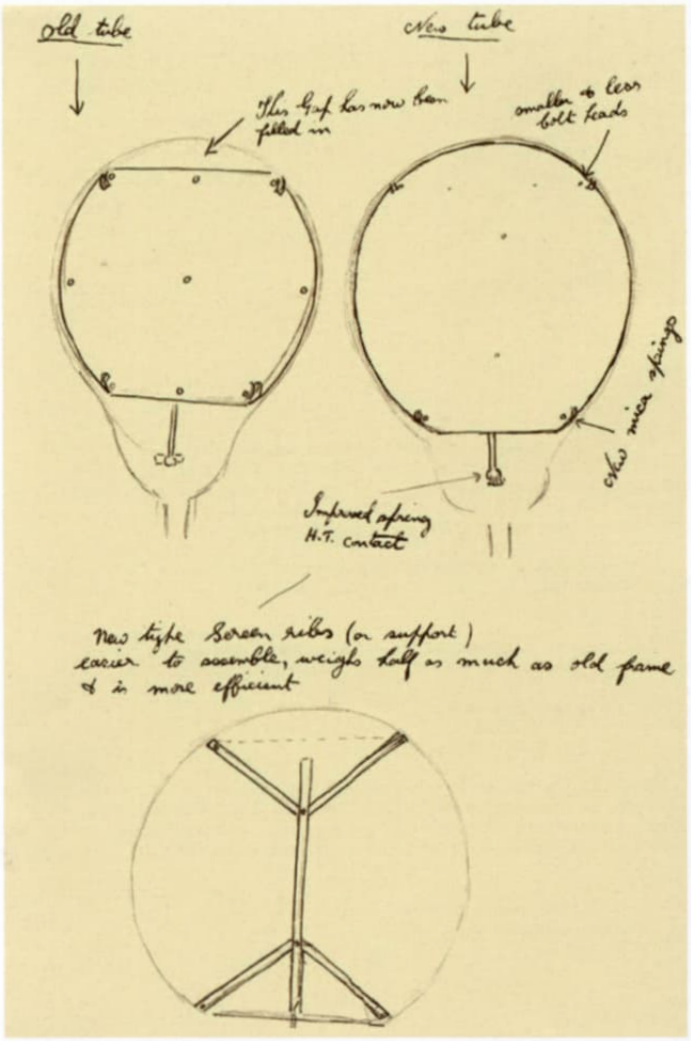


Figure 4

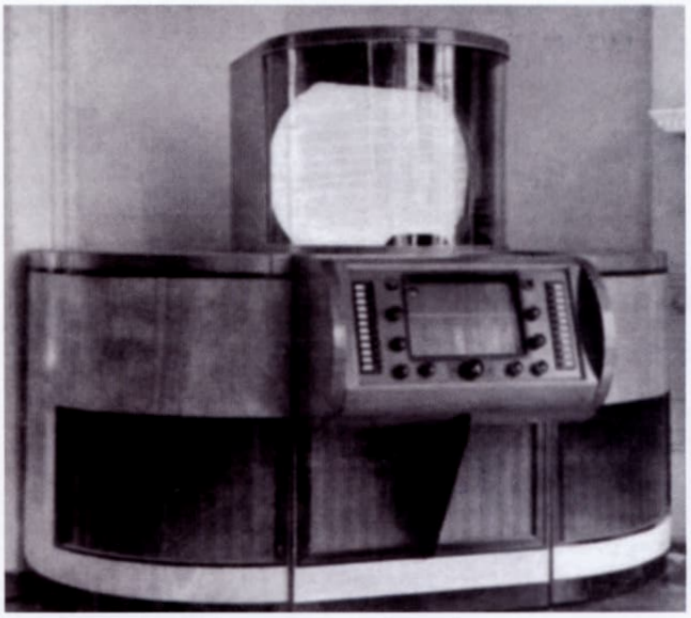


Figure 5

of the type above described can be satisfactorily made."

Just recently, Malcolm was going through old papers and found a hand-written letter to JLB which has helped to fill in the gaps. The letter, dated April 8 1946, is from his glassblower Arthur Johnson. We have transcribed it in full with minor corrections to spelling and syntax and added a few comments as footnotes.

With his letter, Johnson enclosed a sketch (Figure 4) of the large cathode ray tube on which he was working.

63 Southwood Drive,
Tolworth,
Surrey

8/4/46

Dear Mr. Baird,
Glad to hear that you are getting better, you must have been a lot worse than we thought.

I am of the opinion that your absence has been felt by all of us, and I gather more especially by the directors, who seem to be at sixes and sevens over most things, but as you left a fairly clear cut programme there's nothing for you to worry over.

30" Tube
I have another one on the pump, which should be off this week – and it should be an improvement on the last, altogether there are four alterations and improvements (see sketch).

I have had a little trouble with the bulbs, one let me down during working and I found that five of them were not properly annealed. I explained the position to Jobling (Pyrex) they referred me to Hewittic [1] for re-annealing them. I wrote back to them pointing out we were not disposed to ask any more favours of Hewittic, and as we expected these bulbs to be sufficiently annealed to enable us to work on them, would they appeal to Hewittic on our behalf? This they have done and I have heard back from Mr.Haney of Hewittic, that they [will] do the job for us, so that's cleared. I have handled all matters relating to my department myself as we cannot afford to risk upsetting either of these firms.

11" double-viewing tube [2]

This tube I have shelved in lieu of another 11" projection tube and this is under way as an (improved spare) and will be finished before the Mark II power unit is ready.

The Met Vic oil Diff pump is now good enough for assembly and incorporating into the Mark III projection unit if required.

I have received the fluorescent powder [3] from Germany and will ascertain as to further supplies. As there is only a small quantity, I am not disposed to use it till I get some light test apparatus and standards to work from. I am handling this myself and am getting a unit made up.

I think this is all for now, hoping you'll be back soon also that the rest of the family are O.K. I expect Mrs. Baird could use a six months holiday (with full pay).

Yours sincerely, A.H.Johnson

We have inserted some annotations in Johnson's letter. These refer to further explanations, which we give below.

In his letter [1] Johnson refers to the Hewittic Company, the main supplier of large glass bulbs used in mercury arc rectifiers for the vacuum tube industry, in which Baird's majestic 28-inch television screen had been fabricated. Johnson certainly had good reason to take the company to task as badly annealed tubes may lead to leakage and a steady loss of vacuum causing a complete failure of the CRT. A stress fracture could ensue after evacuation causing an implosion (like an explosion only the forces act towards the centre of the tube), which would be potentially very hazardous in such a large bulb. The 30-inch glass tube was the centrepiece for the "Grosvenor"

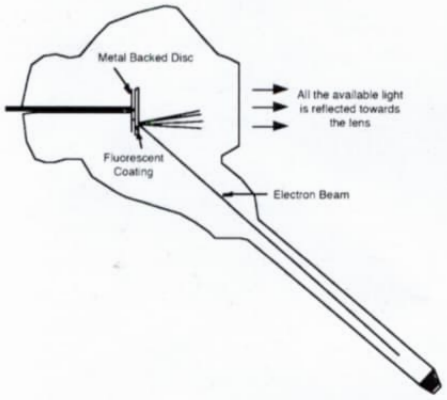


Figure 6

Figure 7

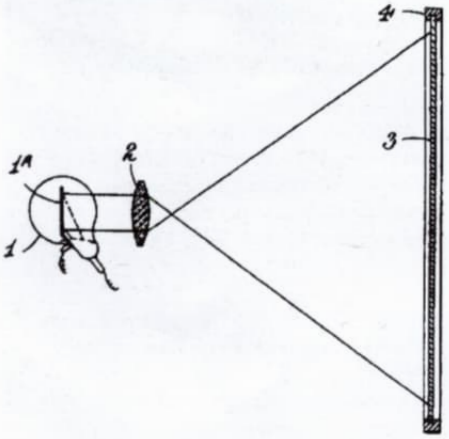


Figure 8

TELEPHONE: MAYFAIR 9999 Extn. 7422 248

Our Reference 21/2/2

Your Reference

MINISTRY OF AIRCRAFT PRODUCTION,
SIGESO - Room 1037
STRATTON STREET,
BERKELEY STREET,
W.1.

11th January, 1946

John L. Baird, Esq.,
Television Engineers,
3, Crescent Wood Road,
Sydenham, S.E.26.

Dear Sir,

We are in receipt of your letter dated 23rd November, 1945 in which a request is made for a sample of "yellow-white fluorescent powder", for cathode ray screens, information on the FERNSEH Co. of Berlin, and the present address of Drs. Goerz and Moller of that Company.

A search for a sample of the powder has been requested, and when this becomes available you will be informed.

The present address of Drs Goerz and Moller has been given as a Robert Bosch factory at Heidenheim, Controlled by:-

Lt. Col. French,
W.T.S.F.F. 20,
H.Q., B.A.O.R.

We hold the following documents which may be of interest to you in connection with the Fernseh Co., Berlin, and which may be perused at this Office at your convenience. We are unfortunately unable to release documents on loan or to make copies.

CAFT Assessment Report G 17A, B.C.
Eval. Report 208, 302.
WTSFF Report G 17 B

It has been suggested that you may perhaps wish to interrogate a Prof. Heimann in connection with German television. We are informed that he will be brought to this country towards the end of January. If you are interested, it is suggested that you contact our Mr. H.L.M. Blanchette for further information, (SIGESO., Industrial Liaison, Mayfair 7422 Extn 9).

John B. Score

J. B. SCORE

for Co-ordinating Officer
SIGESO.

Figure 9

(Figure 5) receiver model placed in the Savoy Hotel to show the BBC's broadcast of the Victory Parade. The location was rather appropriate as the Foyer of the Savoy was mirror panelled, enabling a multiplicity of reflected images. Due to weight and cost (about £1500), only a single Grosvenor model housing, at that time, the largest direct-view television screen in the world, manufactured by John Logie Baird Ltd. It was last seen in public at the Radiolympia show in 1947.

On the 11-inch double viewing projection tube, [2] the authors initially assumed that Johnson was referring to a copy he was making,of the projection tube that BTL/Cinema TV had used for the Boon/Danahar boxing match in 1939. The Baird Television projection tube as detailed in Figure 6, produced an intensely bright image from a small front-surface highly reflective internal screen developed by Dr Szegho. The tiny internal 405-line image used a very expensive high magnification, colour corrected lens manufactured by Taylor, Taylor Hobson, (Figure 7) to project television images on a 3 x 3.75 metre screen. This was the tube used by the BTL/Cinema TV engineers for the Boon/Danahar boxing match in 1939.

This confusion was brought about by the knowledge that Szegho had secretly supplied JLB with a number of BTV projection tubes in 1940 for use in his stereoscopic colour television project.

However, the authors can now reveal that JLB designed and patented a simpler method of theatre projection that greatly reduced the cost, enabling an inexpensive lens to be utilised.

GB602341 Applied 10 April 1945 accepted 25 May 1948

Abstract:
"My invention consists in using an uncorrected lens in conjunction with a cathode-ray screen of large area (for example of about 2 feet square), and restricting the amount of magnification of the image so that the imperfections produced in the resulting picture due to the nature of the lens are not of sufficient magnitude to make the picture unacceptable. For example, a 2 feet by 2 feet image may be enlarged (i.e., have each linear dimension increased) from five to ten times. By this device an inexpensive lens without colour correction can be used, without undue loss of definition."

GB602341 was JLB's last issued patent. Figure 8 indicates that the screen is set within the centre of a spherical glass tube and is therefore inadvertently 'double-viewing', based on the 28-inch design, but smaller. By using an 11-inch tube (Figure

8) JLB could project a large television image of the Victory Parade on a five-foot screen with a simple lens, by simply restricting the magnification to just over five times. Further evidence is supplied in 'John Logie Baird: A Life', Page 363:

"At the Savoy Hotel the programme would be seen on a 5-foot projection screen."

The fluorescent powder [3] is the "yellow-white fluorescent powder" from Fernseh that JLB had requested as referred to in J B Score's letter (Figure 9) dated 11th January, 1946 from SIGESO, (Ministry of Civil Aviation, Operations and Technical Radio Committee (Watson-Watt Committee): Sub-committee for Investigation of German Electronics and Signals Organisation 1945-1946.)

During Douglas Brown's interview with Szegho in 1990 it was pointed out that the best fluorescent material for withstanding the high beam velocity was 'biscuit' coloured, giving the images an almost sepia tint.

By early June, it looked as if JLB was making a partial recovery and his diary contains notes on large-screen television at the Savoy Hotel and in cinemas in central London. Sadly, he died in his sleep on June 14, just a few days after the BBC had resumed its television broadcasts and had televised the Victory Parade.

*About the authors:
Douglas Brown is Director of the Science and Technology Forum at the University of Strathclyde. He is the author of a forthcoming television history book, "Images Across Space" which will be reviewed here in the near future. Malcolm Baird lives in Canada and is a retired professor of chemical engineering. In 2002 he co-wrote (with Antony Kamm) a biography of his father entitled "John Logie Baird: a life". This book is the basis of a feature film project currently at the development stage.

Big Bertha Boogies Again A report from the deep South by Dicky Howett

Celebrating 50 years of 'ITV in The South', BATCs Paul Marshall and stalwart chums Dave Hill and Sam Booth (plus Dicky Howett who brought along his authentic 1960s Southern Television 'Auricon' 16mm camera) took part, at Southampton's sumptuous Rose Bowl stadium, in a gathering of television memories.

It was at 5.30pm on the 30th August 1958, from a converted (Plaza) cinema in the Northam area of Southampton, that Southern Television began transmitting. Thus it was on the 20th September 2008, in the 'Hampshire Suite' that over 280 people, (mostly, ex-Southern Tv old-timers, with a smattering of TVS and Meridian staff) gathered for an impressive buffet, a chat, a rummage through memorabilia and amazed collective gasps at 'Big Bertha', the fully-restored original-condition late 1960s Southern Television scanner. On show also were two live Marconi Mk VII four-tube colour cameras, (themselves over 30 years old) one outside covering arrivals and the other in the marquee, shooting the elegantly tanned Fred Dinenage and guests. Media coverage included the attendance of crews from Meridian ITV and also The Royal Television Society who are making a commemorative DVD. Colour footage from the two Marconi cameras will be included as an 'authentic' touch.

Restoring a Dulci "Stereo Two" Preamplifier and DPA10 Power Amplifiers

By Tony Fell

When young I remember listening to a valve hi fi system of a family friend and although later I was given a Dansette and a reel-to-reel, by the time I had my first audio separates everything was solid state. The concept of listening to audio passed through a non-linear thermionic device connected to a loudspeaker via a transformer seems to evoke a nostalgic sentiment to some ears, although my own feelings are neutral here.

My servicing training normally resulted in economic repair techniques to get things going, but now I can take on complete restoration projects, where time is not an issue. A friend asked me if I could look at the equipment, which had been in his family but unused and stored in a garage since the 1970's. I had previously restored a 405 line tv some time back, and not having come across a great deal of valve audio gear (my experience is mainly modern radio, tv and amateur radio) I took on the project, possibly as an article or subject for a website, where accompanying digital photos are invaluable.

It would appear that the system was purchased in 1963 (date on capacitor) and one power amplifier had been repaired later (capacitor date 1968): the power amplifiers seemed identical apart from the shroud on the audio transformers (one black, one grey). I did not have any data on the preamp, the power amplifiers are essentially the Mullard 5-10 circuit, with a switched tapped transformer permitting 3, 7 and 15 ohm loads.

Dulci sold a large number of these economy power amplifiers over the period – budget hi fi perhaps.

Power amplifiers

These did not seem in great condition, all valves absent and rusty valve holders. Although the original hammer finish paint was flaking in places, top chassis were unrusted, and some of the painted legend on the rear panels was missing. Examination showed leakage from the electrolytics, dc leakage in the "plastiseal" wax capacitors, and many resistors, including so-called 10% hystabs way out of tolerance.

Luckily both audio and mains transformers were ok, but the shrouds needed painting. At this point it seemed the best thing would be to dismantle and reconstruct the amplifiers, as everything was on a busbar and tag panels and point to point wiring. All valveholders would be replaced with shrouded ceramic types, and the wiring updated to separate mains and ht/heater voltages completely. The benefit of having two mono amplifiers is that one can be dismantled and reassembled by comparing it with the other unit.)

The units were stripped down with the exception of the speaker terminals, 2-pin ac outlets and octal socket, which were riveted. I covered these with masking tape, also used to hold paper to cover the rear legends.

Underneath the cleaned chassis, a few tiny rust spots were removed, then basic metal cleaning with WD40. Top chassis paint could have been stripped, but after cleaning, the main defects were pinholes in the paint. This surface was sanded with 1200 emery paper, cleaned, and repainted using a small gloss paint roller with direct to metal hammered finish silver grey paint (Wickes).I used two coats, not only was this a close match to the original but the result had a stunning gloss finish. The transformers were carefully desoldered, and I decided to dismantle them, to permit the shrouds to have rust inside removed and spray painted with silver vehicle paint and clear lacquer, rust was also removed from the long 2BA screws, and the heads lacquered.

The voltage selector plates on the mains transformers were masked prior to spraying. I repaired the damaged paint lettering with black rub down types and applied four spray lacquer coats.

Reassembly.

Initially I obtained new B9A valve holders with a gold securing clip, however the ceramic part was too big for the chassis holes. I was lucky to get some new ceramic B9A holders of the old shrouded type at a radio rally, retained them with pop rivets, as the originals had been riveted. I decided to use an ordinary ceramic B9A valve holder for the

EZ81 rectifier, this type makes better contact to the hot pins. It would appear that the EF86 and possibly the ECC83 would benefit from the fitting of B9A screening cans.

Dulci followed Mullard's method of a busbar running from the negative of the main capacitor to a tag under the audio transformer fixing screw at the other chassis end. I merely replaced it with a new length of 16swg tinned copper wire held in a vice and pulled straight. The new main capacitor was an RS new old stock 50uF+50uF/450V, and I used a Farnell E350 regulated power supply to charge it via a 100k resistor in 50V steps. This worked well, and when measured both sections were in excess of 50uF. I did not have any 15uF/350V vertical components, so I chose to use a plastic blanking plug in the chassis, and mount a small tag strip secured in one of the vacant holes to support a 16uF/450V axial component underneath. I replaced all resistors with 0.5W 1% or 2% metal oxide or metal film(except where 1W 5% carbon film were needed) and capacitors by 47n polyester and 100nF polypropylene. The two ceramic caps were replaced with silver mica.

The 47 ohm and 47k resistors around the EL84s were replaced with 1W types, with 270 ohm 7W wirewound for the cathodes. I always use silicon rubber sleeving on component leads that get hot or carry high voltage.

I replaced the pan head screws on the speaker terminals, in fact I used new plated screws throughout, with washers to prevent paint damage. The input phono sockets were corroded so when the new twin sockets were fitted, a small washer was inserted between chassis and socket paxolin to prevent it bending.

The contacts of the rotary output impedance selector switch were thoroughly cleaned prior to refitting. "New" colours 3 core mains flexes were a tight fit in the old eyelets, but were retained with cable ties as the technique of tying knots in supply cables is not now acceptable as a cord grip method.

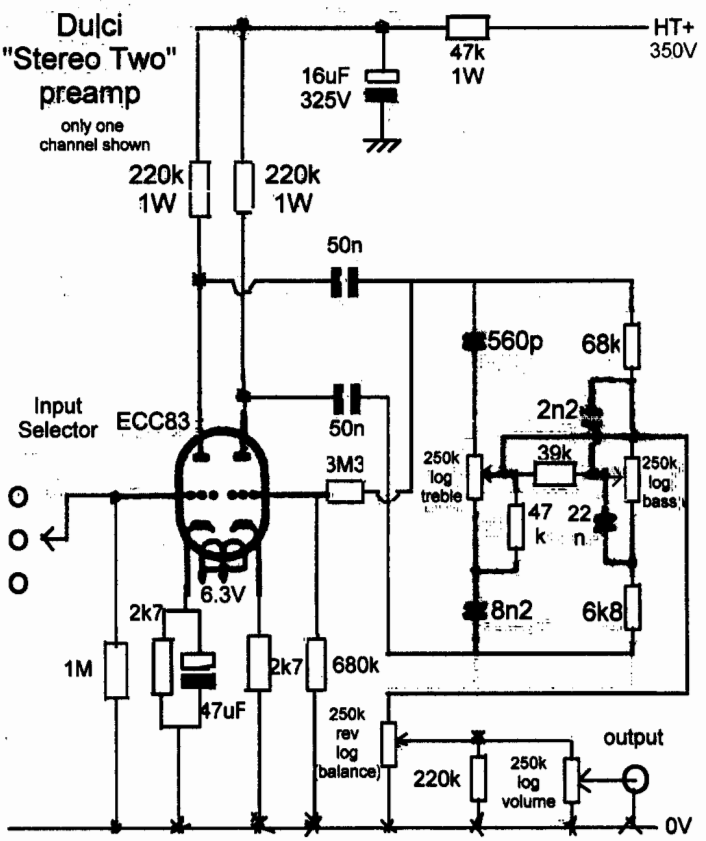


Fig 1

Testing

Having completed all the wiring I initially installed only the EZ81 and applied power. The HT rose to 400V with no load, so I switched off to fit all the valves, again all were new. After switch on I applied 1KHz tone to the input – very loud, no distortion, very little hiss and hum. One socket needs about 50mV, the other 200mV. This is useful depending on your application or preamplifier. I now proceeded to dismantle the other power amplifier, and reconstruct it as the previous one. This was achieved in a somewhat shorter time.

The final action was to clean the amplifier bottom covers, these seemed plated and without rust. After drying I applied 4 coats of clear aerosol lacquer, and refitted using new self tapping screws and washers.

"Stereo Two" Preamplifier

It is interesting to consider that the original 5-10 power amplifier appears in 1954 (the EZ81 came later) yet it is still being made over 10 years later. At that time Mullard developed a high quality preamp based on two EF86 valves used in the Quad 22. At the Dulci end of the market, most would only be using line levels or ceramic or crystal pickups so high gain and equalisation for magnetic pu and tape head were not needed. However the unit works well and the Baxandall bass and treble tone control is an active circuit. As this unit was enclosed, it seemed in better condition than the power amps. It is not self powered and requires ht and heater supply from the DPA10 using a cable terminated in an octal plug. The circuit is a ECC83 per channel with one triode connected as an amplifier ahead of the other triode with the bass and treble network slung between input and output – I have drawn a skeleton sketch (Figure 1) Removing the top cover revealed the controls and sockets mounted on the box but everything else was on a printed circuit board. Again checks on the resistors indicated values way out, and I also replaced two Hunts capacitors on the bass controls. A scratchy noise resulted from adjusting the volume and balance pots but this was again due to leaky Plastiseal capacitors coupling the ECC83 to the network. I was out of 47nF/400V caps so instead I used some 47nF+47ohm contact suppressors rated at 250V rms: the noises disappeared.

The phono sockets on the rear needed a good clean but the plastic legend plate was offset so it was removed and the four corner holes moved with a small round file. There is a humbucker pot but it didn't make much difference. I decided to separate the ht and heater for each valve channel and feed from each DPA10, but only one powers the indicator lamp – the original 8V bulb was still intact. One final change I made was to install a double pole mains switch with a terminal box for mains in and mains out to the DPA10's. Only the Stereo Two metal case is connected direct to the three core cable mains earth. One useful preamp feature is when Disc is selected two variable pots on the rear permit level and balance adjustment.

The owner particularly wanted a magnetic turntable input so I constructed a small external RIAA preamp using 4558 dual op amp IC on stripboard in a screened box with a 15V 100mA external power supply.

Front Panel

This is both pleasing and distinctive, consisting of a photo etched copper plated brass plate, with the legend and grid pattern in white. This looked tired, with severe tarnish and scratching, discoloured white paint, and broken knobs. The top and bottom aluminium covers required repainting with silver grey paint as before, and the brass plate had the lacquer and white paint removed with paint stripper. Sadly some of the marks on the plate are down to defective electroplating, but it responded well to a polish with wadding. Although I had never done this before, I heated the plate whilst rubbing in white engraving wax, and after cooling gently scraped away the surplus wax using a piece of perspex to avoid scratching the brass. After a wipe with meths and a water wash, the plate was carefully dried and four coats of clear lacquer applied. This helped to remove any remaining deep scratches. After fitting the panel, as a temporary measure I have fitted five grey Marconi knobs, but will replace with white knobs when I have located some.

Performance

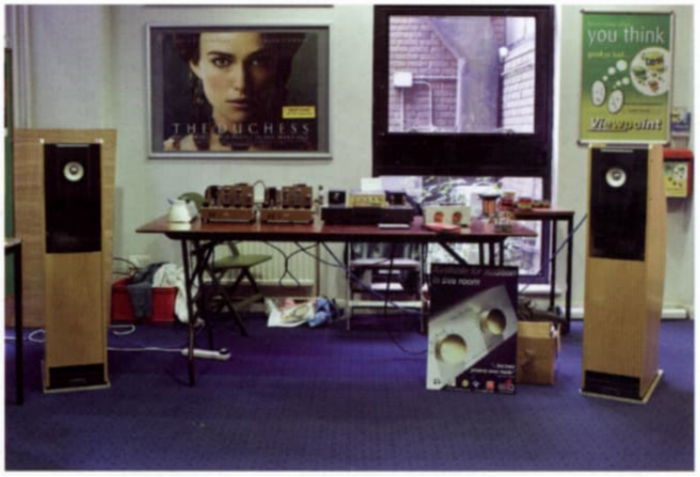
Whilst not being a high end Leak or Quad, this preamp and amps combination yield a very pleasing sound, with a true log/antilog balance control and bass and treble controls with excellent variability. 12 watts to each efficient speaker was adequate for the front two channels of a surround sound system The decision to replace all the power amp and many preamp components has resulted in low noise and it is hoped a high level of reliability. This has encouraged me to undertake further restorations of this type.

Wootton Bassett auction

Photographs from 28th September 2008 by Mike Barker

Audiojumble!

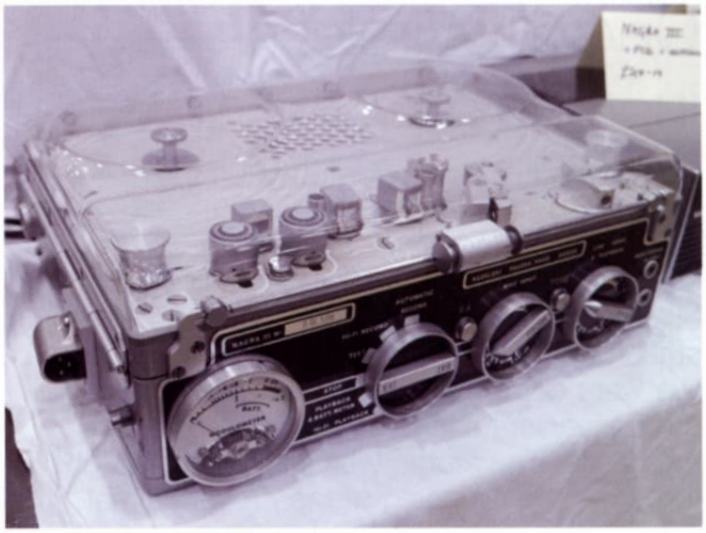
Photographs from 12 October 2008, Angel Centre Tonbridge by Carl Glover

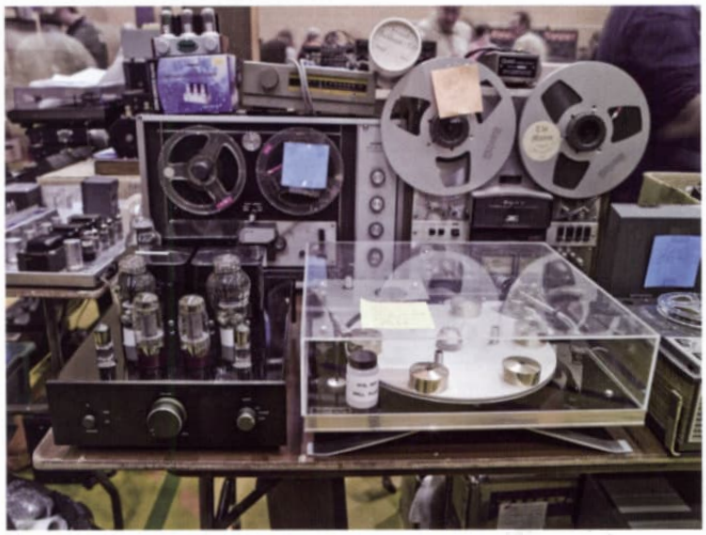



TEAC
TEAC
STUDER


LANEY


Ferrograph





Crystal Wireless in Wales

by Ian L Sanders

"When the engineers commenced their search for a studio at Cardiff in the early days of 1923 there was little indication of a shipping slump in that city, for every inch of office space within reasonable distance of the station and hotels appeared to be occupied. We were compelled to accept a cramped but convenient site over a cinema opposite the castle. The studio was just large enough to permit the swinging of the proverbial cat. Its windows faced the road, and no amount of shuttering proved sufficient to cut out the rumbling noises of trams passing below".

Burrows, A.R. *The Story of Broadcasting*. Published by Cassell and Company, London 1924.

BBC broadcasting formally began in Wales with the opening of station 5WA in Cardiff on February 13th, 1923. A confined studio measuring just 225 sq. ft. was established above the cinema at 19 Castle Street overlooking Cardiff Castle, from which the Welsh language was to be heard for the first time on the British radio with the operatic baritone Mostyn Thomas performing the traditional Welsh folk-song *Dafydd y Garreg Wen (David of the White Rock)* on opening night.

Operating on 353 metres, the 1.5 kilowatt Marconi transmitter – situated about a mile away at the electricity works on Eldon Street (now Ninian Park Road) – was connected to the studio by a post-office telephone land line. The transmitter's aerial, an unusual, four-wire "cage" design suspended between a cooling tower and a chimney, rose to a height of some 150 ft. and was so designed as to provide maximum crystal set coverage to the towns and villages in the industrial mining valleys north of the city.[1]

Notwithstanding the BBC's plan, however, the screening effect of the intervening hills often meant that reception of 5WA on a crystal set in many of the outlying areas – particularly those to the north of Pontypridd – was often quite unreliable. Ironically, though, excellent crystal reception of the Welsh station was frequently reported by English listeners across the Bristol Channel located along the Somerset coast.

The BBC's management (notably its Managing Director, John Reith),

The slider-tuned *Westraphone* by Western Radio Company of Queen Street, Cardiff was a simple receiver built on an open mahogany plinth. The set at top (shown here with a replacement permanent detector) carries the Post-Office registration number 863 and features the manufacturer's transfer on the coil. The version at bottom, with an original cat's-whisker/galena detector and terminals for two pairs of headphones, has the registration number 4182 inscribed under the base. Top photograph courtesy of David Jones.

Announcer Frederick Roberts at the microphone with the station's orchestra on 5WA's first day of broadcasting, February 13th, 1923.

Children's Hour at 5WA in 1924 with Uncle Leslie, Auntie Betty and Uncle Norman. The Welsh Children's Hour Radio Circle badges (right) awarded to junior listeners were the first to feature the "radio sunbeams" design, adopted later by all the BBC local stations.

The Mark of Efficiency.

Are you content to Listen to Swansea Relay Station only?

If so, a "Cosmos" Crystal Set will suit you.

"Cosmos" Crystal Sets from £3. 0. 0. complete with all accessories.

"Cosmos" Amplifiers for operating Loud Speakers—from £1. 15. 0.

Do you Want to Hear all the other Broadcasting Stations?

Then you MUST use a "COSMOS" Valve Set, unequalled for efficiency and purity of reception.

"RADIOBRIX" Valve Sets from ..... £8 0. 0. complete

"COSMOS" Radiophone Valve Sets from £14 10. 0. ,,

"COSMOS" Universal Valve Set (as shown below) from £17 10. 0. ,,

Obtainable from all Wireless Dealers.

SPECIFY **COSMOS** SETS

Advertisement of Metro-Vick Supplies Ltd., Swansea.

South Wales Daily Post, December 12th, 1924.

Frontispiece

LOCATION OF BROADCASTING STATIONS

The BBC stations at the beginning of 1924 consisted of eight main and one relay transmitter (Sheffield). Dotted circles represent a radius of 25 miles – about the limit for crystal reception operating under normal conditions. Under the terms of the original BBC local station scheme, Wales was served only by Cardiff, leaving most of the principality without any crystal coverage. With favorable circumstances, however, listeners in the middle and north parts of Wales might have been fortunate enough to receive the Birmingham or Manchester station on a crystal set.

Pitman's Radio Year Book 1924. Published by Isaac Pitman & Sons, Limited, London.

anxious to improve crystal set reception in the poorest of the Welsh coal-mining towns as a vehicle in the fight against growing communist sympathies in the region, quickly sought to improve the situation. The company's Chief Engineer, Peter Eckersley[2], driven by more altruistic motives, was also influential in pushing for improved coverage in the South Wales coalfields, viewing his responsibility to provide *"poorer people with entertainment rather than pander to the better off."* As a result, the transmitter power at 5WA was subsequently increased to 10 kilowatts, increasing the crystal range to some forty miles in several of the problem areas, although reception in much of the Rhondda Valley remained problematic.

With only the Cardiff station in operation, Wales was poorly represented in the overall broadcast scheme and when the recommendation was made by the Sykes Committee in late 1923 to introduce low-power relay stations, Swansea Borough Council – although not on the original list – petitioned strongly to be included in the planning. On April 30th, 1924 the BBC's Broadcasting Board accepted the premise that it was right that *"all towns of considerable population should eventually have facilities which would enable them to receive broadcast programmes on inexpensive sets"*.[3] Inexpensive sets in this context, of course, referred to crystal receivers, which by this time were dominating the wireless market. The decision to build a relay station at Swansea was finally made on May 28th, 1924 and on December 12th, 1924 Wales' second broadcast station, 5SX came into service.

In common with the other BBC relay stations, the crystal range of 5SX was restricted to no more than 3-5 miles, and served only the immediate area. Swansea could, however, boast the most varied programme material in the country with programmes relayed from both London and Cardiff, in addition to broadcasting some of its own productions. Wasting no time to reach out to the potential new audience, the Metropolitan-Vickers Company placed an advertisement by in the *South Wales Daily Post* on the Swansea station's opening day informing readers that their *"Cosmos" Crystal Set* priced at three pounds would suit those who were content to listen only to the new relay station.

This circa 1924 "piano-style" crystal set was built by a Mr. Edwards (see close-up at top left) living near Ruthin, North Wales. Ruthin is about 45 miles from Manchester (2ZY) and about 25 miles from Liverpool (6LV), so it might just have been possible to listen-in on a crystal set if conditions were favourable. Photographs courtesy of David Jones.

However, those wishing to hear *all the other Broadcast Stations* would require a *Cosmos Valve Set*, with prices starting at £14 10s. 0d. – a figure well beyond the reach of most people, especially the working population of the mining towns of the industrial south.

Although Cardiff and Swansea were the only truly Welsh stations, crystal users in North Wales might, under exceptionally favourable conditions, have been able to receive 2ZY, Manchester or possibly 5IT, Birmingham, and – with the help of an amplifier – even the relay station 6LV, Liverpool. For those in the west or middle of Wales, however, an expensive multi-valve receiver would have been needed to receive any kind of signal. Such owners were in the minority in Wales, as pointed out by a writer in the *South Wales Daily News*[3] for December 13th, 1924, suggesting that *"for the family who can buy a valve set, there are hundreds who can only run to crystal outfits."*

Licence figures for Wales were not recorded before 1930, but despite the fact that by 1925 there were about 700,000 and 160,000 homes within crystal range of the Cardiff and Swansea stations, respectively[3], extrapolation of the available numbers suggests there were no more than a few tens of thousands of licenced listeners at most in the whole of Wales by the end of 1924. Of course, there must have been significant numbers of unlicenced listeners in addition to those listening legally, but in general, the harsh economic climate in the mining valleys of the mid-1920s meant that sales of even the lowest-cost crystal sets were far behind the rest of the British Isles.

The original list of the BBC member companies[4] operating between 1923 and 1926 and other contemporary sources reveal the existence of some nineteen wireless manufacturers in the greater Cardiff area (including Aberdare), four in Swansea, one in Tenby and five in North Wales (Abergele, Denbigh, Flint and Colwyn Bay – four towns within about 20 miles of the relay station 6LV, Liverpool). Of these Welsh manufacturers, however, only three are known by the author to have actually manufactured crystal set models, although others – especially small-scale firms in Cardiff – would have almost certainly produced sets for the local market.

The opening of the BBC's high-power, long-wave station, 5XX at Daventry in July 1925 brought more of the population of Wales within crystal range, but because Daventry broadcasts were relayed from the London station, the majority of listeners in the Principality received programmes with no specific Welsh content. The Cardiff and Swansea stations were closed in 1933 with the opening of the BBC's West Regional transmitter designed to serve the southwest of England and the heavily populated areas of Wales. By this time, of course, the crystal set had long since disappeared from all but the poorest of homes, displaced by more powerful valve receivers.

1. Lucas, Rowland: *The Voice of a Nation – A Concise Account of the BBC in Wales 1923-73*. Published by Gomer Press, Llandysul, Dyfed 1981.

2. Eckersey, P.P: *The Power Behind the Microphone*. Published by Jonathan Cape Ltd., London 1941.

3. Davies, John: *Broadcasting and the BBC in Wales*. Published by University of Wales Press, Cardiff 1994.

4. Lorne Clark – private communication.

The author's first crystal set, a Gecophone No.1 was purchased from an antique shop on Whitchurch Road, Cardiff in 1974, starting a lifetime obsession with the subject!

Any further information on crystal receivers of Welsh origin would be most gratefully received. Please contact the author at author@crystalsets.com

Crystal Reception in Wales:

CARDIFF – Wireless has made considerable progress in South Wales, especially since the Cardiff station commenced operations, and the number of authorised stations in the vicinity of Cardiff is estimated at 1,000.

We understand that crystal sets have sold like hot cakes to residents within 10 miles of Cardiff, and, in general, satisfactory results are being obtained. More or less "blind" spots appear to exist, however, in some of the deep narrow valleys, and only poor results are obtained even with two- or three-valve receiving sets.

Wireless Weekly, April 11th, 1923.

CARDIFF – A good deal of dissatisfaction is stated to exist among South Wales listeners-in in regard to the alleged deficiency of the broadcasting service. When this was inaugurated it was declared that the Cardiff station would prove adequate for the whole area, but this does not seem to be the case, and bad reception is reported from many places. Results are possible, of course, with elaborate valve receivers, but owners of crystal sets find that their standard range is greatly reduced when operating in South Wales. For example, a case is quoted of a crystal set giving first-class results up to a thirty-mile range in other parts of the country which fails to do so when only ten miles from the Cardiff station. There is a demand that the British Broadcasting Company shall regard South Wales as a "blind spot", and another suggestion is that a relay station be erected at Swansea.

Wireless Weekly, July 11th, 1923.

Swansea, Too
Right in the centre of the town of Swansea there is a blind spot where crystal reception is decidedly bad. The local dealers had already taken up the matter with the B.B.C. when their case was unexpectedly strengthened by the appearance of similar trouble in London. The B.B.C. call it "asymmetrical radiation", but what they call it in Swansea and Peckham won't bear repetition.

Popular Wireless and Wireless Review, April 4th, 1925.

The Original BBC Local Stations

London	2LO	November 14th, 1922
Birmingham	5IT	November 15th, 1922
Manchester	2ZY	November 15th, 1922
Newcastle-upon-Tyne	5NO	December 24th, 1922
Cardiff	**5WA**	**February 13th, 1923**
Glasgow	5SC	March 6th, 1923
Aberdeen	2BD	October 10th, 1923
Bournemouth	6BM	October 17th, 1923
Sheffield*	6FL	November 16th, 1923
Plymouth*	5PY	March 28th, 1924
Edinburgh*	2EH	May 1st, 1924
Liverpool*	6LV	June 11th, 1924
Leeds/Bradford*	2LS	July 8th, 1924
Hull*	6KH	August 15th, 1924
Belfast	2BE	September 14th, 1924
Nottingham*	5NG	September 16th, 1924
Dundee*	2DE	November 9th, 1924
Stoke-on-Trent*	6ST	November 21st, 1924
Swansea*	**5SX**	**December 12th, 1924**

*low-power relay station

Opening dates for the original BBC transmitters. Operating as a relay station with a power of 200W, Swansea was the last of the local stations to be opened. The local stations were phased out when the Regional Scheme was established

Welsh Crystal Set Manufacturers, 1922–1926.

Model	Manufacturer
Duophone	Radio Supplies (of Cardiff): 38, Albany Road, Cardiff.
Rhodiaphone	Cecil Rhodes Ltd.: 180, Bute Street, Cardiff.
Westraphone	Western Radio Company: 59, Queen Street, Cardiff

Rhodiaphone by Cecil Rhodes Ltd. of Cardiff.

The Cardiff Wireless Exhibition

I HEAR from Cardiff that every kind of preparation is being made for the Wireless Exhibition and Radio Convention which is to be held in Cardiff from May 12th to 19th. The organisers of this exhibition are installing their own plant in order to give continuous broadcasting the whole time it is open, and manufacturers of all kinds of wireless sets will show them at their various stalls, and give practical demonstrations of how to work them. Many London firms will be at the exhibition, and other leading firms will show their goods through innumerable well-known Cardiff firms who are exhibiting.

Popular Wireless Weekly, May 5th, 1923.

Radiograms

SWANSEA Radio Society has passed an unanimous resolution urging the B.B.C. to place the next relay station decided upon in Swansea. It will be remembered that this town was not mentioned in the provisional list of towns where it was proposed to build relay stations.

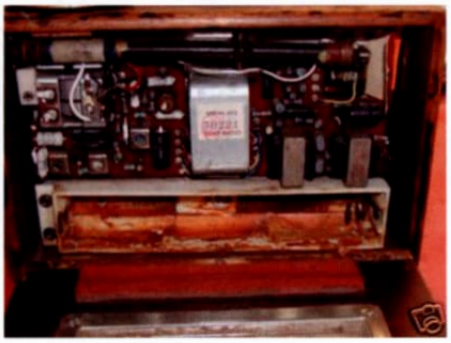
Amateur Wireless and Radio Review, November 10th, 1923.

The Case of the Czech-Canadian Sony

by John Panton

I can never resist checking out the US, UK and German eBay sites for radio bargains. Items from the US or UK often have high postage costs, leading me to abandon a potential bid. The Austrian Post Office, by the way, even includes a charge to cover the 'Maut' on the motorways!

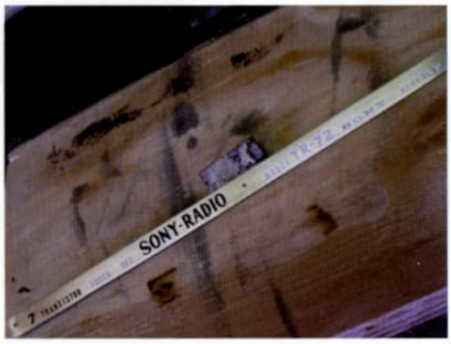
Not quite DOA, but limping badly



Hope that corrosion doesn't go too far

Back and hinges off

Lacquer looks bad, lettering looks good

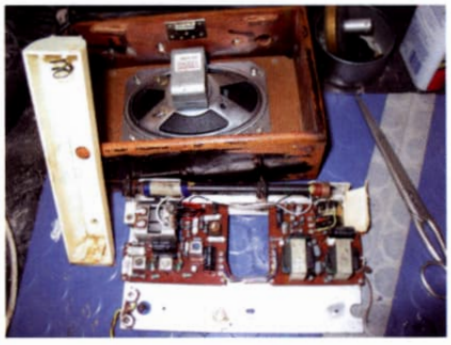


Wet & Dry removes the lacquer, leaves the lettering

Cover your back!

You gotta getta grip

Stuck up



Chassis, speaker, battery-holder cleaned

When I saw a Sony Gendis TR 72 on offer from the Czech Republic recently, the likelihood of a reasonable price seemed remote. Apparently that day my resistance was low, postage was merely 12 euros and there were only 4 bids in, up to 17 euros. It was a Sunday, which usually speaks against a bargain price; on the other hand it was at midday, when a lot of people may be out. It could be that the source address put some bidders off and admittedly the appearance of the radio case was not persuasive.

Anyway, I entered a relatively high proxy bid and, to my great surprise and delight, won it for 23 euros. This set was apparently produced for the Canadian market around 1956. I'd love to discover some details of its history.

There was a little confusion over the payment and a singular lack of email response in German or English from the seller, but just when I was beginning to wonder about a write-off, the radio actually arrived, well-packed and unexpectedly quickly.

The appearance of the radio had been accurately described in the auction – pretty grim and more grim than pretty. Still, that's how I like to get them. It's nice to look at the 'museum' but restoration is the best part of collecting.

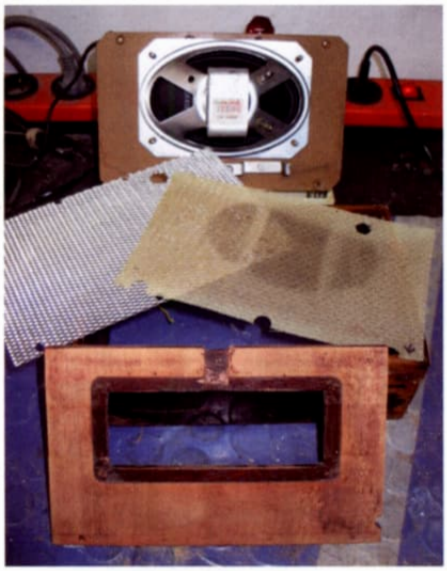
The Sony had lost a lot of its finish, there was neither a handle nor fittings, one knob was missing and the veneer on the back cover looked as though it had been scratched off by a bear that could smell beeswax sealing the coils inside.

The description had also asserted, "Works perfectly", so I connected 4.5V from the PSU and was assailed by perfect silence. Oh well, look later…

The first step is to remove the eight screws holding the hinge for the back cover and put them into a tin for safe keeping. Remember, you're going to be working on this for several days and it's much easier to have the original bits than to have to find new ones. The brass hinge had been lacquered and at this age inevitably shows some corrosion.

It needs rubbing down to the metal with 600-wet&dry, then re-spraying with clear lacquer (that used for metallic finishes on cars is good here). The back cover carries a brass strip with Sony brand name and the model number just above the hinge. Luckily, the letters are recessed so you can treat the strip in the same way as the hinge. In my case, this had been nailed on to the front to replace a missing front nameplate. It is slightly longer than that at the front but hadn't been cut to fit, so I was able to rescue it.

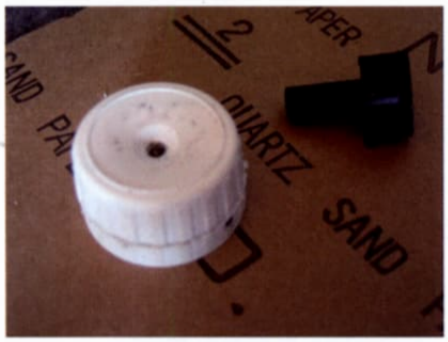
Now, to the back cover: since the only bear I had around was in the stock market, I had to make my own claws. Break off the blade of an old dinner knife (unless your wife's looking) and sharpen the edge. This will nicely lift the remaining veneer off in large portions. After sanding down any remainder, cut a piece of new veneer somewhat larger than the back – I used oak, but suspect the original was beech. It doesn't matter much because the grain and colour will disappear under the finish. Apply wood glue evenly over



Speaker grill and cloth feeling washed out

No lacquer left

Hope that's what it looked like originally



Pill-box lid

Made to measure

Joint effort

Sprayed knob, mould and finished brass cap

Comparing with an original

Tuna tin metamorphizing

the surface and clamp to the back between two solid pieces of flat wood. After it has dried, cut the edges off using a mini circular saw. Be careful that the veneer doesn't start to split off. It's better to remove more with a sander than to risk that. The mini-saw can also be used to remove the veneer from the grille cutout. Now fill the grain with a wood filler and sand down well to a smooth finish.

Removing the chassis is relatively straightforward. The knobs (in this case, the knob) are grub-screwed and can be loosened from the inside. Under each are two screws to the chassis. Releasing these four screws and a fifth through the middle of the battery holder, which may be hidden under a label, will free the chassis. Any frustration caused by two tiny wooden stops for the back cover can be relieved by breaking them out and replacing later. It will do you good and makes things easier anyway. Just unsolder the speaker connections and the chassis will now come out.

It is now worth completely disconnecting the battery holder to clean it thoroughly. Brasso is good for getting rid of corrosion. Old toothbrushes and artists' brushes are great improvements on cloth-wrapped fingers. A bit of friendly persuasion allows the brass +/- connectors to be pulled out and, if you are as lucky as I was, one will give unexpectedly and leave you flat on the workshop floor. Still lucky, because the reason for my sudden change of direction was corrosion, leaving a chance that the original description, "works perfectly" might eventually apply.
I soldered some brass strip salvaged from a 4.5V battery to the remains of the connector and re-fitted. Smearing the brass with Vaseline should avoid future corrosion.

We still need to remove the speaker, using a ¼" socket driver. That's easy, but remember to protect the membrane before storing it. A hardboard cover with another 6 screws is then revealed. It is a good idea to render the speaker bolts immovable in the board using a copious amount of glue around their heads.

Finally, it is possible to take out the grille and the speaker cloth. Soak the cloth in soapy water (gall soap is excellent), wash with clean water and leave to dry on a flat surface. Clean the flies and barbecue sauce off the metal grille with a toothbrush, refraining from returning the brush to the bathroom, and check the speaker membrane for holes caused by hatpins stuck through the front of the grille and for household cleaner spray.

Remove the Sony badge and the indicator arrows from the front and top of the case, respectively. Here, the badge had been bent, damaging the enamel. I was able to achieve a passable repair using white 2-component epoxy (PC-11 from www.pcepoxy.com), polishing with 600 wet&dry before applying a clear lacquer. The bolts on the indicator arrows break off easily (guess how I know?). Solder or super-glue back into position and be more careful next time!

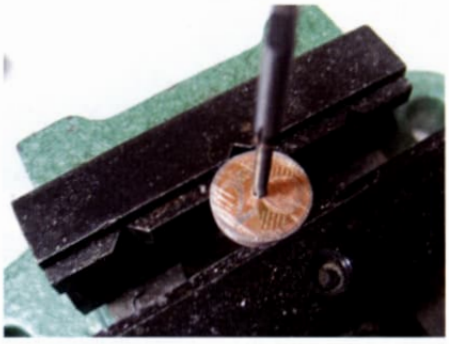
Since my radio had no handle, the wooden case is now completely unencumbered. The finish is almost certain to be at least

Two handle covers, raw

Covers sanded and primed

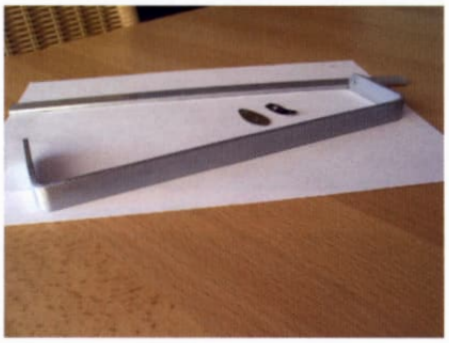
Covers Sprayed

That makes 4 Cents...



Tapping

In place



Getting a handle on it

New leather pull

Prima facie case

crazed and probably seriously damaged. Assuming there is some left, obtain some colour-matched paint before going any further. Mine was called chocolate brown and had the number RAL 8017HR. Sand off right down to the wood, using a delta sander. Do not use paint remover unless, of course, you love restoration to the point of making more work; it tends to lift the veneer! Apply three coats of the paint, lightly sanding down between coats. It will be better if you have the facilities for spraying. You can actually buy spray cans of the chosen colour but it is prohibitively expensive. Finish with a couple of coats of clear lacquer.

I had put out some feelers for a spare TR-72 volume knob in vain, so had to see if I could make one. At some point, a plastic pill bottle came into view whose lid had the right diameter and also grooves on the edge. I cut the edge down to give the correct height and added a tube to fit the potentiometer shaft. It was sprayed with primer followed by 'brass' paint. A photograph of the top of an original knob was stuck on the top. I made a mould of the cap and produced a replacement in car-body paste. Finally, the whole thing was sealed with lacquer and didn't look too foreign.

The handle was obviously going to be a finicky job. I started with the side holders, mainly because no source could provide a strip of aluminium in the required dimensions and I kept hoping something would turn up. (It did!) Two egg-shaped base plates were cut and shaped out of computer-case steel (that stuff is really hard!) and holes drilled to match those in the radio case. The side pieces were made from strips cut from a tuna-fish tin after its sojourn in the dishwasher. I thought this radio was going to be fishy enough without also smelling of it. The strip was brazed onto the steel at some point and then gradually connected all the way round. It could then be carefully cut to size and shape. In situ it has to fit over the base plate, so at this stage one should make sure it does so. Drill holes to match those in the plate. Finish with a primer and the 'brass' spray.

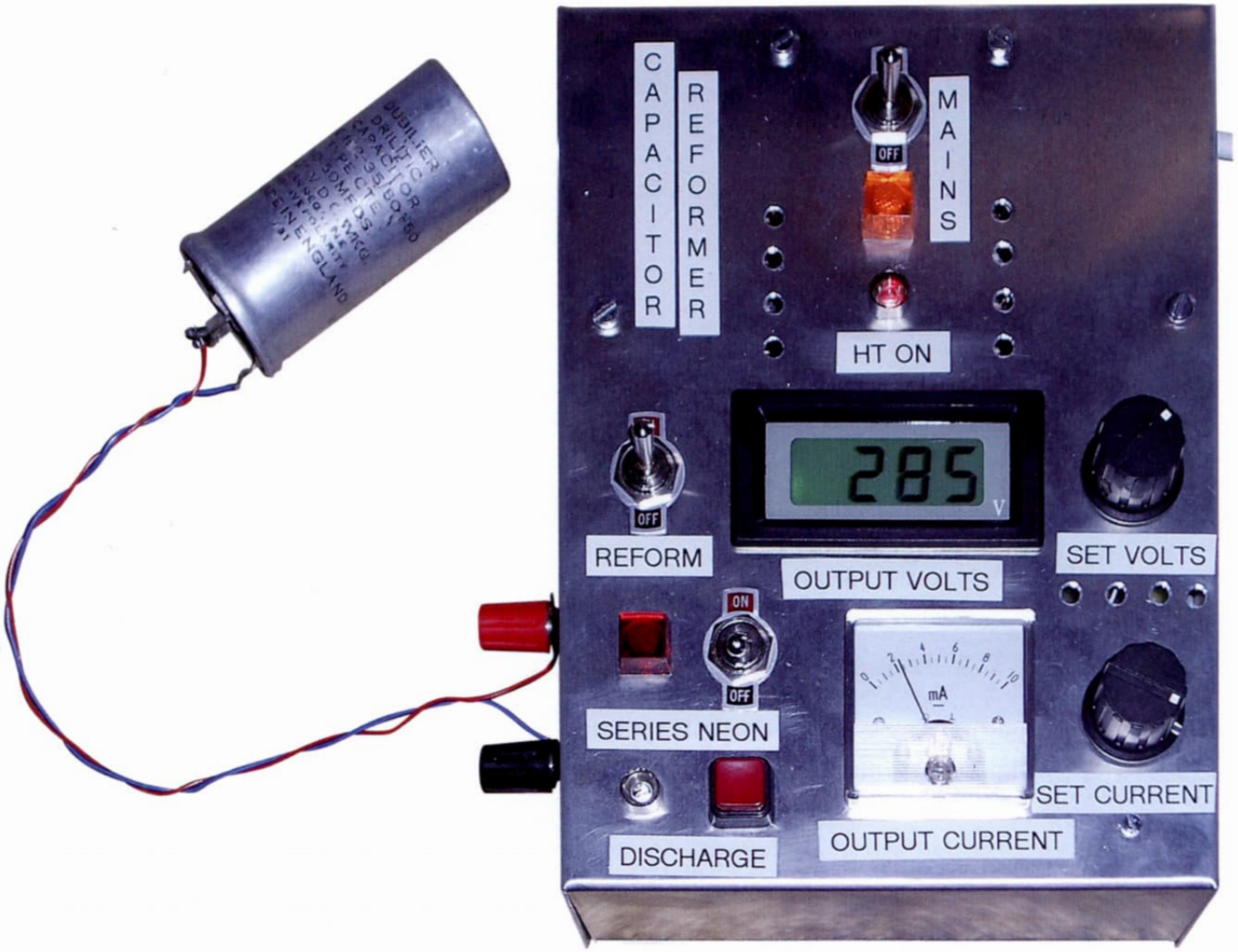
For fixing the handle, a couple of M3 brass bolts and customized nuts for the inside are necessary. I made the 'nut' by soft-soldering together two 2 EuroCent pieces, drilling a hole and tapping to M3. The finished nuts and bolts need to be flush with the inside of the wooden case to make sure the chassis will fit.

A neighbour whom I help with PC problems came up with an aluminium flat almost perfect for the handle – thank you, Franz! Determining where to bend the rod to obtain the right length for the handle was as taxing as it was vital. All I can suggest is to keep the flat too long until all the other work is completed, bend it on a round rod in a stable vice, heating as much as you dare. Making a mark on the rod and noting where it appears after bending can provide some guidance. Probably more by luck than judgement, mine could hardly have been better. The original seems to have some chrome plating and a slight tinge of brass on it. I didn't try to match that...

The order of assembly to be recommended would be:

Sony badge
Grille
Speaker cloth
Hardboard speaker frame
Arrest pointers in top
Handle
Speaker
Chassis
Wooden stops for the back cover.
Back cover and grip

I would still replace the knob if an original came along, but with the missing brass nameplate replaced by a right-angled brass strip which had to be hand-sawn 1mm smaller along its length, the radio looks quite acceptable – and, yes, you guessed it, after a little alignment it "works perfectly"!



Capacitor Tester and Reformer Unit

By Stefan Niewiadomski

This article was first published in the June/ July 2008 issue of Radio Bygones. It is reproduced here by kind permission of the editor, Mike Kenward. The PCB for the project is available from Radio Bygones Editorial Offices (see reference 1) order code RB102, for £6.50 including post and packing.

When bringing old valve-based equipment "back to life" an important factor is the condition of the capacitors (or should I say "condensers" in old-speak), some types of which tend to degrade over the years, especially if the equipment hasn't been used for a long time. The worst thing to do is to simply power the equipment up and hope for the best, as this can result in the dramatic destruction of the power supply electrolytic capacitors, and poor performance because of leaky and faulty capacitors in other parts of the circuit. This unit allows suspect capacitors to be tested and slowly "reformed" if necessary and therefore made safe for many more years of service.

One approach to this problem is to assemble a motley collection of meters and power supplies on your workbench, or even to "borrow" some HT supplied by working valve equipment. Certainly this approach can be made to work but the high voltages involved can make this risky (for you and anyone else who may stroll past), especially since the lash-up may have to be left powered up for a few days to properly reform some "sick" old electrolytics.

De-luxe Model

The unit described here is a self-contained "de-luxe" capacitor tester and reformer which gives the best chances of successfully and safely verifying and if necessary "mending" capacitors without risk to the capacitors themselves, or more importantly, to the user. The unit is an electronically-controlled adjustable HT supply, up to about 500V, with built-in voltage and current metering and limiting. This allows the reforming current to be accurately set and monitored so that the process can be carefully controlled.

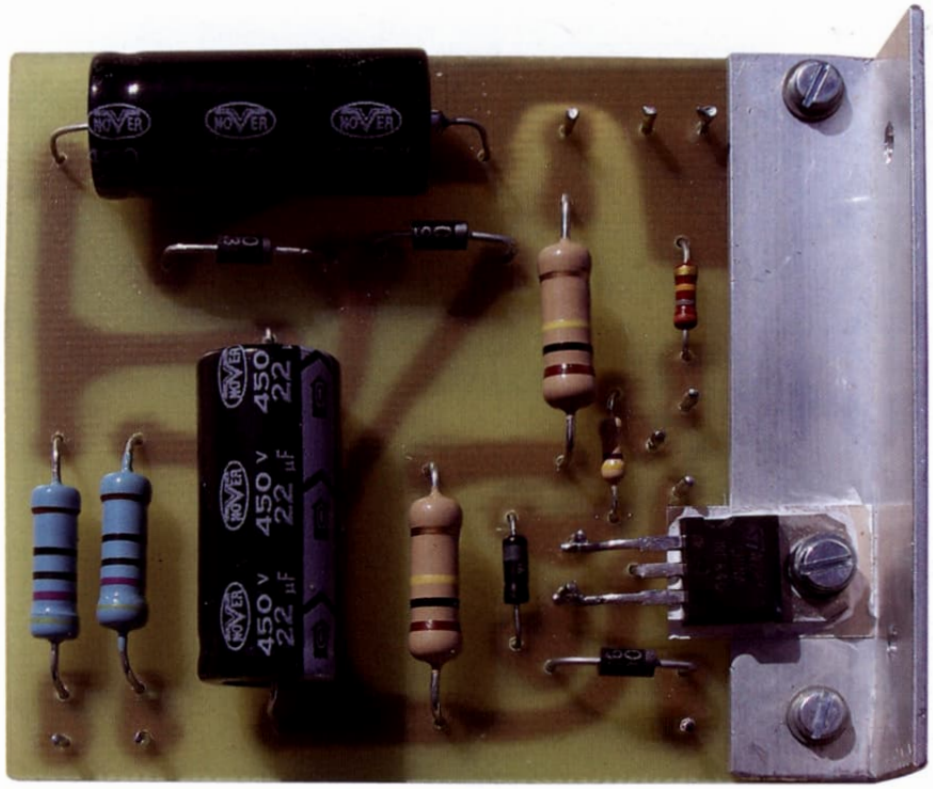
Components are available from various suppliers to build the unit completely from new. Hopefully the experienced constructor with a decent "junk box" will have many of the components to hand.

Why Might a Capacitor Need Replacing or Reforming?

An electrolytic capacitor is manufactured as a "Swiss Roll" of two long lengths of aluminium foil rolled up, mounted in an aluminium tube and sitting in an electrolyte. It is the large total surface area of the long lengths of foil, coupled to the high dielectric constant of the electrolyte and the closeness of the foils to each other which gives the electrolytic its high capacitance value for its volume.

During the manufacturing process a thin layer of aluminium oxide is formed on the aluminium foils to insulate them from each other. While the capacitor is in regular use, the layer stays in good condition and continues to maintain this insulation. If a capacitor is unused for a long time, as is the case if say an old radio is left in the attic for years, the oxide layer deteriorates and insulation is lost. At its most modest form the capacitor will become leaky and at its most extreme it will fail catastrophically with a bang when DC is re-applied because of rapid heat build up caused by a large current flow through the faulty insulation.

Happily most electrolytics will recover successfully if the oxide layer is reformed to its original thickness and uniformity by the application of a slowly increasing, current limited, voltage source, up to its original (and maybe a little beyond) working voltage. Any



heat generated by the low resistance of the faulty oxide layer must be given time to dissipate out of the case, hence the need for a slow reforming process, which may take several hours, or even days, to complete.

If you come across a suspect electrolytic, first of all examine the terminal end of the capacitor for any signs of splitting of the seal or "oozing" of the electrolyte. If this is evident, then don't attempt to reform it. If you want to keep the appearance of the original component you can consider hollowing out the internals, inserting a modern capacitor and preserving the external appearance of the original.

Over the years paper dielectric capacitors can also become leaky which can upset the bias of valve stages, or maybe pull the AGC line to a fixed, low gain, level. This unit allows these capacitors to be checked for leakage and discarded if faulty, since reforming isn't an option with these capacitors. As with electrolytics, paper capacitors can be hollowed out and a new component inserted into the tube, thereby maintaining the vintage appearance of the original.

Generally speaking, silver mica, ceramic, plastic film and polystyrene (used in post-WWII sets) are reliable over the long term and shouldn't need replacing.

Circuit Description

Figure 1 shows the schematic for the complete unit. The mains input to the unit is switched by SW1 (MAINS ON/OFF), monitored by neon N1, and fed to the primary of the transformer T1. T1 and T2 are connected secondary to secondary, thereby safely stepping the mains voltage down and then back up to about 230V RMS for rectification and smoothing. Note that T2 needs to have windings capable of generating about 230V, typically achieved by connecting two 115V windings in series. This arrangement may seem odd but it has the advantage that no "valve" transformer (which are getting hard to find new these days), capable of generating 230V directly, is needed. If you have such a transformer in your junk-box or can salvage one from that old valve radio you've been saving for spares, then this is definitely acceptable. Such a transformer may also have a 6.3V heater winding which should be suitable for generating the LT supply for the digital meter M2. See later for how to make use of such a transformer if you have one.

The high voltage secondary of T2 feeds a voltage doubler circuit, comprising diodes D1 and D2, and capacitors C1 and C2, to generate a supply (marked HT+ on the schematic) of about 500V. This form of the doubler circuit has the advantage that C1 and C2 are connected in series across the output and hence each only needs to be rated at half the output voltage. R1 and R2 limit the switch-on surge current into the doubler circuit.

R3 and R4 serve two purposes: firstly they set the current through the HTON indicator LED1 when the unit is on, and secondly they bleed the charge from C1 and C2 when the unit has just been switched off. This dual purpose leads to somewhat of a compromise for the values of R3 and R4, since they need to be high enough so that they don't carry too much current and therefore run hot, but at the same time they need to be low enough so that they discharge C1 and C2 reasonably quickly when the power is switched off. An ultra-bright LED was used for LED1 which gives a very bright output from the relatively low current (about 2mA) passing through it. In my prototype unit C1 and C2 take a couple of minutes to discharge through R3, R4 and LED1 to a safe level and this time should be allowed for before any modifications are attempted on the unit.

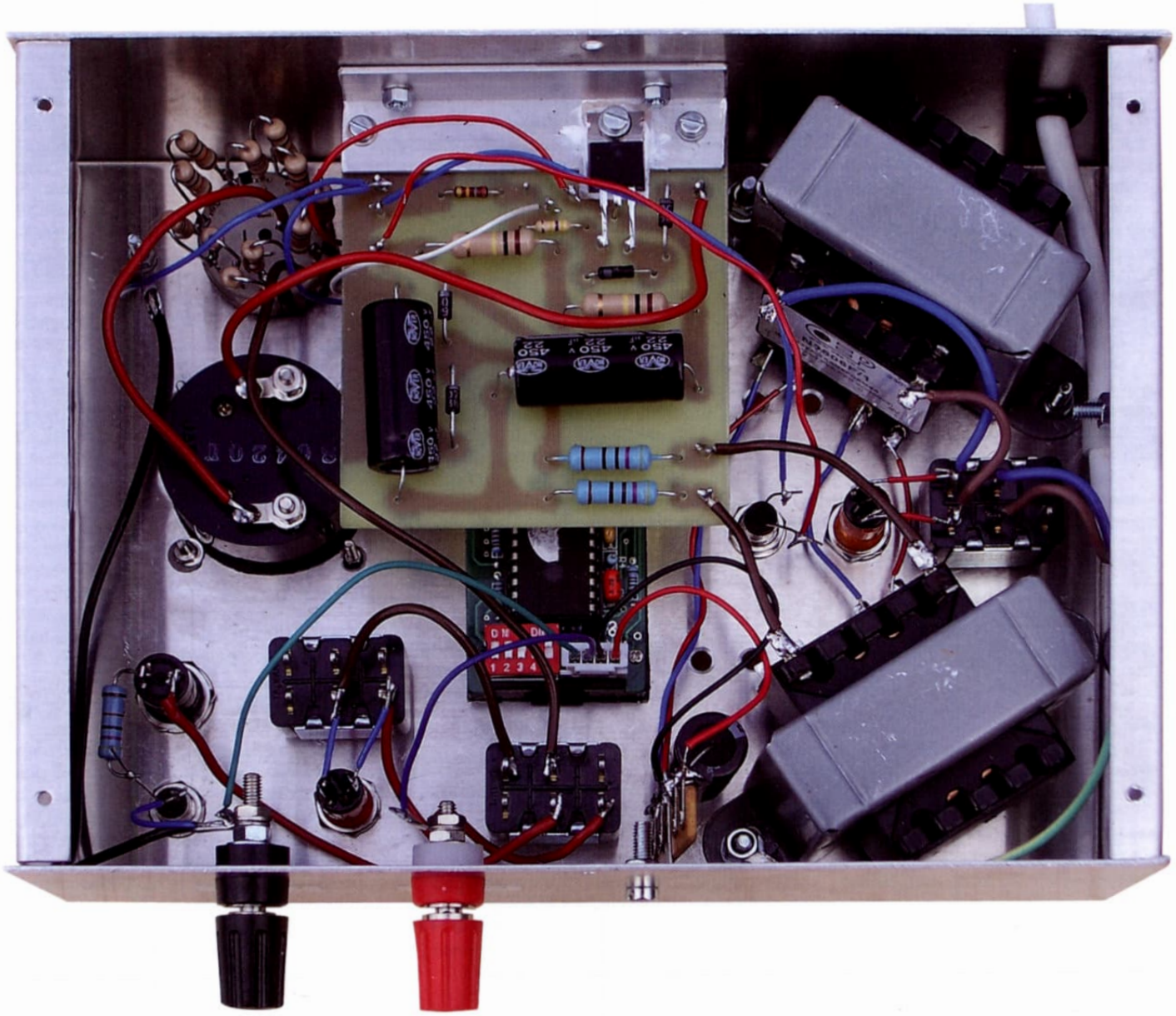
The HT+ line feeds the top of potentiometer VR1 (SET VOLTS) and its wiper controls the gate voltage of power MOSFET TR1 via R5. The IRFBE20PBF device used for TR1 has a maximum Vds rating of 800V with an on resistance of 6.5ohm and a 1.8A continuous rating (definitely not exploited in this application). A close enough alternative to the IRFBE20PBF is the BUK456-800B. The 800V Vds rating gives some safety margin for TR1: if you use a lower HT+ supply, a 500V device such as the IRF840 can be used, but check the lead-out for the device before using it.

The source of TR1 follows its gate voltage and provides a low resistance version of the gate voltage. 12V zener diode D3 protects TR1 against reverse source-gate voltages, and supplements the internal protection of the transistor.

Note that VR1 needs to be a high resistance value to limit the power it dissipates since it has the full HT+ across it. I used a 24mm diameter potentiometer which has a 500V maximum voltage rating and 0.5W maximum power dissipation. *Do not use just any potentiometer you have in your junk-box for this component, as its voltage and power rating are critical to its long-term survival in the circuit.*

The variable voltage from the source of TR1 is passed via diode D4 to a 10mA analog panel meter M1 to the current limiting resistor chain, R6-R16, arranged around rotary switch SW2. D4 prevents the possibility of reverse current being passed through M1, thereby damaging it. SW2 allows a switchable resistance of between 0 and 110kohm in series with the output to limit the current supplied to the capacitor being reformed. SW3 (REFORM ON/OFF) allows the CAP+ output voltage at SK1 to be switched on and off without turning the mains supply on and off. The negative side of the capacitor being reformed is connected to ground via socket SK2 (CAP-).

The other 6V secondary winding on T1 is used to derive a low current DC supply for the digital voltmeter M2, via D5 and C3. I used another 1N4007 for D5 (as for D1, D2 and D4), but obviously if a lower voltage, lower current diode is available, it should be OK to use it. The meter I used for M2 consumes about 20mA and has a built-in regulator which enables it to be run from an unstabilized supply between 5-15V. It may seem like overkill to build a digital meter into such a unit, but this makes the unit completely self-contained, and hence safer and more convenient to use. Later on I'll describe how to use this meter to measure the leakage current through a capacitor before and after it has been reformed. Such a digital meter isn't expensive these days, many models being available on the internet, and in my view is well worth the cost. If you already have a 500V analog voltmeter, use it if you want to, in which case D5 and C3 will not be needed.



Series Neon

If you research ways of reforming capacitors, one technique often found is to include a neon in series with the reforming supply, which in association with a series resistor both limits the charging / reforming current, and gives a visual indication of the current flowing. So that this technique can be used with this unit, a series neon N2 can be connected in and out of circuit by SW4 (NEON ON/OFF). This neon has a high value (typically 150kohm) resistor mounted inside its casing and so doesn't need an external series resistor. Clearly when N2 is in circuit its series resistor severely limits the possible output current, and it is therefore only used when making low current leakage measurements, rather than when reforming a capacitor. This switch and neon are a bit of a luxury, but I thought I'd include them so that I could compare the visual indications of the meter and the neon. You can leave them out without too much loss to the functioning of the unit.

Discharging the Capacitor ...
You Know it Makes Sense

SW5 (DISCHARGE) is a non-latching push button switch which allows the capacitor being tested or reformed to be discharged via R17 and LED2 before being disconnected from the unit. This is a safety feature so that fully charged capacitors are not accidentally left on the bench to "bite" later. Most experienced constructors (including me) will have been caught in this way at some time in the past and will testify that it's not a pleasant experience. Note that one set of contacts of SW3 prevents SW5 from attempting to discharge a capacitor being actively reformed (ie with SW3 in the ON position), which wouldn't be a sensible way of using the unit anyway. When the brightness of LED2 falls to zero, the capacitor is fully discharged. I made SW5 a non-latching switch so that it couldn't be inadvertently left in the ON position, which wouldn't in itself be a disaster, but would certainly confuse the user if left in this position unnoticed.

Construction

The prototype unit was built in an aluminium chassis (bought from Maplin), size 203mm x 154mm x 64mm, with a base panel, with the controls mounted on the top panel of the chassis, as shown in the photos. This arrangement gives easy access to the controls and good visibility of the meters. The placement of the components is not critical and can be adapted for other enclosures to hand.

Because of the high voltages present inside the case, for the sake of safety I strongly advise the use of a grounded metal case.

Figures 2 (a) and (b) show the tracking (at life size) and component layout for the PCB I used to mount most of the HT components. The PCB is pretty simple and is easy to manufacture at home. Mount the components in ascending order of size, taking care to correctly orientate TR1, the diodes, and C1 and C2. There is one wire link on the board, which can use bare copper wire, since there is no danger of it shorting to any other points. This link allows the possibility of inserting a resistor in series with the ground leg of VR1, thereby allowing the minimum output voltage of the unit to be raised.

I inserted 1mm terminal pins into the holes for the inputs and outputs to the board to facilitate inter-board wiring, rather than trying to insert wires into the board itself. Once the PCB has been fully assembled, the wiring to the switches, sockets, meters and LEDs

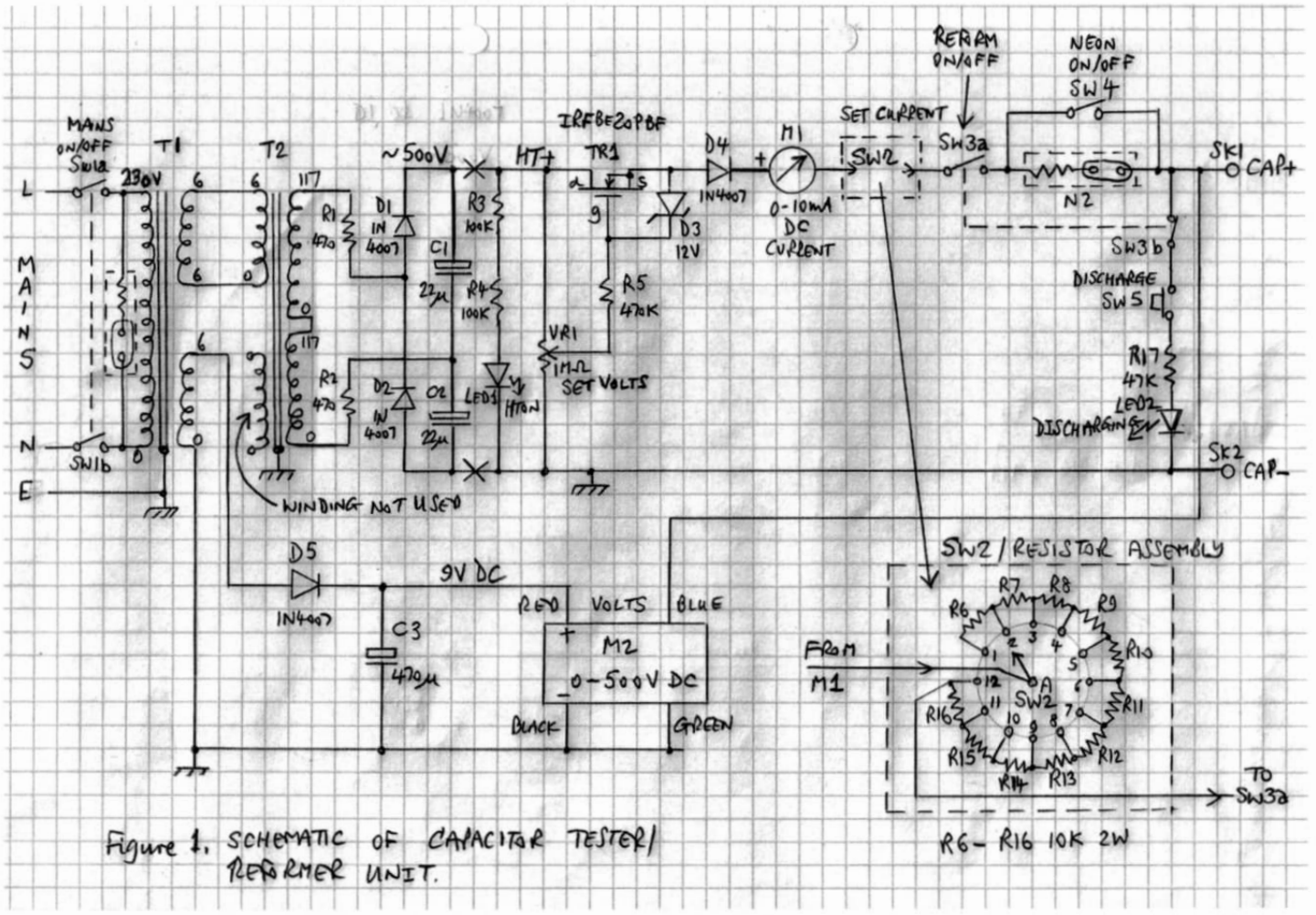


Figure 1. SCHEMATIC OF CAPACITOR TESTER/REFORMER UNIT.

Figure 1: Schematic of capacitor tester/reformer unit

can be connected. If preferred, a tag-strip construction method can be used instead of the PCB, as the layout is not critical.

Figure 1 shows the contact numbers on SW2, and resistors R6-R16 are mounted directly on the switch. The way the input and output to SW2 are arranged results in a decrease in overall resistance (ie increased capacitor charging current) as SW2 is rotated clockwise.

The PCB is mounted on an aluminium angle bracket bolted to the inside of the chassis, just above VR1 and M2, as shown in the photos. The TO220AB package of TR1 is also bolted to this bracket, as shown in Figure 2. *The metal tab of the transistor is connected internally to the drain terminal and so it needs to be insulated from the chassis by an insulation washer / bush arrangement.* This arrangement also aids TR1 power dissipation, though the power is usually small because the output current of the unit is low. The potentially higher power dissipation for TR1 is at higher currents (say 10mA) and low output voltage, since any drop from the HT+ voltage takes place between the drain and source of TR1.

The photos of the unit show the top panel layout of controls and meters M1 and M2, on my prototype unit. I didn't think it worthwhile to draw a detailed panel layout diagram, as no doubt constructors will have their own ideas for the best layout. Make sure you have all the panel-mounted components to hand before you start drilling: exact dimensions of switches, neons, potentiometers, sockets, LEDs, and meters from different suppliers may vary. The cut-outs for the meters (round for M1 and rectangular for M2) were made by drilling just inside the marked outline of the component and then cutting the small aluminium bridges still left with a pair of side cutters (probably not the best use for side cutters, so don't use your best, high-precision tool for this). Then the holes were smoothed with flat and half-round files until the meter fitted into the cut-out.

A tag strip bolted to the side of the case was used to support D5 and C3, which were not mounted on the PCB. A few ground tags give useful connection points to 0V, either fixed by their own holes and screws/nuts, or using existing holes such as those used to secure the transformers. The correct polarity wiring for the LEDs is with the short lead connected to ground.

The only slightly tricky switch to wire up is SW3: make sure that when the switch is in the REFORM ON position, SW3a contacts are closed and SW3b contacts are open.

To avoid the possibility of connecting an electrolytic to be tested and reformed the wrong way round, use different colors for the output sockets. Fairly obviously, I used:

SK1	CAP+	Red
SK2	CAP-	Black

I mounted the output sockets on the left hand side of the chassis (as viewed from the front) of my prototype, as this suited the way I was going to use the unit on my work bench. You can adjust this if different positioning suits your set-up better.

As shown in the photos, the mains cable enters the unit at the right side of the chassis. For the sake of safety, a rubber grommet must be used where it passes through the chassis, and the cable clamped to the chassis inside the unit so that it can't be accidentally pulled from the outside. The earth wire from the mains cable is connected to the metal chassis via a ground tag.

Be careful that the polarity of M1 is observed and make sure you wire up M2 according to the manufacturer's instructions, being sure to get its power leads the right way round.

Although the unit doesn't run hot, a few holes can be drilled into the base and top surface of the chassis to aid air circulation, and feet fitted to raise the base above the bench.

Testing the Unit

Note that there are high voltages present inside this unit and great care should be taken while testing to avoid contact with these potentially lethal voltages.

After wiring up the unit, thoroughly check the locations and polarity of all the components in the chassis and check that all the solder joints are good, with no solder bridges or shorts. Double-check the wiring of the unit, especially the mains and HT wiring. Make sure that there are no possibilities of short circuits if wires move slightly.

Now plug the unit into the mains, switch on

SW1 and check that N1 and LED1 (the HTON indicator) light. Check the HT+ voltage: this should be about 500V. Measure the power supply voltage to M2: this should be about 9V, being stabilised by the internal regulator in M2. M2 should light and indicate whatever voltage is present between SK1 and SK2.

Using the reading on M2, check that the CAP+ output is switched on and off as SW3 (REFORM ON/OFF) is toggled. Rotate VR1 (SET VOLTS) and check that the output voltage between SK1 and SK2 changes from about 0 to +500V (assuming you used similar transformers to the ones I used). Make sure the output voltage is at a minimum with VR1 fully anti-clockwise and at a maximum with VR1 fully clockwise. If it's the other way round, *switch the unit off, unplug from the mains and allow C1 and C2 to fully discharge,* and swap over the outer connections on VR1.

If everything seems to be working, a "good" capacitor, for example another 22uF 450V electrolytic similar to C1 and C2, can now be connected between the CAP+ and CAP- terminals, but first rotate VR1 and SW2 fully anti-clockwise. This ensures that a large initial surge current doesn't flow into the capacitor, which could damage M1 and even the capacitor itself. Slowly rotate VR1 and SW2 clockwise in small steps in turn, gradually raising the voltage across the capacitor and increasing the current available to charge it, but be careful to keep this current below 10mA. Note that this current is simply charging this known good capacitor, and does not represent leakage current, as might be the case for an old capacitor in need of reforming. Raise the voltage across the capacitor up to its maximum rating, or the maximum output of the unit, whichever is lower. Eventually the current supplied to the capacitor should fall to very nearly zero as shown on M1 and by a very dim glow on the LEAKAGE neon, N2 (if switched into circuit by SW4), indicating a fully-charged, low leakage capacitor. Remember this capacitor now contains a great deal of energy, and it's sitting there ready to hurt you if you handle its leads, so don't do it!

Now switch SW3 (REFORM ON/OFF) to the OFF position and press and hold down SW5 (the DISCHARGE switch). LED2 should light brightly and then gradually lose its brightness as the capacitor discharges through R17. Since the unit is still switched on, the voltage across the capacitor is still being measured by M2. Eventually M2 will indicate that the voltage across the capacitor is close to zero. It is now safe to disconnect and handle the capacitor.

Using the Unit

One way often suggested of checking whether a capacitor is leaky and therefore needs reforming (or discarding in the case of a paper capacitor) is to apply an ohmmeter across its terminals. If the capacitor is good the meter will "kick" as the capacitor charges, and then fall back to a high resistance reading of several Megohms. One problem with this technique is that the ohmmeter will only have a low voltage internal source (maybe 3V or 9V) and so it doesn't really test the capacitor in the way it will be stressed in real life, hence the advantage of building and using this unit.

When carrying out this test, always ensure that at least one side of the capacitor is disconnected from its surrounding circuit, otherwise you could be measuring leakage paths around the capacitor. Alternatively remove the capacitor from the original equipment altogether, making careful note of its connections for when you put it back.

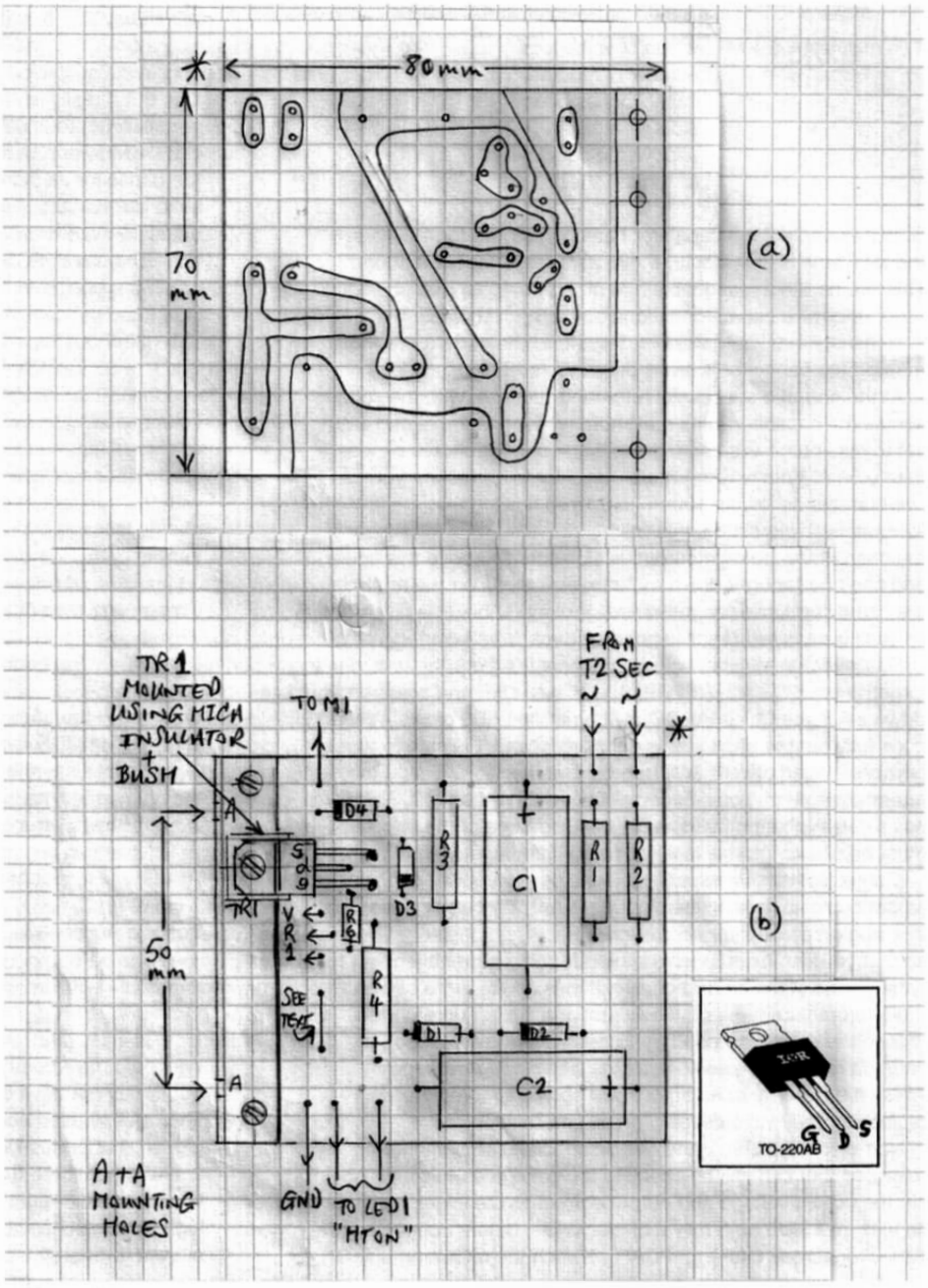
Before connecting a suspect capacitor to the unit, set the output voltage and output current to the lowest settings (ie VR1 and SW2 both fully anti-clockwise). Solder flying leads to the capacitor terminals and connect these to the CAP+ and CAP- sockets, making sure the polarity is correct.

You might want to place a small box over the suspect capacitor, just in case it decides to self destruct. By proper use of the voltage and current controls, this is very unlikely.

Switch the unit on and set the REFORM switch to ON. Check the current reading on M1: with SW2 at the maximum resistance setting this should be much less than the 10mA maximum of M1. Now slowly increase the output voltage and current using VR1 and SW2, but keep the current to less than 5mA. At each stage leave the settings for half an hour or so to allow the reforming process to take place, as shown by the current indicated by M1 reducing. You may see small "kicks" in the readings on M1 as the capacitor's insulation repairs itself. For successful reforming of a very leaky capacitor to take place, it's a good idea to stop for several hours at say one quarter, one half and three quarters of the capacitor's rated working voltage. Also check that the case of the capacitor isn't getting warm. *You should never reform using a voltage and current combination that causes the capacitor to get noticeably warm. If the case is warm, then the internal point(s) generating the heat are bound to be very much hotter.*

There are several opinions as to how much time is needed to reform an electrolytic. On the Internet I've seen a reference to a formula that says the time taken is given by:

Figure 2: PCB Tracking and Component Placement



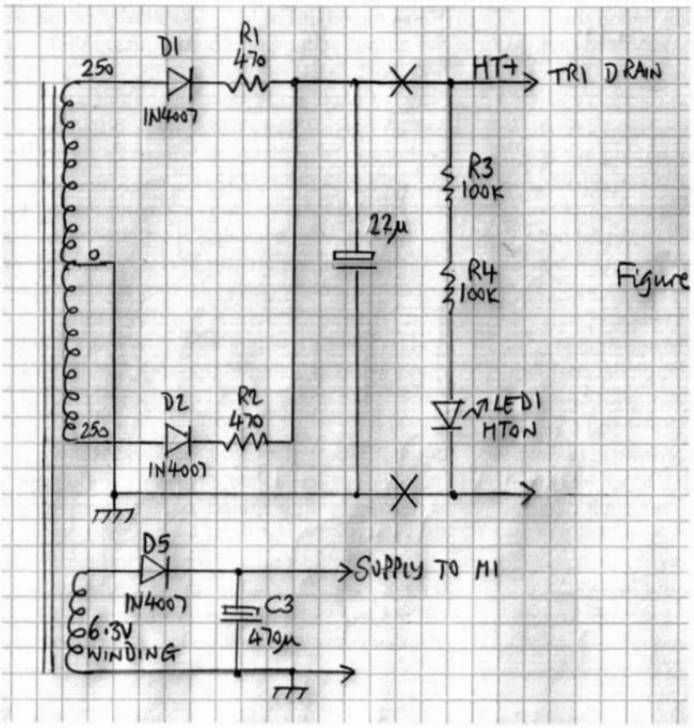


Figure 3: Use of valve mains transformer to generate HT+ Supply

T (in minutes) = 5 + M where M is the total number of months the capacitor has been in storage, either in unpowered equipment or "on the shelf".

So for example if the capacitor has been stored for 40 years, the total time is (5 + 40x12) = 485 minutes, ie about 8 hours. This seems like a reasonable rule of thumb. Note that you can't "over reform" a capacitor as long as the applied voltage is less than its maximum working value and the current flowing through the capacitor is small because its leakiness is low.

At the end of a successful reforming process, with the voltage across the capacitor at its maximum working voltage, and SW2 set to minimum resistance, the leakage current should be less than 0.5mA. With a 10mA meter used for M1, I reckon you can see currents as low as 100uA (ie 0.1mA) flowing through it. With N2 switched into circuit, this will be indicated by a faint glow of the neon. If the leakage current is significantly above this figure and can't be brought down by further sessions on the reformer, the capacitor is permanently damaged and should be discarded or its casing salvaged for use with new capacitors inserted into it.

Finally, before disconnecting the capacitor from the unit, don't forget to set SW3 (the REFORM switch) to OFF and press and hold down SW5 (the DISCHARGE switch), while LED2 glows. When LED2 goes fully out the capacitor is discharged and it is safe to touch its terminals. Alternatively SW3 can be switched to OFF and the discharge rate of the external capacitor can be monitored on M2. Since M2 has a very high input resistance, the discharge of the capacitor must be due to internal leakage rather than any external path.

Many electrolytics, especially those used in power supply smoothing circuits, consist of multiple (usually two or three) capacitors in a single case. It's best to re-form these sections separately so that you can be sure where the reforming current is going to. Otherwise it could be that one section is taking more of the current more than the others and these sections are left unreformed.

Be careful that you don't try to reform any low voltage cathode resistor by-pass electrolytics with a high voltage. These are typically rated at 25V and should simply be replaced if they indicate leaky on an external meter.

Non-electrolytic, eg paper dielectric, capacitors cannot be reformed, but can still be checked for leakage on this unit. Again set the output voltage and output current to the lowest settings (ie VR1 and SW2 both fully anti-clockwise) before connecting the capacitor across CAP+ and CAP-. Switch the reforming unit ON and set the REFORM switch to ON. Check the current reading on M1: with SW2 at the maximum resistance setting this should be much less than the 10mA maximum of M1. Now slowly increase the output voltage and current using VR1 and SW2, keeping the current to less than 1mA, and watching the voltage across the capacitor on M2. The current through the capacitor, as indicated by M1 and N2, should fall to a very low level if the capacitor is good.

Don't forget to discharge the capacitor by switching REFORM to OFF, and pressing and holding down the DISCHARGE switch, before removing it from the unit, and allowing enough time for the voltage to fall to zero.

How Leaky is the Capacitor ...some Maths

Let's say you want to quantify how leaky an electrolytic is before you reform it, and how much less the leakage current is after you've reformed it, how do you do this? Here's a way using some simple maths.

The charge Q (in Coulombs) held in a capacitor of value C Farads would have a potential difference across its terminals of V Volts, and these three values would be related by the formula:

$Q = C . V$ Equation 1

Now let's say the charge changes by a small amount, ΔQ ("delta" Q), and since the capacitance stays constant, then the voltage changes by a corresponding small amount ΔV. Equation 1 now becomes:

$\Delta Q = C . \Delta V$ Equation 2

This looks suspiciously like a bit of differential calculus, and so it is, but it really isn't too difficult. So let's say you charge a 32µF capacitor up to 250V using the reformer unit, then switch the REFORM switch to the OFF position and watch the voltage across the capacitor as displayed on the digital voltmeter M2. Say in 30 seconds the voltage falls to 235V, that is a ΔV of 15V (actually a negative ΔV, but for the purpose of this exercise we won't worry about this). Therefore we can now calculate the value of ΔQ (that is, how much the charge in the capacitor has changed) from Equation 2:

ΔQ = 32uF x 15V = 480µCoulombs

Assuming the voltage measurement has been carried out using a voltmeter with an infinitely high input resistance, this is the amount of charge that has leaked out of the capacitor via any leakage paths inside the capacitor. We are not too familiar with dealing directly with the concept of charge and it would be more useful to have this charge leakage expressed more indirectly as a current, which we are familiar with. So now let's convert this charge loss into a current.

Charge and current are related by:

$Q = I . T$ Equation 3

Where Q is the charge in Coulombs, I is the current in Amps, and T is the time in Seconds.

Again let's say the change in charge is ΔQ and the change in time is ΔT. We can now calculate the current I by re-arranging Equation 3 to give:

$I = \Delta Q / \Delta T$ Equation 4

So for a ΔQ of 480µC in a time of 30 seconds, we get:

$I = 480\mu C / 30$
$= 16\mu A$

We could have combined Equations 2 and 4 into a single equation, but it may not have been as clear as using this two-step approach. The values I used above are typical of what you'd measure on an old-ish, but perfectly usable electrolytic after it has been reformed. I actually measured these numbers on a 32µF Plessey capacitor marked with the date "Aug 65". In fact since no voltmeter has an infinitely high input resistance, the 16µA represents the worst case leakage current through the capacitor, since some of the charge must have

exited the capacitor via the voltmeter.

Alternative Circuits

There are many alternative methods and modifications a constructor can make to the design of the unit to suit components you have to hand or slightly different ways in which you intend to use the unit. Probably the main change you might want to make is the in the way the HT is generated from the mains.

If a "valve" mains transformer is available this can be used in the unit instead of the T1 and T2 arrangement. Remember I only used this step-down/step-up arrangement so that a valve mains transformer didn't have to be sourced. If you have a transformer with a high voltage center-tapped secondary then a full wave rectifier arrangement can be used, as shown in Figure 3. From a 250V – 0 – 250V transformer you should get about 380 – 400V for the HT+ supply, without the need for a voltage doubler, which should be sufficient for most practical purposes. Of course you will have to modify the PCB to accommodate the different arrangement, or use a tag strip.

Chances are that such a transformer will also have a 6.3V secondary winding originally intended for powering the valve filaments. This can be used to generate the LT supply for M2. It may also be useful to connect this 6.3V voltage to an external socket so that it could be used to power standard valve filament circuits if needed, thereby increasing the usefulness of the unit.

Reference 1

The address to write to for the PCB, type RB102 is:
Radio Bygones, Wimbourne Publishing Ltd
Sequoia House, 398A Ringwood Road, Ferndown
Dorset BH22 9AU

Component List

R1,2	470ohm 2W carbon film or wirewound
R3,4	100kohm 2W carbon film or wirewound
R5	470k 0.25W carbon film
R6-16	10k 2W carbon film
R17	47k 2W carbon film
VR1	1Mohm 500V 0.5W linear potentiometer (see text)
C1,2	22uF 450V axial electrolytic
C3	470uF 25V axial electrolytic
TR1	IRFBE20PBF N-channel MOSFET (or IRF840 if 500V Vds is acceptable)
D1,2,4,5	1N4007 diode
D3	BZX55 500mW 12V zener diode
T1,2	Mains transformers, 0-6V + 0-6V secondaries (see text)
LED1,2	Panel-mounting ultra bright LED and mounting bezel
M1	0-10mA DC analog panel meter
M2	0-500V DC digital panel meter (new2006power, bought through eBay, see text)
N1,2	Panel mounting mains neon, with integral resistor
SW1	Mains on/off double pole toggle switch
SW2	Single pole, 12 way rotary switch
SW3	Double pole, two way toggle switch
SW4	Single pole, two way toggle switch
SW5	Single pole, non-latching push button switch
SK1	Banana socket (red) CAP+
SK2	Banana socket (black) CAP-

Miscellaneous

Knobs for VR1 and SW2.
PCB (if used, RB102).
Insulating mounting washer and bushes for TR1.
Aluminium bracket for mounting TR1 (50mm x 15mm x 15mm).
Case: 203mm x 152mm x 65mm aluminium chassis and bottom panel (Maplin XB68Y or similar.
Insulated connecting wire.
Mains cable, grommet and cable clamp.
Tag strip to support D5 and C3.
Earth tags, screws and nuts.
Feet for chassis base.

Letters

Dear Editor,

I wonder if any readers remember the "Radio Constructor's Centre" in Westborough Road, Westcliff-on-Sea, Essex?

Since the 1930s Bill Fleming ran this thriving shop for both enthusiasts and also for the radio and TV repair trade. The tiny shop was jammed packed with every conceivable component including valves and latterly transistors.

When I became interested in making radios and amplifiers as a teenager in the 1960s, I would visit Bill's shop regularly. Saturday was a day to be avoided, as the little shop was packed with enthusiasts with a queue extending onto the pavement outside. Bill would also provide advice and he would know of others if practical advice was required by a budding enthusiast.

During the 1980s, I believe, Bill's son took over the business, but the glory days of the 1930s to 1960s were by then over. A few years ago I had occasion to go past the shop and the inevitable had happened: it was closed and boarded-up. A few months later the even more inevitable happened - the premises had become an Indian takeaway.

I felt it was worthwhile recording for posterity the marvellous enterprise of Mr Fleming as I have never seen it mentioned in any enthusiasts' magazine, etc.

On a different subject, a week or so ago I drove along Priory Crescent in Southend-on-Sea to notice the old Ekco Works boarded-up and seemingly ready for imminent demolition. Another link with the past gone.

All best wishes,

Ray Pallett
www.memorylane.org.uk
Memory Lane
P O Box 1939
Leigh-on-Sea
SS9 3UH
England

Dear Editor,

I despair at the over–restored offerings that are appearing in the Bulletin as of late. A thirties radio should look like a thirties radio and not like a prop for a Doctor Who programme! A set that was made 60 years ago should retain that patina of the age. The weird obsession with health and safety (political correctness?) should not demand the wholesale destruction of (for instance) the original wiring, which having lasted 60 years will go on quite happily as long as it is not disturbed. I replace faulty components by fitting new parts in the new cases, but leave the rest and the valves, if original, alone. As long as the set is lightly fused I am happy to use it without the paranoia of non–standard thermal fuses and over cleaned chassis, new systoflex sleeving et al.

Yours sincerly,
Roger Chacksfield

Days of Wine and Radios

by Martyn Bennett

A highlight of the year for European radio collectors is the annual meeting at Riquewihr in Alsace, France. The meeting is organised by the CHCR (Club Histoire Collection Radio) and is held on the first Sunday in May. In sharp contrast to English meetings it is an open air affair! Because of its central location – close to the German border, Switzerland and N Italy – it attracts a truly international band of radio collectors and has a friendly atmosphere.

I first went to Riquewihr well over 10 years ago, encouraged by a group of jolly French collectors met at a BVWS Harpenden meeting (Francois Humery, Andre & Jeanine Chompret and Jaques Dubois). After a lapse of several years Anne & I returned for the 2007 meeting and we went again this year. Riquewihr, pronounced "Rick Veer", is a very small medieval walled town situated in the heart of the wine producing region. The whole area is a unique mix of French and German influences, having 'changed hands' many times in its long history. It is also sheltered by the Vosges mountains and enjoys warm sunny weather - although this is not always the case in early May.

The precise location for the meeting in the town has varied over the years, but currently it is held in the coach park, backing onto the town wall. In 2007 the organiser, Christien Adam, had the whole park at his disposal, but in 2008 he was squeezed into three quarters of the area. This added a certain 'liveliness' to the space allocation proceedings – all part of the fun. Just like here, there has been a decline in the prices of collector's radios. Although the majority of radios are French, there are also a few British sets and I usually manage to buy at least one. I bought a Fellophone last year and a British Ericsson this year.

Several foreign collectors have lobbied me in the past to try to stop the NVCF clashing with the Riquewihr meeting; now that the NVCF is managed by the BVWS, the organiser, Guy Peskett, has been able to co-ordinate with his opposite number, Christien Adam, to achieve this. As an appreciation of co-operation we were invited to join the CHCR team for dinner, which was most enjoyable. Now there is no clash of meetings, I would encourage BVWS members to visit the French meeting and have a holiday at the same time.

Thanks for the Memorabilia

Dicky Howett looks at a few of his tv toys.

These days, my weighty tv equipment collection is complemented by a somewhat smaller assembly of tv toys, knick-knacks and various items of broadcast memorabilia. This assemblage is snugly housed at the corner of my dining room in an illuminated and adapted display case (Edwardian actually). Although I have several items of steam radio provenance, generally, my collection reflects aspects of past television programming and promotion. As is apparent, this small scale 'television' collecting is by far the easiest to accomplish and indeed store.

Currently, the better available old 'collectable' television memorabilia can be found, typically at boot fairs, on ebay or at charity shops. These items usually are commemorative mugs or boxed series issued by toy makers, Lledo and Matchbox. Themes covered consist of '40 years of ITV' , '35 years of Coronation Street' or 'Heartbeat Memories' with classic vehicles (cars, buses or vans) emblazoned with the appropriate logos. Of better quality and probably now not found at boot sales or Oxfam shops is the famous Dinky range of green 'tv vans.' I have three of these BBC outside broadcast vehicles; the Eagle Tower, an MCR and the famous Roving Eye, complete in all instances but without the all-important (to a collector) boxes. Boxes will double the price (although reproductions are available) and double that price again if you happen to find a reasonable condition boxed blue 'ABC Television' control van complete with camera, cable, cameraman and Debrie pedestal. (Current ebay 'Buy It Now' price £195). Other 'scanners' can be found, some from Japanese toy maker Gragstan Asahtoy, who in the 1950s produced a friction-drive NBC 'Remote' tin truck, (ebay price £60) with two orthicon-looking cameras ('WNBT WRCA'-these cameras are sometimes missing) and a charming misspelling of the word 'Television'. This toy van was sold also in red livery but with a correction to the erroneous 'Televition' spelling. Ah so. Later, Corgi cheapened the entire BBC fleet with a tatty 'BBC' Escort van.

Smokers of the world unite, especially during the 1950s when US TV Station, KXLY-TV (CBS Spokane) commissioned a novelty ashtray with the company ident. The camera depicted on the tray (see photo) is a freelance example of an RCA TK 30A image orthicon camera with only two lenses. Lately, I've noticed that these ashtrays continued to appear with several different station call signs, proving that the template was capable of slight variations on a theme. Same old goggle-eyed camera though.

Much rarer, although not impossible to find, are the 'one off' souvenirs, produced 'in house' for a specific tv or radio occasion. To find these items, one has either to wait patiently for ebay to list, or scour 'junk' shops or be in at the actual event commemorated.

During 1994, BBC Television celebrated 40 years of its tv news service. At the time, I was a member of the Alexandra Television Trust (also ex-BBC staff) and as the original television news studio was at AP (studio B) I, along with the other Trustees, was invited to attend a buffet at AP. Gathered were many staff members past and present including several famous news 'faces', Richard Baker, Robert Dougall, Angela Rippon and the ill-fated Jill Dando. At the conclusion, we were all dished with commemoration paperweights in nice blue boxes. (I found a spare lying about but this has since been 'collected'.)

Another 'one off' in my collection is a small tea plate, with, printed on the back the words 'designed by Wedgwood for the BBC on

the occasion of the opening of Broadcasting Centre by Her Royal Highness The Princess Anne November 10,1971'. Although of doubtful syntax, this inscription refers to the erstwhile BBC radio and television studios (no longer with us), at Pebble Mill, near Birmingham. Perhaps in the not too distant future, some enterprising manufacturer should consider 'studio demolition' commemoration plates? The old Southern TV Studios in Southampton would be a good trial run, with possibly the BBC Television Centre not far behind?

One of the very rarest items in my collection is a beautiful 'scale' model in brushed brass. This model depicts a Vinten HP419 (Mk1) pedestal. The 'BBC tv' camera on top is an amalgam of mostly a CPS Emitron Mk3 with a little bit slapped on the front , possibly of a Marconi Mk III. This exquisite model is attached to a circular polished wooden base, with space for a 'commemoration' plaque of some kind. As an indication to the quality of this model, all the lenses unscrew, as do the pedestal 'domes', the 'tiller' and even the pan handle! A totally unnecessary refinement, but wonderful quality all the same. Hours of fun twiddling.

Incidentally, over the years, other tv companies made their own presentation model cameras. I've seen a Link 125 (made of wood!), a Marconi Mk VIII, and, of course, ATV had the 'Seeing Sport' trophy with its racy Pye Mk3. The BBC programme 'Top Town' had a Marconi Mk III on a Debrie pedestal. Who was the final 'Top Town' winning team and did they get to keep the trophy? Further investigations might uncover the whereabouts of all these model awards, but as yet, I've had no success.

Although not definitive, I've traced something of the 'history' of my model CPS Emitron and Vinten pedestal. I gather it was found originally in an antiques shop in Kent (possibly Ramsgate) and bought for £75. I acquired it later (from the original purchaser) but for considerably more money! My information to date suggests it was 'made' for presentation purposes during the 1960s in the workshops of BBC Television Centre by a Polish-born employee. Three of these models were constructed. One was given to a retiring BBC executive, one to an Australian jockey, George Moore, who was voted BBC Sportsview 'International Sports Personality 1967' and the third model, I own. There are no identifying marks on my model camera or the wooden base. However, there is a very small shallow scratch on one side of the camera which probably explains why it was never used as a presentation object, but held back perhaps as a template, used as an exhibition spare or 'taken home for safe keeping'. Eventually, the award found its way to Kent. More than that, details are not known and likely never will be. Perhaps a future edition of the Antiques Road Show might prove enlightening. Until then, if anyone knows better?

Old Radio Sets by Jonathan Hill

published by Shire Publications August 2008. Book Review by David Read

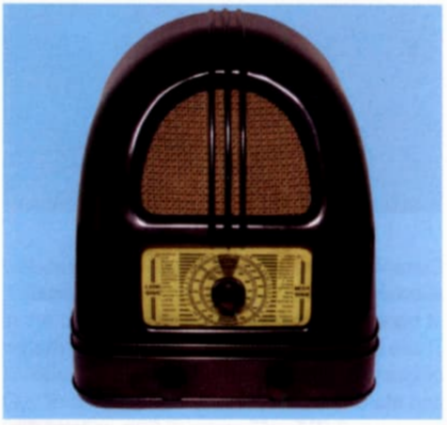
Roman Roads, Buckles, Privies and Water Closets, The Salt Industry. Name your subject area, indeed almost any subject area, and you will find that Shire Publications has it covered with the best compact book (listed as Albums) in the market place. Amongst twenty or more albums in my bookcase is a particular favourite that always brings a smile to the face. It is named *British Pigs*.

Shire, created in 1962, quickly became established as an essential reference for collectors in every field, and a unique publishing success. Their catalogue is quite simply extraordinary and their success has been based from the start on using authors who are mostly collectors and know their subjects through research, practical knowledge and enthusiasm. Now, nearly half a century later, Shire's creator has decided to take a well earned rest and has sold the company to Osprey Publishing who are specialists in military history. This has always been a major subject area for Shire so the enterprise looks to be in safe hands.

Under the new owners the publishing operations have been brought up to date with respect to modern technology and means of distribution. Many of the long established classics at Shire have been reprinted many times so the opportunity has also been taken to give some of these a new look where appropriate. This has now taken place for Jonathan Hill's book *Old Radio Sets*, which was first published in 1993 and had gone through four reprints. The new 2008 edition, now in full colour and with plenty of additional material, is a transformation and a delight to read.

The new publisher has been quoted as saying *"Authors need to be highly disciplined. They need to strike a critical balance between academic rigour and readability. The ideal author has an encyclopaedic knowledge of the subject and can compress it into 10,000 words."* This surely describes Jonathan exactly. His book starts with the period that preceded public broadcasting and progresses up to the 1970s without a hint of rushing or dumbing down. This balance is complemented by excellent illustrations and photographs of radios and ephemera in colour and beautifully printed on good quality paper.

The changes that have taken place at Shire were reported on in The Times by Stephen McClarence in July this year, and with respect to the program to update certain albums he wrote, *"I can hardly wait for Old Radio Sets and The VW Camper Van"*. Well, I can't speak for the camper van but we do now have the new edition of *Old Radio Sets* authored by Jonathan Hill. It is priced at £5.99 and is a bargain.



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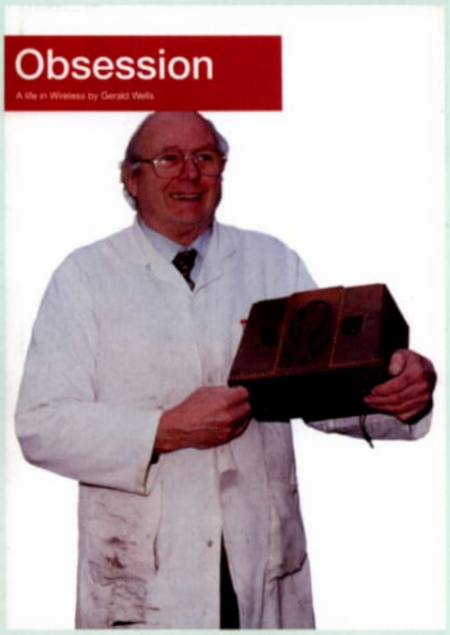

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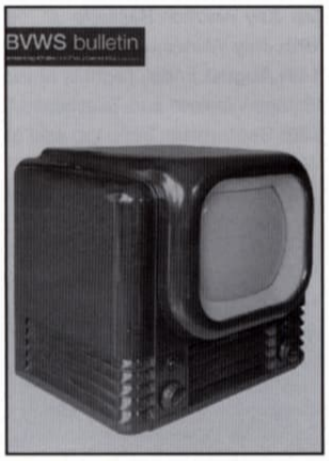

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News and Meetings

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

2009 meetings

25th January Workshop at Vintage Wireless and Television Museum
8th February Audiojumble, Tonbridge
22nd February Harpenden Auction and AGM
12th April BVWS North West meeting, Lowton
19th April Workshop at Vintage Wireless and Television Museum
10th May NVCF, leamington Spa
6th June Garden party at Vintage Wireless and Television Museum
7th June Harpenden swapmeet
5th July Wootton Bassett
19th July Workshop at Vintage Wireless and Television Museum
14th August Friday Night is Music Night at Vintage Wireless and Television Museum
13th September Table top sale at Vintage Wireless and Television Museum
18th October Harpenden swapmeet
1st November Workshop at Vintage Wireless and Television Museum
22nd November BVWS North West meeting, Lowton
6th 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
Audiojumble: The Angel Leisure Centre, Tonbridge, Kent.
Enquiries, 01892 540022
NVCF: National Vintage Communications Fair
See advert in Bulletin. www.nvcf.co.uk
Wootton Bassett: The Memorial Hall, Station Rd. Wootton Bassett.
Nr. Swindon (J16/M4). Doors open 10:30.
Contact Mike Barker, 01380 860787
For more details with maps to locations see the BVWS Website:
www.bvws.org.uk/events/locations.htm

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