The Bulletin

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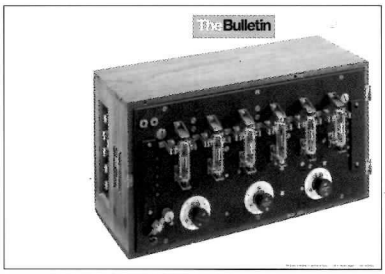

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From the chair

Sitting, listening to the radio yesterday, a 1938 Marconiphone, which has come to the top of the repair list. I heard the reporter announce "today is the last day of good weather that we can expect until next spring". What a depressing thought! Sure enough this morning I was greeted with a torrent or rain and wind when I drew back the curtains on the outside world. This can only mean one thing. More time for Vintage Radio and television work, well I'm not complaining about that. Although less time spent out in the Garden and doing things outside is not so good. This turn in the weather does have some significant impact elsewhere. The Vintage Wireless Museum. With money from the Museum roof Appeal. The work has started on replacing every inch of the boarding and roof coverings on the Buildings that house a large portion of the Collection, workshops and stores. Work is going very well and the small but highly dedicated team of workers are to be congratulated on their very high standard of workmanship. I am sure that the work carried out will last well over the twenty-five years that the old roof has been on. As money is available, each section is worked upon, but as winter looms, it is ever more crucial to be able to press on with the work and complete it before bad weather stops play.

The BVWS now holds the remaining stock of 'Tickling The Crystal' as well as 'Tickling The Crystal 2'. The BVWS has negotiated a price reduction with Ian Sanders, the author, and we are now able to supply either book with a five pounds discount to members or if you purchase both books together a total discount of twelve pounds. Postage of course is as before, extra. We are hoping to expand on the available vintage radio and television books with benefits to our members in the future. Plans are progressing well on the Valve display at the NEC in October with some very rare items to be seen.

One of the regular events the BVWS supports is the National Trust Polesden Lacey Festival, Greville Day. The day is set in a particular year, and many actors in period costume are in attendance to re-enact the lavish parties that were hosted by Mrs. Greville. We supply period sound and vision on restored vintage equipment. This year, as the day was set in 1940, there was a distinct lack of television as no broadcasts were being made at the time. To reflect the wartime situation of shortages, two radiograms from the early 1930s, a Murphy A8 and gram unit, and a Marconi 536, were supplied with a theme of "Keep it going". The A8 and gram unit from my own collection and the rather lavish Chinese lacquered Marconi 536 coming from John Sprange. Thanks John! I was amazed when one parent was heard to explain: "Those round discs are called records. You have never seen one of those. This is what we had before CDs". Another child was fascinated by the workings of the autochanger mechanism in the Marconi radiogram, and we soon went through a stack of records, rejecting each one so that the action could be watched over and over again.
Well back to the bench with me as the work is starting to pile up around my feet.

Mike

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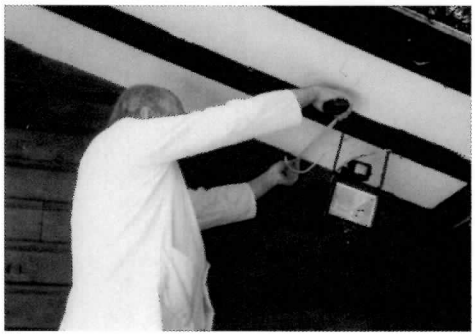
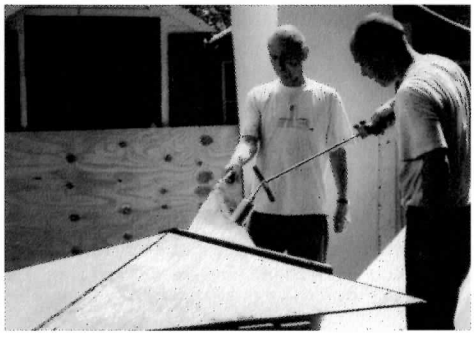




Restoring a Bush Baby, the TR 104

by Henry Irwin

Bush Radio were not notably hasty in their response to the transistor. Their first transistor portable, the TR82, was not introduced until 1959, some time after many other manufacturers had taken the plunge. Their somewhat conservative reputation was based on good basic circuit design, performance and solid reliability. Consequently it was several years before Bush introduced its first true 'pocket' transistor radio, the TR 104, in July 1961. True to form it was not quite the same as everyone else's offering. Bush were not content to cram a standard six transistor circuit board into a small plastic case with a circular dial on the front and a PP3 battery. Conceived as a dual use personal set, the TR104's tuning thumbwheel could be read from both the front and the top as it had station names on its upper surface visible through a window and wavelengths on its outer edge which projected through a front aperture. This allowed it to be used as a normal portable or to be tuned while worn over the shoulder with its shoulder strap and simulated leather case. In this guise it was probably aimed at the female market.

Above and Opposite page above: Close up photographs of restored TR104

Product design

In a very good article in BVWS Bulletin Volume 23, Number 2, David Atwood covered the work of industrial designer David Ogle for Bush Radio. At around this time he had raised their profile in the field of case design giving them something perhaps slightly different from the competition. Ogle's designs were perhaps not as uncompromisingly functional as say those for Braun by the more famous Dieter Rams, but they were certainly more quirky and individualistic.

In 1960 and 1961 he had passed from the curved and rounded forms of the TR82 into a more angular and rectilinear phase. The TR104 and TR102 are from this period and to me, although different in size, share common stylistic elements and preoccupations. For instance the TR104 and TR102 both feature a large expanse of plain louvred grille, have brushed aluminium trim and a similar colour palette with bluish greens and reds set against a neutral background of cool greys or beige. Ironically Ogle was to return to explore curved planes and forms again in the TR106 just before he was tragically killed.

Anatomy of the TR104

When you open a Tr104 there is a surprise in store. Not the expected printed circuit but a dinky little aluminium chassis. This was not the last all-new transistor radio that Bush introduced with this type of construction but it was certainly the smallest superhet consumer radio with a metal chassis and point to point wiring produced in the UK. The TR104 continued in production until 1964 when it was replaced by the similar size TR114 which had a printed circuit. In fact a Tr112 was also introduced in 1964 with an aluminium chassis but this was merely a restyling of the TR102 complete with its old innards. Bush's first all printed circuit set seems to have been the TR106, introduced in 1962, so both types of construction continued side by side for several years.

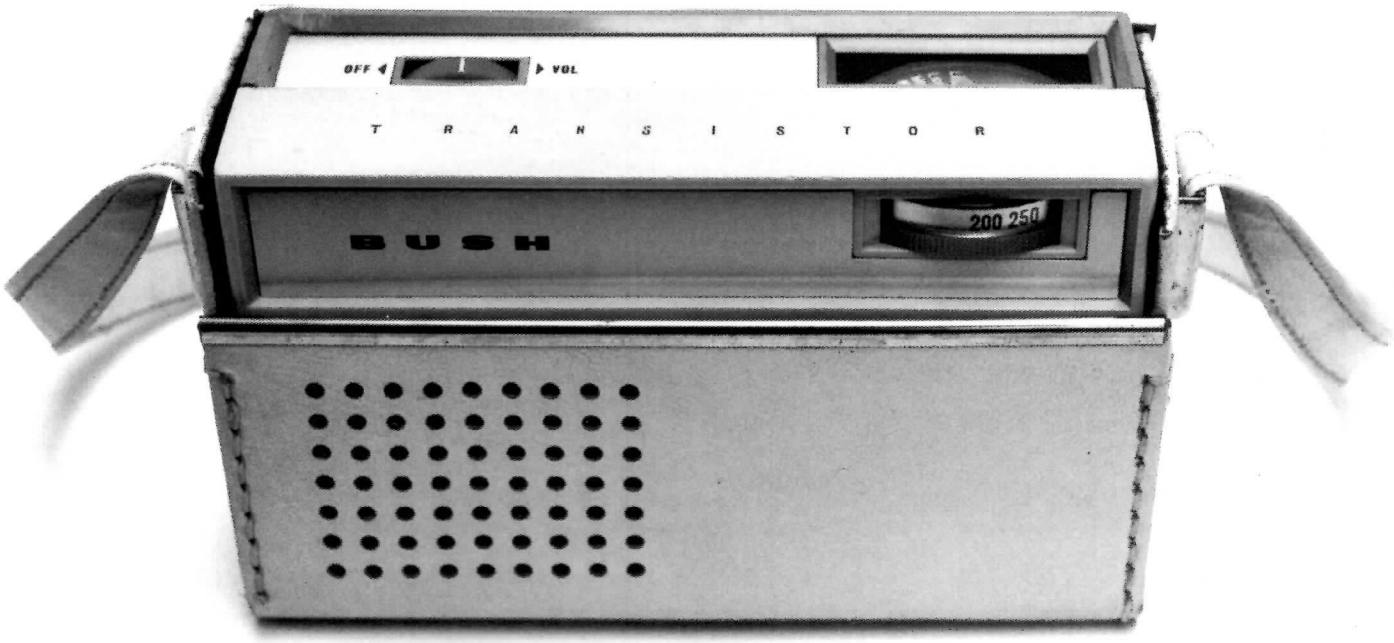
The construction inside really is a little marvel. You may regard this as merely an anachronism but I think there were some advantages to Bush in this approach. Firstly, early printed circuits were prone to hairline cracks and lifting foil (early Pye sets were plagued by this). Secondly a metal chassis allowed a very tame RF design with good screening. More subtly I think it also allowed Bush to adopt a form of flexible three dimensional construction that meant they could group components in three different axes to maximum effect and provide a high specification circuit in a case just 145mm x 88mm x 52mm. The TR104 offers a superhet with two double tuned IF transformers, an AGC clamp diode, properly heatsinked output transistors and space for a larger than usual PP7 battery. This would have given superior selectivity, better overload resistance, greater output power and longer battery life than many other small battery portables of similar size.

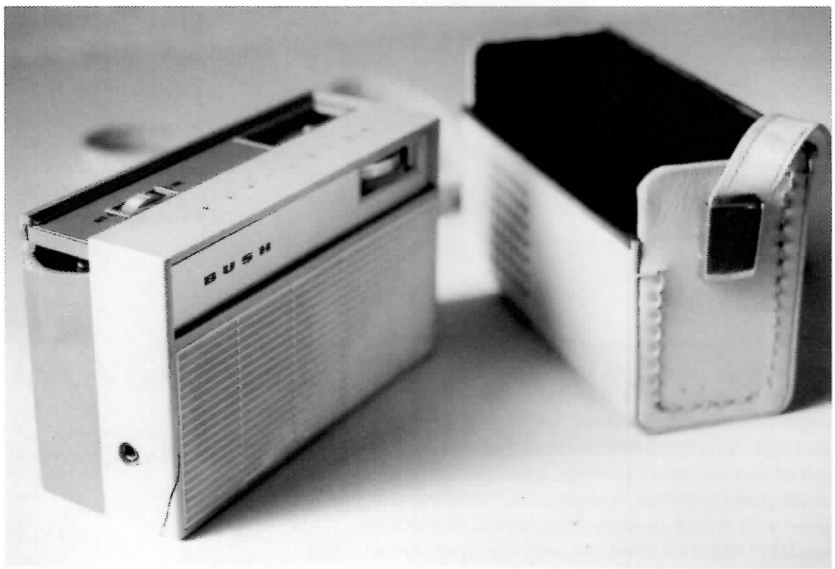
As can be seen, the chassis is almost like the shallow box section of valve radio construction turned on its side. Cleverly the not-so-miniature double tuned IF transformers project both above and below the chassis to save space while the oscillator coil, which at first sight appears to be hanging in the wiring, is actually bolted to its own little angled bracket, its angle chosen to take advantage of available space. Tops of IF cans and transistors are on one side of the metal, the AF transistors being neatly held in a brass heatsink clip, while most resistors and capacitors are on the reverse side. Component density is high and the point-to-point wiring of a very high standard. This would have been a more difficult assembly task than merely inserting vertically stacked components side by side on a printed circuit board but Bush's assembly staff have risen to the occasion.

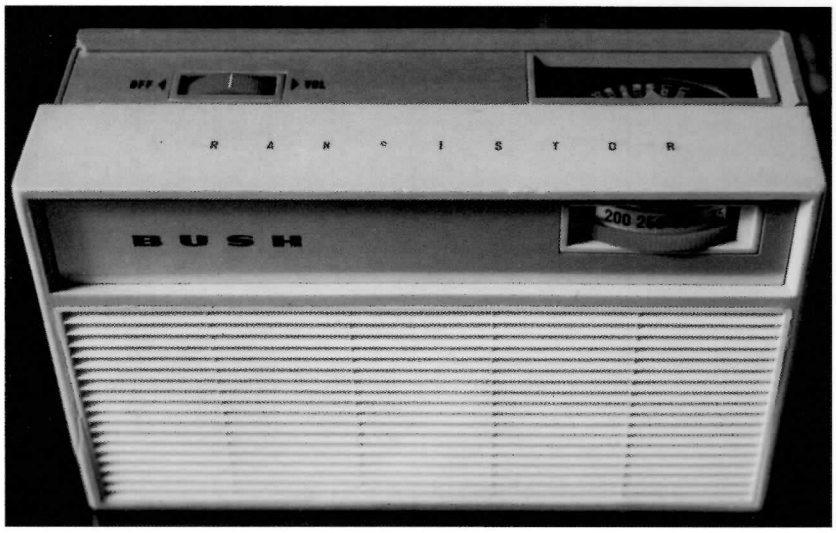
There is one odd thing. The tuning thumbwheel is pivoted on the top panel which is a separate sub assembly. It is linked to the spindle of the miniature Plessey tuning capacitor by a slot and a spring loaded arm. I can only think that this extra complication allowed a degree of adjustment after its assembly so that the wheel lined up with the front aperture. However with credit due to Bush, it is beautifully engineered and the bearing is silky smooth in use. There is a further adjustable flange screwed to the underside of the tuning control. The Trader sheet makes great play of adjusting this so that when the control is turned to the long wave switching the flange contacts the side of the case and ensures that the word 'Light' comes up in the centre of the tuning aperture. Also in classic Bush fashion, everything screws apart! Was this cost-effective engineering? Well, I don't know but it is certainly fascinating to look at.

Opposite: radio and case, as bought, showing missing piece and crack.

Opposite: Close up showing missing top edge.



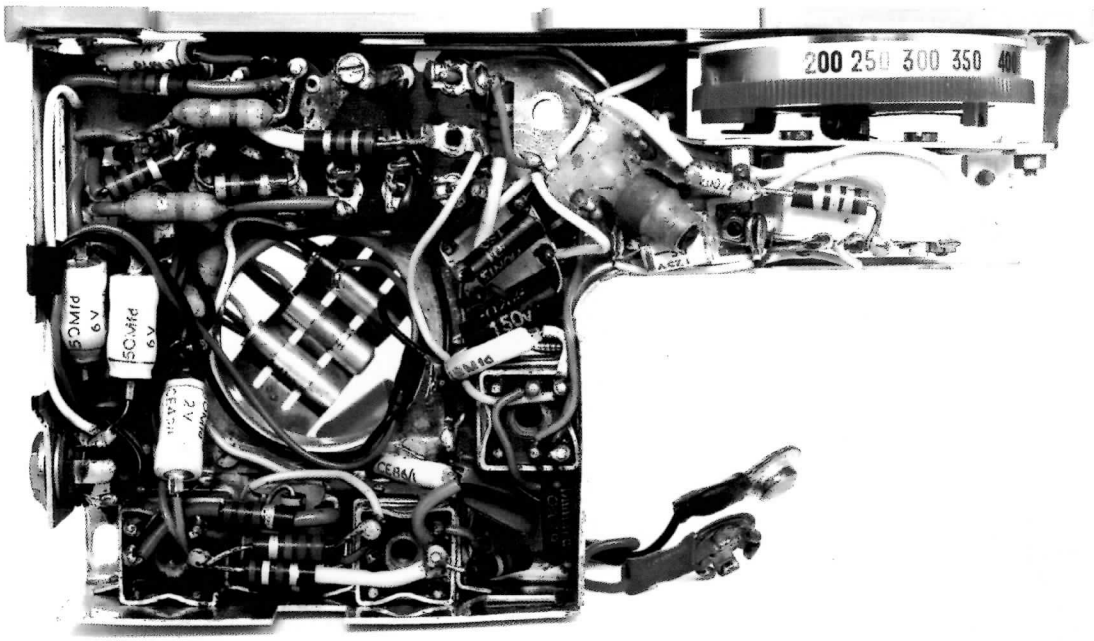




The Circuit

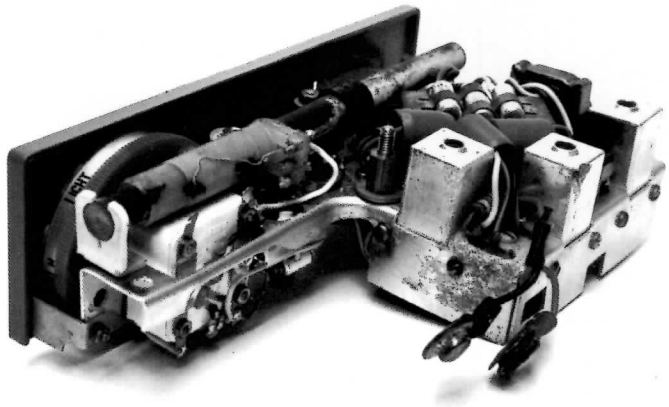
The circuit is a six transistor superhet using the Philips/Mullard AF117 post alloy diffused transistors in the RF stages and the OC81D/81 package in the output. As already mentioned, it has two double–tuned IF stages with AGC diode across the first stage. I haven't reproduced the circuit as it is available on Trader Sheet 1530 on the excellent BVWS CD ROM.

Starting at the antenna we see the first departure from standard Bush practice. Because the long wave coverage is pretuned the TR104 doesn't use the two ferrite rod coils which they used in their other sets. In these, Bush arranged for both the MW and LW coils to be in parallel on medium wave (inductances in parallel give an overall inductance which is less than that of the individual coils). This is something you don't often see mentioned in connection with the TR82 etc., but I believe it increased the pickup from the ferrite rod which gave those Bush sets which used it a slight 'edge' in sensitivity. But back to the TR104, it puts a fixed capacitor plus trimmer across both the antenna and oscillator coils to tune in what was the old 'Light Programme' on 200 KHz. Since the AF117 is 'livelier' than the old OC44, a damping resistor of 180k is switched across the oscillator coil on medium wave. This limits the amplitude and keeps harmonics of the local oscillator at a manageable level. This means less whistling at the top end of the band after dark, a problem caused by harmonics of the oscillator beating with stations in the 49M band. A pity some Far Eastern manufacturers (not Sony) didn't take note of this. Moving on to the end of the IF stages, the detector diode D2 is where it should be, inside the last IF can. The complete screening provided by this means that we don't get a nice fat heterodyne at twice the IF frequency. After detection, the audio signal is developed across the volume control but this is connected as part of the negative feedback loop from the output. The reasoning here is that when the volume control is advanced, feedback is reduced and more output is available. It may also give a degree of bass boost at low volume settings. The output is of the single ended push-pull type with direct connection to the speaker via a capacitor. This saves on an output transformer but requires two sets of close tolerance resistors to bias the output transistors. It's a sensible arrangement to save space remembering that



Left: Front of chassis with point–to–point wiring of resistors, capacitors and diodes.

Below: Aluminium chassis out of case.



no matched NPN/PNP output transistors were generally available at this time.

Poor condition

When I first came across a TR104, at a BVWS event, I had been on the lookout for one for some time. They appear to be fairly rare and I was pleasantly surprised that it came complete with its case and shoulder strap in good condition. Usually they are the first thing to disintegrate and be thrown away. The elation at discovering one in a good case must have induced selective blindness. The elation was short-lived because on removal of the case I found a large piece missing from the top left of the case of the case back. I uttered a few choice words and then, trying to be philosophical, thought if ever another one did turn up at least I would have a good case.

I have a theory. I have seen only one other picture of a 104, apart from David Atwood's article, on a website and it was cracked in exactly the same place. There is no means of securing them in their case other than weight and friction and I believe that when removed, by turning upside down for battery changing, they were frequently dropped, the weight distribution ensuring that they hit the ground at this point.

Case restoration

Usually radios that are so obviously cracked or broken are not worth adding to the collection. What to do? Bin it and retain the carrying case? But then who knows when another undamaged specimen will turn up! Of course there was that unique little metal chassis, worth it just to view as an item in its own right. I wasn't prepared to give up on this one that easily. So the following idea began to form in my mind. Some time back I had bought some Milliput - a resin putty, thinking that it could be used to repair bits of missing bakelite. Milliput is of course white, yellow or silver grey, but I had thought it could be coloured in the mass by mixing brown acrylic paint.

The challenge now was to try and colour the resin putty to match as closely as possible the plastic back of the TR104. This would have to be done while the putty was still pliable and then used against the outer surface of the case to form a reasonably smooth and shiny finished new surface. The mould material would have to allow easy withdrawal from the set resin without breaking it. A further complication was the colour itself, not a standard primary, but a greenish blue showing some signs of uneven discolouration. Consequently I set up some experiments to try and find out if these two requirements could be successfully addressed.

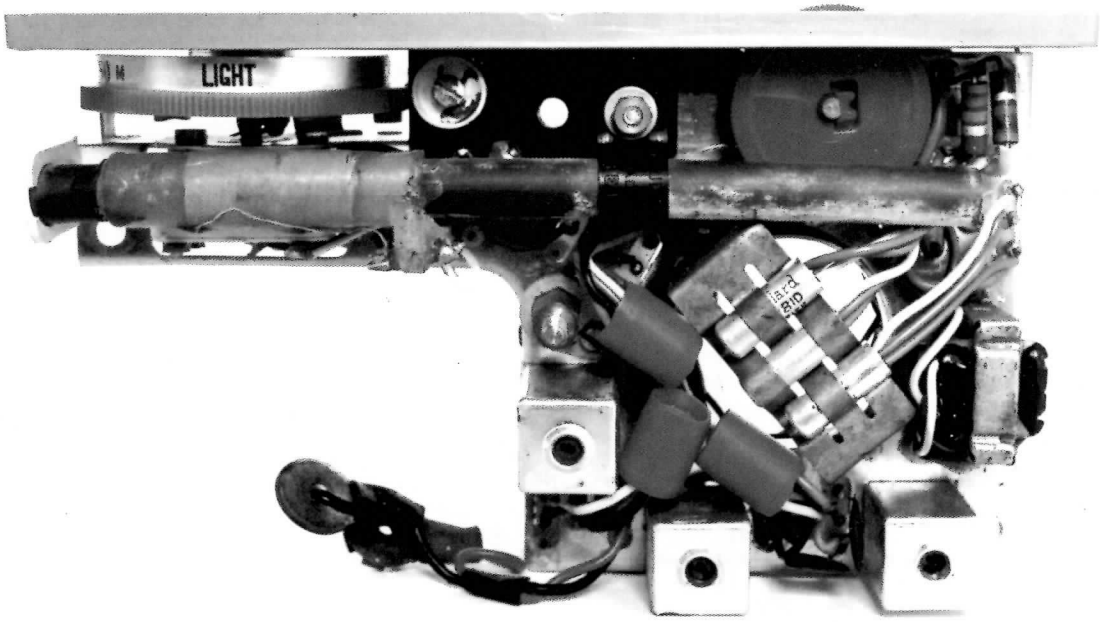
The break was on a top corner and the most important finished surfaces were going to be the side and top. As a first attempt I constructed a right angle out of two pieces of perspex carefully cut and superglued together. This demonstrated the problem, even with a little vaseline pre-applied, the Milliput wouldn't separate from the perspex when set. In a last ditch attempt I utilised a small piece of aluminium in a perfect right angle. Into this, pressed fully into the bend with a blade, I glued a thin piece of copper foil. The inner bend needs to be as sharp as possible with little radius and the foil needs to be stuck with a removable glue like 'UHU'.

Here's how things went. When the resin putty was pre-coloured and mixed (more on this later), the aluminium and foil mould was taped in place over the side of the case, one piece down the side, overlapping the break edge and the other piece over the top where the bevelled edge would have been. A suitable quantity of still pliable putty was pushed firmly into the void of the break while pushing the mould against the case with the other hand. it is important to compress the putty as much as possible, consistent with not breaking the case, in order to remove any air spaces. On this depends the success of the joint between the repair and the outer edge of the case. At this stage I didn't worry about having a blob of excess putty on the inside of the case. The whole thing was then left to set; Milliput recommend 24 hours, but I prefer 48.

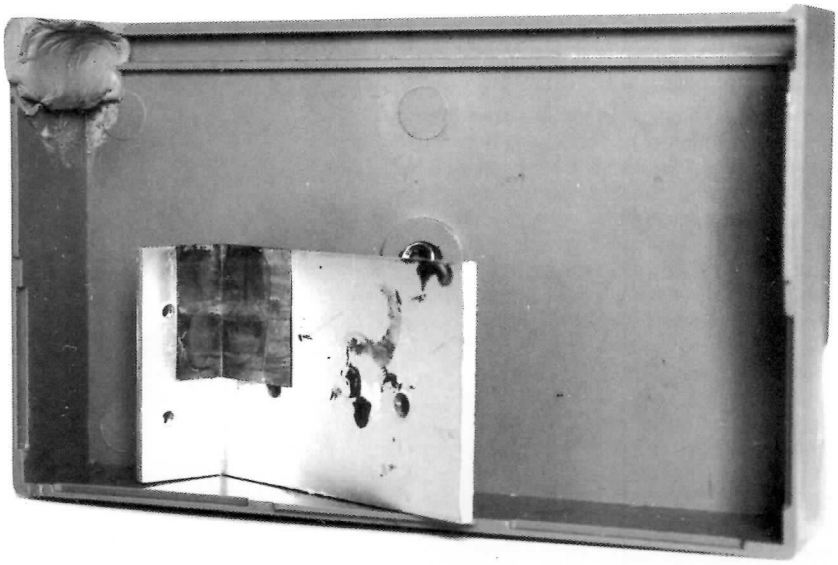
The original intention was to remove the aluminium from the foil by breaking the weak glue bond and then peeling back the foil from the resin surface. In practice

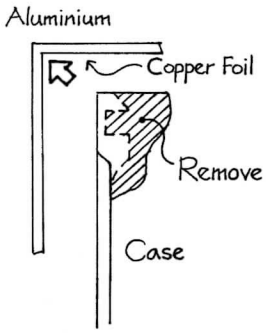
They appear to be fairly rare and I was pleasantly surprised that it came complete with its case and shoulder strap in good condition.

Right: Back of chassis with transistors and IF cans.



Below: View of case with repair before filing down. Also aluminium and copper foil form used to retain resin putty.





Above: Illustration of profile for chamfered lip.

when relatively light leverage was applied the foil came away easily from the surface while still glued to the aluminium backing. What was left was a flat and shiny surface with fairly minor imperfections which didn't require any further polishing. I now needed to remove the excess material to arrive at a shape which was a mirror of the opposite side and would allow the case to be reassembled. In this respect Milliput is useful, it is easier to apply than Araldite and can be cut, ground, filed and polished with relatively simple tools.

The illustration shows the stages in which the unwanted resin was removed. Carefully measured lines were drawn on the top flat, shiny surface of the new resin with a fine drafting pencil to represent the edges of what would eventually be the new chamfered lip. A lot of material was removed initially with a model drill and abrasive burrs. This was done outside and a mask should really be worn, a lot of resin dust is generated. A small, flat file was then used to cut back to the first line on the flat surface which represents the inner edge of the lip. When this was achieved the material was filed back to the second line at an angle of 45 degrees to form the chamfer. These small files actually leave quite a fine and slightly matt surface to the Milliput which can be further polished with metal polish and cloth or a polishing disc. Next, perhaps the most difficult bit, the channel under the lip which accepts the top panel. This was started with the model drill and finally gouged out with a small jeweller's screwdriver the blade of which had been sharpened on a file. Woodworking tools would have served as well if not better. This was the most time consuming bit of the whole exercise. Constant checking was required and the danger was always to go too far and reduce the thickness of the walls too much.

Now, to return to the question of colour mixing. I chose artists' acrylic colours because I thought it would be most compatible with the synthetic resin. Experiment showed that a fair percentage in relation to the amount of resin would be required and I wasn't sure if this would compromise the integrity and finished strength of the resin. I used Daler Rowney Pthalo Green (a slightly bluish green) and Paynes Grey to reduce the intensity. These were mixed with the white form of Milliput. The process is messy and should be close to a source of running water to allow washing and drying of hands after each mix. It takes about 5 minutes to mix the initial resin and hardener. From then on you have about 60 minutes to add the colour in stages before the mix becomes too stiff and difficult.

I prepared a suitable quantity of the putty and formed it into a small thin dish in the hands. To this with a spatula a dollop of green about the size of an index fingernail was added in the middle of the 'dish', folded over like a Cornish pastie and the colour kneaded through the mix with finger and thumb to achieve uniformity. After each mix I quickly washed and dried the acrylic from my hands otherwise it would have streaked the next mix. When the right intensity of green was achieved I then began to add the Paynes Grey with the same procedure, washing and drying hands between each mix. Although the makers suggest adding water to improve putty working for this use it is essential to keep it dry or the colour will run.

I needed three dummy runs before I arrived at what I thought was a satisfactory match. I had the workpiece beside me so that when i reached this stage I was able to apply the material straight to the mould. As a guide only, I used six spatula portions of green and and four of grey added to about 20 x 20 x 20mm of original white mix. Even slightly different quantities would probably modify this, so anyone attempting this would need to carry out their own preliminary tests. This would be a much simpler procedure for primary colours like red or blue and even easier for white cases.

I had to do a few minor repairs to the case front. A

crack on the lower edge of this had been badly 'fixed' before by someone using superglue without accurately closing the gap. All the superglue and misregistered plastic had to be scraped out from behind with a handle mounted scalpel blade until the crack closed at the outside and then reglued from behind. A missing letter on the top was redone with a 2.5mm drafting pen, china ink and a straight edge. Then it was fixed with acrylic varnish sprayed through a small aperture cut out of thin card. Overall I'm satisfied with the repair. The radio is never going to pass as a pristine example and the colour match is not perfect on close inspection but from a greater distance the new inserted piece is more convincing and especially when mounted in its case, the repaired top edge and lip are quite difficult to detect.

Circuit restoration

The chassis is held to the front of the case by two screws and a nut beside the mounting for the ferrite rod. Luckily work required to the circuit was fairly minimal. All the little electrolytic capacitors were fine and were not leaky. The same unfortunately cannot be said of the infamous Hunts capacitors which Bush, like many others used at the period.They are in little black moulded tubular packages and the problem is that the moulding is porous.The dielectric absorbs moisture over a long period and the value of capacitance increases. In the majority of decoupling functions this is not serious, but in one position it poses a hidden danger. The 0.02mf which bypasses the emitter resistor in the mixer is fairly critical; if the value is too large the stage will oscillate too fiercely nullifying the advantages of the damping resistor across the oscillator coil and may even cause squegging. I therefore decided to replace the old one with a polystyrene type (ceramics have too wide a tolerance) and noticed that when I removed the Hunts it had a furrow burnt in its case by the vinyl covering of a nearby wire. This is a reaction with its moulded case so beware, another pitfall!

Forty three years on and the curse of Philips/Mullard appeared not to have struck, so the AF117s had developed no internal shorts and the screened leads didn't need to be snipped. Of course by the time you read this the angel of semi conductor death may well have visited but I prefer to leave the screen connection intact until the amputation is necessary. I still have many sets using these transistors where this has never been needed.

The original speaker appeared not to have survived the trauma of the breakage and had been replaced by a modern 8 ohm Japanese equivalent. The trader sheet lists the resistance of the original as 18 ohms so the output stage would now have been dissipating more power than intended and although these transistors are generously heatsinked, this discrepancy would also have altered the negative feedback ratio. Since three inch speakers of greater than 8 ohms now seem difficult to obtain, I decided to include a 10 ohm resistor in series with the speaker I had. In theory some of the output is now developed across this resistive load but in practice modern speakers are more sensitive than their older counterparts so little audio is lost.

In my experience Bush sets are usually well aligned when they leave the factory and this one just required a few tweaks of the IF cores to compensate for the jolt it had experienced. The thing to remember with these double IFs is to tune for the peaks furthest from the centre otherwise the circuits will be overcoupled and the pass band will be broadened. I found it best to assemble the speaker with its tags facing inwards and I remounted the plastic sheet behind the speaker since some of the components are very close to its frame when reassembled. Finally I arranged a replacement for the unobtainable PP7 battery in the shape of a small container for six HP7 cells and ensured that its contacts were insulated from the chassis.

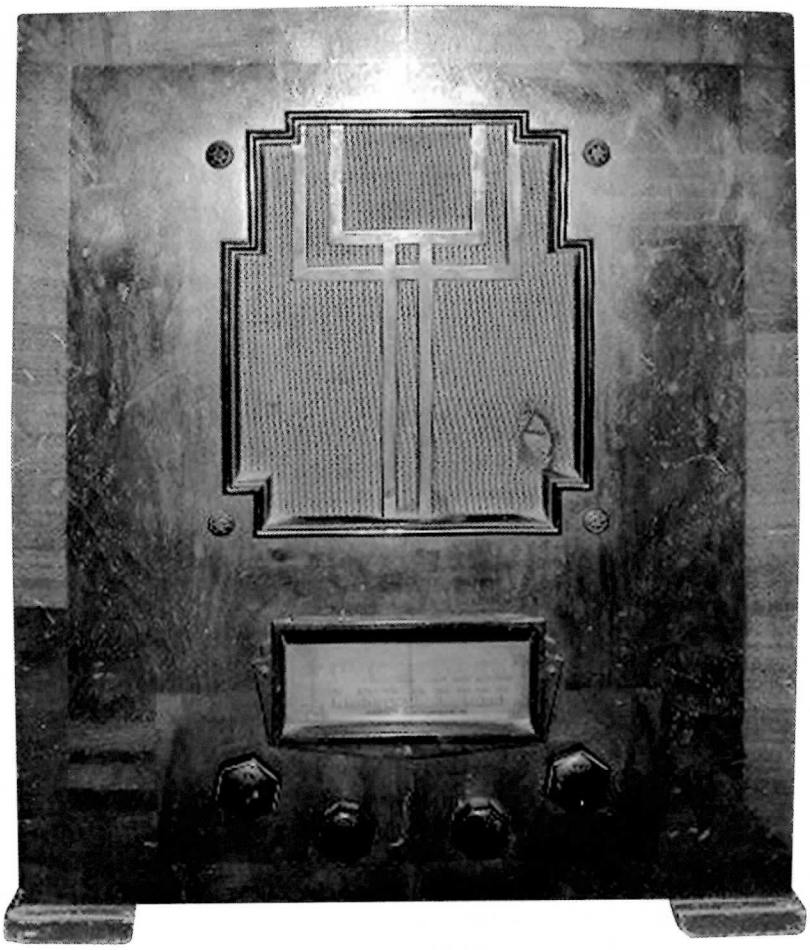
Performance and final thoughts

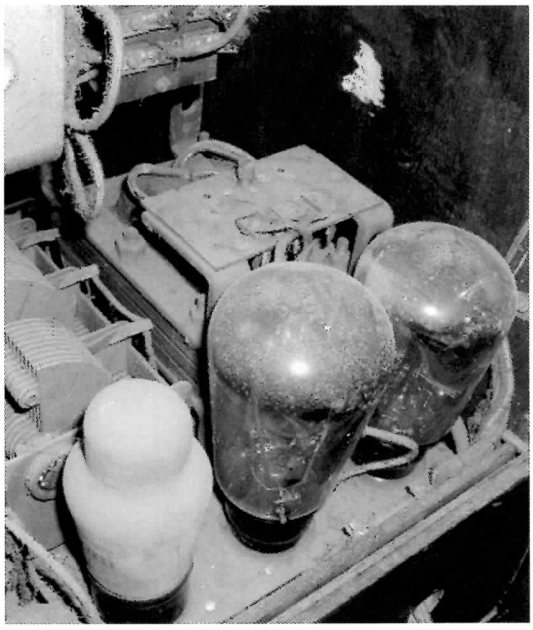
The TR104 in restored form seems to live up to the promise of the better than average personal portable that I mentioned earlier in connection with its design parameters. It is relatively free of annoying heterodynes and is more selective than average. For a radio of its size it is very sensitive with good AGC action. This means that in 1961 you would actually have some chance of hearing Radio Luxembourg in the evening or of hearing the American Forces Network programme in the presence of its stronger neighbours. Sound quality is clear and although there is no real bass there is enough lower 'mid' to give a sense of presence. The quantity of audio available is sufficient to make it useable outdoors in its intended position down by the user's side with its shoulder strap and there is no penalty for this in the form of short battery life.

I don't know how well this product sold. It was in production for about three years but I do not remember seeing many at the time and it seems quite rare today, so I suspect it was not a runaway success. Perhaps within the market it was aimed at, the format was not to everybody's taste. Although it is a clever design I am not sure that it works stylistically. It appears best when looked down at from the front, but when viewed head on it is a little stark and impressions are not helped by the quality of the grille moulding which looks like it came straight out of Hong Kong. It is most attractive when viewed at a distance and when contained in its case.

I think that when one gets down to the scale of the personal portable, often viewed close up for long periods, the user has a more intimate relationship with the actual materials used. In this situation, the appeal of polished metal and glamorous finishes is more important. The stylists of some Japanese sets I think understood this better than their European counterparts and this was not an area in which David Ogle was at his best. Now we can appreciate the TR104 for its quirky qualities. I like the set and think of it as a miniature example of one of those cubist modern houses of the thirties and forties, all contrasting planes and surfaces. Perhaps there should also have been a version with a perspex back so that we could appreciate the internal construction as well.

Restoring a Marconi 262 of 1933 by George Windsor





Right: The set as it originally appeared after being purchased at Harpenden.

Far right: A detail of the unrestored chassis.

On a visit to the BVWS meeting on 8th September 2002, my wife Angela and I had a look at what I thought were goodies on display. One set did catch my eye and Angela also liked it (always a good thing) due to its art deco influenced design and rather nice 'aged but solid' condition. It was a Marconi 262 of about 1933 vintage and complete (apart from a base plate), not obviously broken, and very genuine although dirty looking. I must say I have always been impressed by the build quality of these 1930's EMI sets having already a Marconi 557 of 1937 and an HMV 442 of 1934 in my collection.

The set fired my imagination, a nice deco radio set for my deco living room I thought. After a little negotiation a price was agreed and we took it home.

I normally wait a while before starting restoration or get distracted onto other things but I was determined to get this set done before winter and the cold weather set in.

Bringing something back to life, restoring it both physically and electrically, then being able to use it as was originally intended, proves for me very rewarding.

On greater study the set's lacquer had gone completely in some areas of the sides, had various white paint spills and worst of all, a very clear smoothing iron sole plate imprint on the top!

It was obvious that a complete restoration was required, both physical and electrical. This is how I like my sets as I find a complete restoration something to admire when finished.

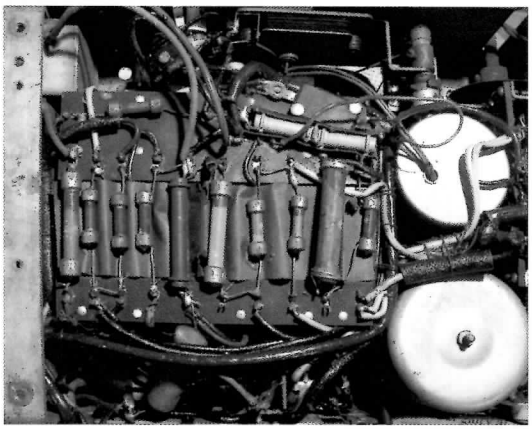
I started work the weekend after getting it home. The first thing I did was to take a lot of digital photos and then removed the chassis and cleaned out all of the old dust, out in the garden with a soft brush and a nice stiff breeze to help it along!

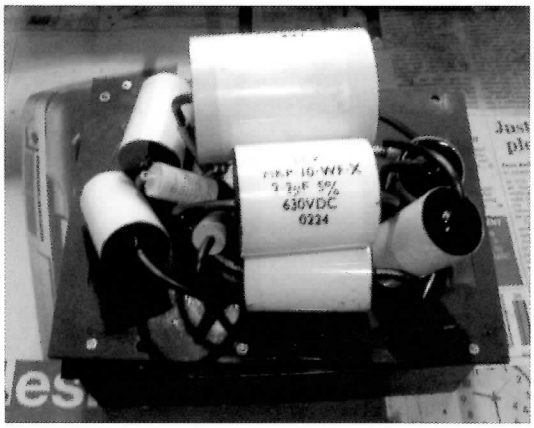
The chassis proved to be in remarkably original condition. After some inspection to the underside it was clear that the dreaded condenser block would need to be removed and re-built. One of the mains smoothers in the block had been by-passed and judging by the square condenser put into use, it was done many years ago!

I decided that this would be my first point of attention and took quite a few digital photos on the macro setting in order to have a record of the wiring positions and their colours. This proved to be a great reference later on, one worth a great deal in confident re-wiring.

I needed the right condensers as I had very few of the right value, voltage and size. On a business trip to London I made a detour at lunch time to Maplins, ordered some high voltage low value caps for the block and they arrived in the post the very next morning, now that was fast!

Before tackling the set electrically I decided to remove as much as was required from the cabinet so that lacquer stripping could commence. The speaker came out once the nuts were off and then the bolts through the cabinet were removed. The cloth was holed and the Bakelite fretwork needed to come out to do the job properly so I tried to take off the cloth frame board, but the cloth was stuck to the Bakelite





very well in some areas so I had to cut the cloth around the fretwork; it was the only way to get to the fret fixings. The cloth was holed so needed replacing anyhow, which was just as well. The fret fixings are little wedges screwed to the inside front panel. When I removed them I thought the Bakelite fretwork would come out nicely but it was stuck fast all around its edge. This item looks very fragile and was a real worry as breaking it now after 70 years would have been heartbreaking.

I decided to fill the inside and outside edges with Nitromors and a fine brush and hoped that whatever was holding it would give way. Whilst soaking I decided to go ahead and coat the whole front face in Nitromors.

After about 20 minutes or so I carefully scraped the melted varnish off with a well-worn, blunt paint scraper. This revealed some very nice wood veneer. After some time and very careful easing the Bakelite framework finally started to move and after some heart thumping time finally came out! It was a tight fit even when the varnish had melted! It was a relief to get it out without damage I can tell you.

When I cleaned off the front with wire wool and white spirit the wood looked wonderful, the veneer proved to be fixed properly, no lifting anywhere except for one small piece near the front foot. It was just pure early 30's EMI quality. I could see it was going to make a lovely looking set. You could not imagine anyone making such a nice case today, it must have cost a fair bit on its own, back in 1933!

Putting the case aside for the time being I decided to tackle the dreaded condenser block.

The first problem with these sets is turning them upside down to work on the underside. A servicing frame would have been wonderful but I could see it would take valuable time to do properly. I decided to use blocks of wood to support the chassis' heavy parts like the mains transformer, original mains smoother can and some coil formers. It was now a reasonable, if a little bit precarious prospect for inverted attention.

I made some drawings and notes on how it was wired, remembering that I took plenty of photos as well (thankfully) and de-soldered the wiring to it. This was tricky in parts as most of the wiring seems to be sleeved in a varnished woven cover that has gone very hard over 70 years and difficult to move. I found it beneficial to warm the area with a heat gun (carefully!) and prize off the sheathing stuck fast to the edges of the block. Once free I then had to unscrew the block and that proved rather difficult as it seemed to me that the block was fixed to the chassis in the factory and then all the wiring added later. You can imagine trying to get to the small self-tappers and then retrieving them from the depths of the chassis-ware! A nice pair of tweezers and a good halogen bench light were the order of the day doing this!

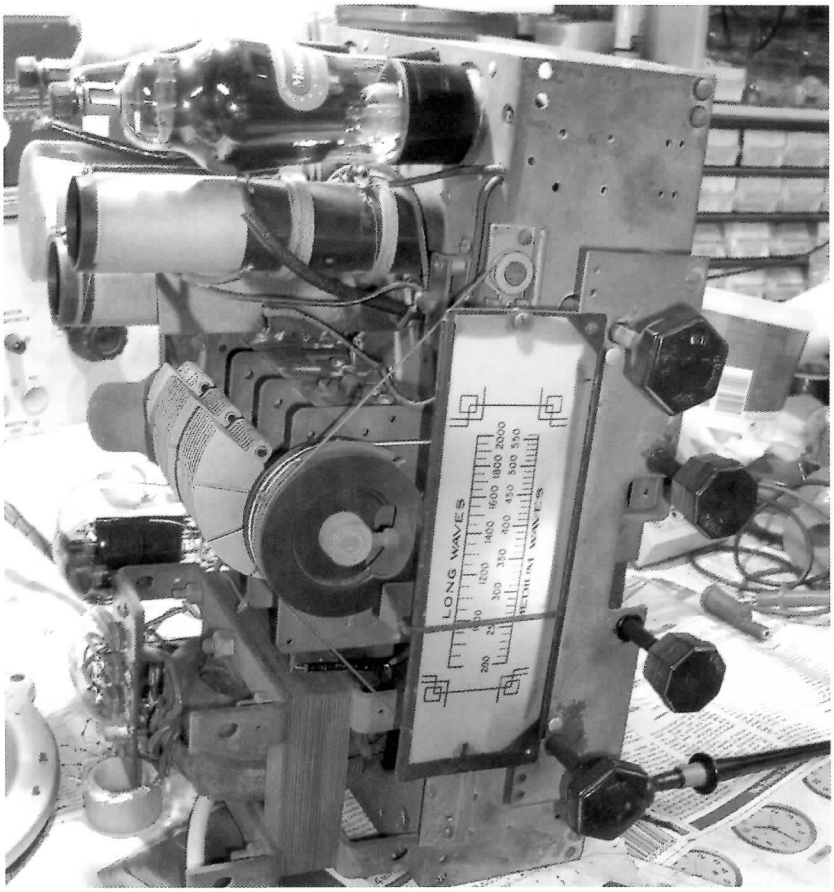
When free the block was a real pain to get past all the nearby wiring, I found it helpful to remove one of the chassis runners from the main metalwork and with a bit of manoevering it came out.

In order to remove the condensers from the box the tag strips carrying the resistors and capacitors needed to be removed first. These are riveted onto the box sides and therefore needed drilling out. Once I'd done that the tag strips lifted off in one piece along with the caps and resistors.

The next problem was how to get the black pitch and original condensers out. The condensers had expanded through leakage I guess and bulged the box sides. It was therefore clear that it would not be possible to knock them out with a mallet.

I decided to suspend the unit upside down using wood blocks on the folded back edges over some newspaper and got handy with my blowlamp!

After quite some time the pitch melted and with me pulling the leads, some condensers came out but some were very reluctant. This I guess was due to expansion. Anyhow after more heat and pulling they were finally all out of the box and a fine mess was made!



The condenser block was re-condensered after some hours careful work. A total of 11 off various 0.1uF, 1uF, 2uF & 5uF were replaced with the only ones I could buy at the time, 630Vdc Polypropylene ones. They were rather expensive 'audio grade' components.

I decided I wouldn't re-pot the condensers in the block and wired the condensers directly to the tag strip positions carefully checking the Trader sheet details of the connection points.
A number of photocopies of this allowed notes to be added as an aid without spoiling the master.

Whilst wiring these in it was necessary to keep checking clearance within the offered up condenser box, re-arranging the condenser positioning where necessary.

Once completed to my satisfaction, I put the box back into the chassis after a bit of delicate manoevering and then proceeded to re-connect the unit to the wiring. The most important and best reference I made was an A4 colour print of the condenser block photo I took before I started work to be sure of the wire positions. I could check and double-check everything before proceeding to the next stage.

The original mains lead was rather dangerous so I decided to replace it with a new dark gold plastic one from B&Q.

Some cold resistance checks suggested the mains TX primary was about right but it was noticed that the mains switch was open circuit when supposedly closed!

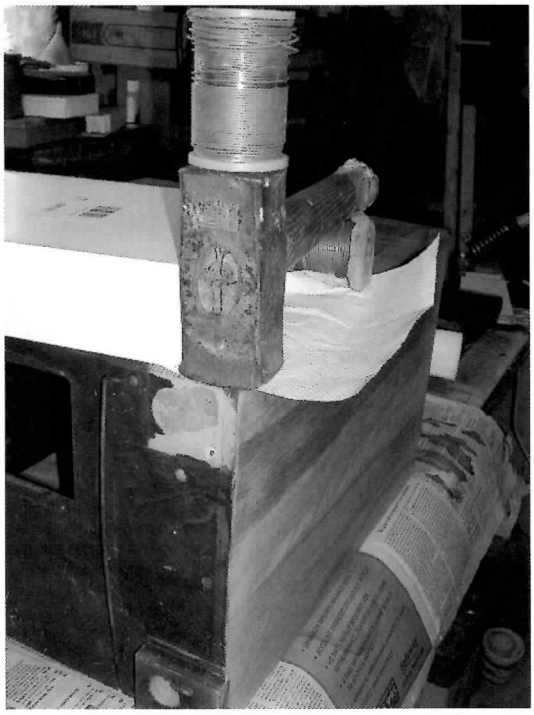
This switch is a rather unusual cam operated slotted toggle item and needed replacing. Bill Smith in Peterhead near Aberdeen came to the rescue and very kindly sent me a used one in the post. This was a tricky item to fit as ordinary spanners just would not serve. I had to resort to pliers and occasional use of a lightweight spanner.

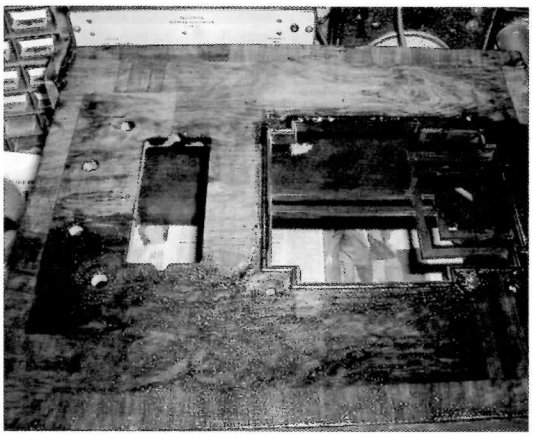
The dial lamp of 6.5V was O/C so was replaced from my stock. Various other checks suggested all was OK so the trusty Variac was brought into use and set for 80V and the set powered up. A meter on AC showed that all seemed to be OK so the volts were increased to 175. After a while the rectifier started to conduct and the HT came up as expected. At 185V the radio sounded rather lively so an aerial was applied. Some tuning through Medium wave and stations were heard! It was a little distorted and noisy but it was working after probably a considerable time of inactivity. How great that was, to get voices and music out of the set once more.

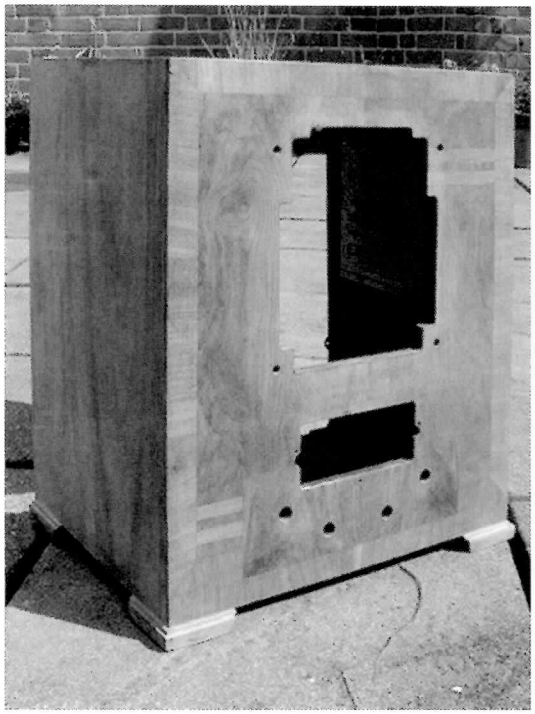
Long wave proved to be either very poor or non-existent depending upon how the wavechange switch was 'biased' physically.

V1, the MS4B frequency changer proved to be rather noisy; gentle tapping would vary the gain and cause a lot of crackling. In use the gain went up and down over time so it needed replacing.

In order to sort the LW reception the wavechange







switch was checked out. This rather well engineered item had two rows of switches and some cold checks proved that several of the spring contacts were not making contact of any quality or at all. This switch assembly is rather difficult to take apart but after making notes and removing some wiring it was possible to remove the fixing screws and move the paxolin contact assemblies away from the cams. I decided to try and 'polish up' the points with a strip of chamois leather sprayed in switch cleaning fluid. I then re-tensioned the strips so that the cams would exert more pressure and then re-assembled it. The switches now seemed to work well, reading low resistance when closed. I noticed that the spring contact that operated on every turn of the shaft to mute the loudspeaker between positions had broken off and was nowhere to be found. This item I guess would have to be the hardest working contact as it operated 4 times per complete revolution of the wavechange switch. I guess it was not a surprise in a radio 70 years of age that it had broken off. The next problem was how I was going to fix this. Not having anything like it as radio scrap I found a TV tuner cover plate with bronze earthing spring contacts riveted on to it. The dimensions were very similar to what was needed and it did have a nice springiness to it. I cut it to length and used the fixing screw to clamp it in the Bakelite holder using the original tag as the wire feed.

Thankfully the set now worked well on long and medium wave, but as I was playing around tuning the stations the dreaded dial cord broke thanks I am sure to surface rust on the drive spindle wearing through the cord. I cleaned off the shaft with fine wet and dry and plenty of turning. Once clean I spent ages trying to get the right length and run of the cord, my goodness what a horrible job that was. How anyone coped in the factory doing that job I don't know! After that I decided to re-direct my attention toward the cabinet. The front was stripped earlier so I tackled the sides and top. The Nitromors worked quite quickly, 15-20 minutes and then I could start scraping it off.When quite clean I washed it down with wire wool dipped regularly in white spirit and finished off drying as best possible using sheets of kitchen–roll.

So there it was, stripped to bare wood. A careful inspection revealed one small area of lifting veneer near the right side front foot. I decided to glue it using white wood glue and used a club hammer on top with a reel of solder to weigh it down further and left it overnight to set.

Some careful cleaning off afterwards using very fine wet and dry paper made the case ready for the next stage. What was the best approach to finishing I wondered? In the past I had used car paint lacquer over stain but it took many coats and long drying periods in between. Having had some experience of finishing a solid beech worktop I decided to try Rustic Oil, which although it sounds like oil is more like a thin varnish. I started by staining the wood and applied Rustin's American Walnut wood stain with a soft cloth.

This was quick and dramatic, the wood colour after coating was really stunning. Another two days later after rubbing down with wire wool I started putting on the varnish. In order to obtain a fine finish it was necessary to use a foam brush and many thin coats. In fact 8 coats were required. This was done over about 12 days in late summer in my brick and tiled roof garage which went up to reasonable temperature in the day holding heat well into the night. In between coats I used fine wet and dry (dry) lightly rubbing down all 4 sides.

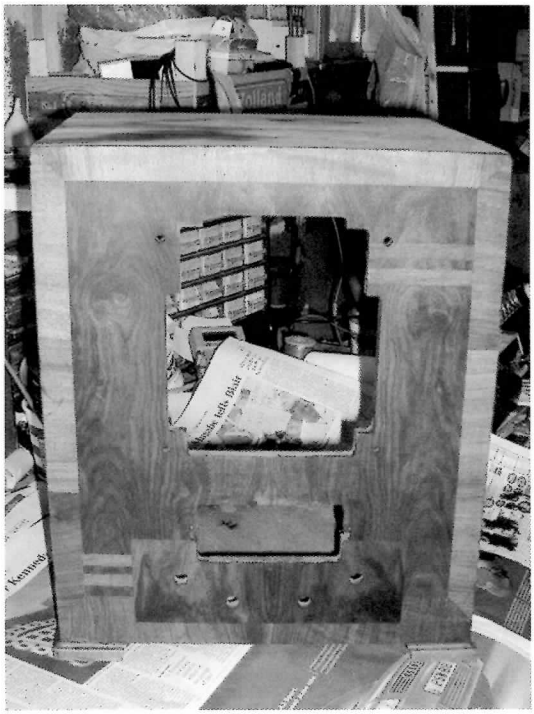
It proved quite difficult to do this varnishing without runs developing over time and some heavy rubbing down in some areas was required to get the surface flat and right.

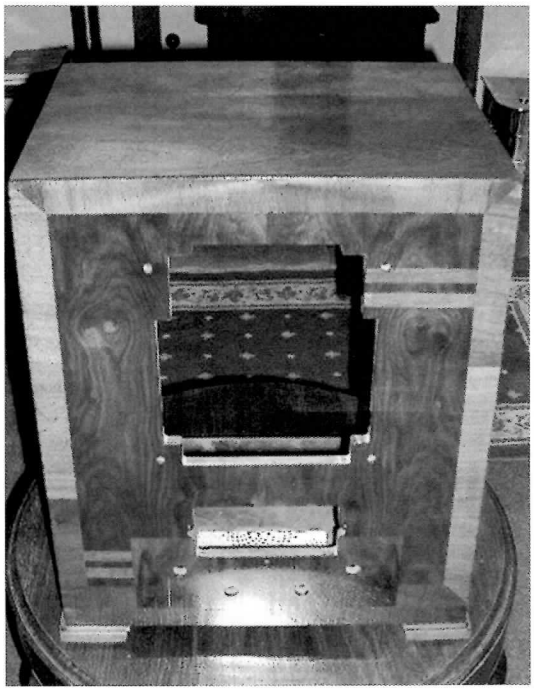
Using this method proved a lot more economical than the cellulose aerosol lacquer I used restoring my 'boat varnish over original finish' (it had to be seen to be believed) Marconi 557.

It did seem quicker, cleaner, far less smelly (no spray fog) and easier as well. Between coats I put the foam brush into a plastic bag to keep it from hardening and made for speedy work on a daily basis. After all this was done the case was left a few days to allow the coating to harden further.

I took the Bakelite speaker fret and the dial surround into the dining room for cleaning and polishing. I had to clean off the old speaker cloth stuck to about 50% of the back. I used a scraper with a fairly sharp blade to clean off the cloth. I then used car body T-Cut to get the surfaces of the fret and dial surround 'cut' going and then used Bakobryte to finish off with a soft duster cloth. I find this works a lot quicker than just Bakobryte in getting a good shine. The speaker fret was carefully done on the table so that not too much load was put onto the rather

What was the best approach to finishing I wondered? In the past I had used car paint lacqeur over stain but it took many coats and long drying periods in between.





Now, if you have tried soldering old contacts you will know it's no surprise that after 70 years of air contact it does not want to know.

delicate frame. Breaking it now would have been too much to bear!

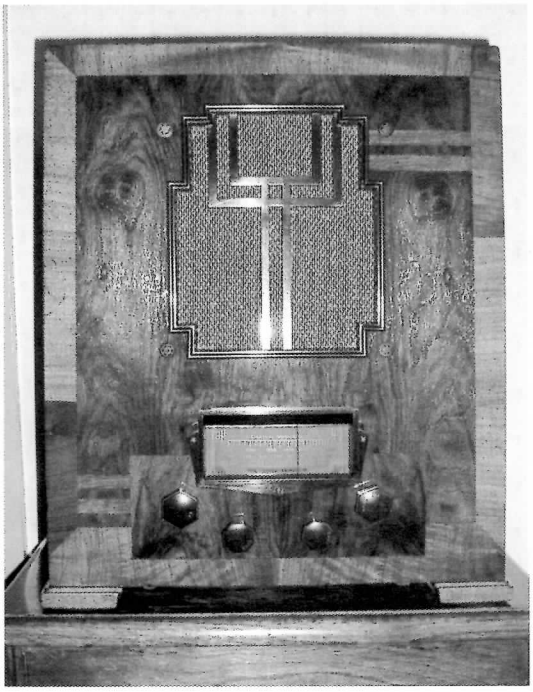
The clear dial glass was washed and polished carefully and re-mounted in the surround. When both were done they looked like new. They were then placed in the set and mounted with their original screws. The case was really looking rather nice now.

I then removed the original speaker cloth from its stretcher board and replaced it with some new but sympathetically styled cloth stuck on with UHU type glue. Once dry the board was re-mounted in the case. I then cleaned the speaker of its copious layers of dust by brushing it off outside with a soft paintbrush. It looked very good with only a slight hole in one edge where the cloth was punctured. It was then bolted back into the case in its rightful place.

Attention was now back oto the chassis and getting it working properly. Reception was lively enough but marred by excessive mains hum. Various checks were made and it was noticed that V2 the IF amplifier (VMS4) 1st grid was very sensitive to mains pick-up and moving a hand near it increased the hum greatly. A lot of component checking was done in this area but nothing seemed to be amiss. This I decided would have to wait until later for more careful consideration.

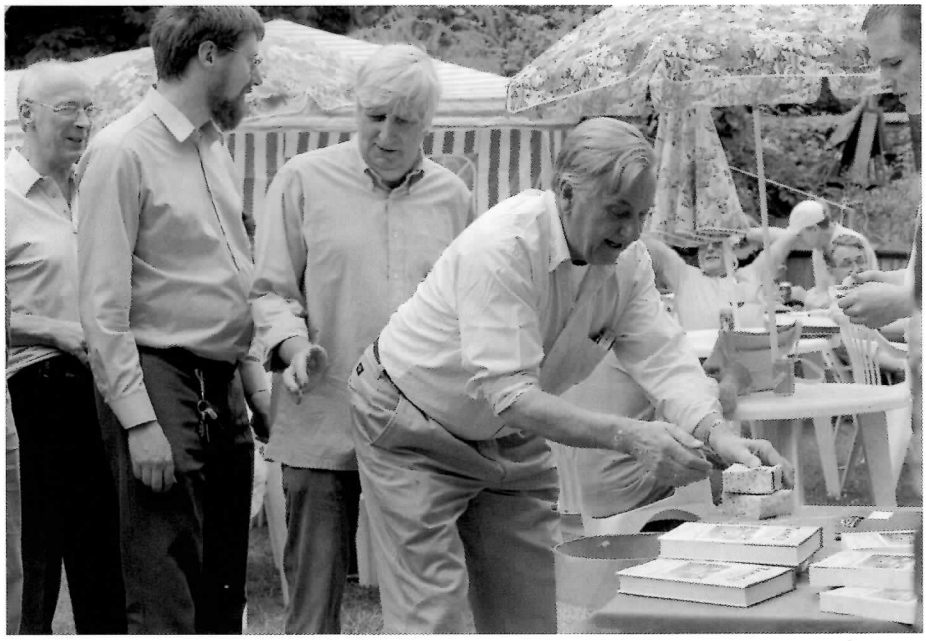
There was also an intermittent joint interrupting reception, just a slight background hum. Some checks revealed a dry joint on the cathode tag of V3 the MH4 grid detector. Now, if you have tried soldering old contacts you will know it's no surprise that after 70 years of air exposure it does not want to know. My best method (picked up from John Wakeley) is to use one of those adjustable fibreglass cleaning pens; they are very good and ideal for valve pins too!
Cleaned and then soldered, the set seemed to behave a lot better.

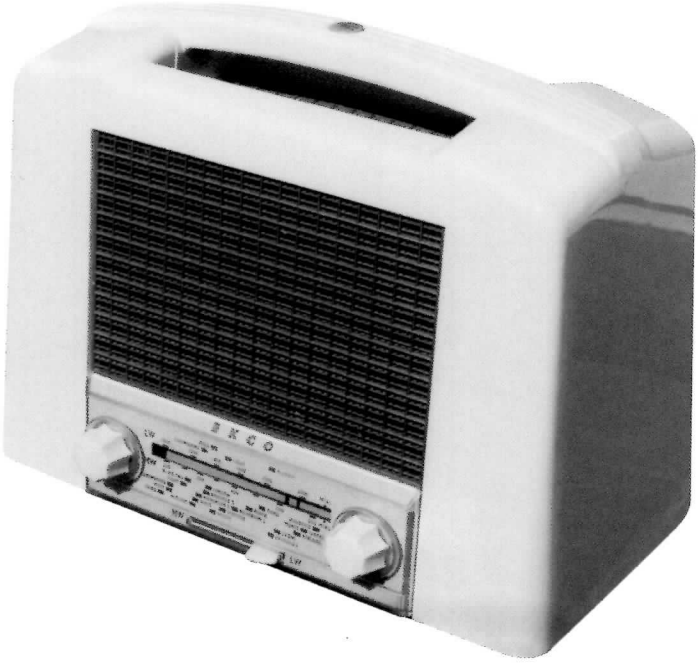
I still have to sort out V2's pick-up issue but it does seem to work quite well now. Using my 'Metzo' AM modulator from Vintage Components (a thoroughly recommended item) and feeding it with 1930's dance band music from my Minidisc player the restored set comes alive and I can appreciate in some part what it might have sounded like in 1933.



Gerry's Garden Party June 2004

photographs bt Carl Glover and Terry Martini





The Ekco models U122 and U159

by Peter Nash

In the early 1950's, many radio manufacturers were keen to tap into the potentially lucrative second set market. The lady of the house often wanted to be able to work around the home and take her favourite programme along with her. What was called for was compact receiver, incorporating its own aerial, that could be perched on a shelf or a corner of the sideboard, plugged in and played with no fuss. The recent introduction of the all-glass valves such as the U40 series aided the design of compact chassis and the use of transportable receivers became very widespread. The sort of radios that immediately spring to mind are the ever popular KB FB10 'toaster', the excellent Marconi T18DA and the subjects of this article, the Ekco models U122 and U159.

Initial impressions convey the mistaken notion that this set must be a battery portable because it looks so petite. In fact it is a 5 valve universal mains superhet covering MW and LW, that has been squeezed into a glossy plastic casing. To date, I have seen four different colours used for the cabinet. The most common colour seems to be cream, but there are also grey, green and deep maroon varieties. There are some cosmetic variations between the U122 and U159 which we examine shortly, but the same basic chassis is used.

There are several attractive features that I like about the cabinet. The contours have been nicely rounded off so that there are no sharp corners to get chipped off. There is an integral handle which has been moulded in across the top. This carries relief detailing and the 'E' Ekco logo in the form of a golden circular button in the centre of the handle. The handle is fairly strong, although if I am carrying one of these sets over any distance, I support it at the bottom as well, just to be safe. The radio has also been designed to look good from all angles, even the rear. The loudspeaker grille is plastic and of the squares–within–squares variety which is easy on the eye. The same material has been used for the top of the case (under the handle) and at the rear of the case too. Thus, cabinet ventillation is good and there is nothing to mar the clean lines of the receiver. The mains lead emerges from the underside where the cardboard 'back' is - if you know what I mean! Also underneath there is access to the mains voltage selector and aerial – earth sockets. I doubt if the sockets were ever used for two reasons. Firstly, the feet that the set rests on are only about 10mm (approx 1/3") tall so that the aerial plug body and its lead would need to be accommodated within this narrow space. A very low profile plug would be required. Secondly, I have never found the radio lacking in gain, so an external aerial probably would not have been needed.

Returning to the front of the cabinet, the presentation differs here according to whether the model is a U122 or a U159. In the U122 the dial is very pleasantly edge–lit with the silver legend glowing softly in the dark. The wavechange selector, however, is a curiously shaped wobbly affair which protrudes from the narrow space beneath the set. This lever takes the weight of the set, not good. If however, the U159 is now examined it will be seen that the wavechange selector is captured in a slot beneath the dial; much more civilised. Unfortunately, the design of the dial is largely opaque, giving a more limited illumination than is possible with the U122. So much for appearances, let us see what lies inside the receiver.

Laying the receiver face upwards, the screws in the feet can be removed to allow the base to come off. This permits unhindered access to the majority of the passive components. Unscrewing the hexagonal pillars that the feet screwed into releases the chassis from the cabinet complete with speaker, frame aerial and dial. The knobs and dial are simple to remove.

The circuit, though conventional, incorporates one or two refinements. Firstly it utilises frequency selective negative feedback in the audio amplifier. What this mouthful boils down to is a simple series resistor and capacitor linking the anodes of the output valve and audio amplifier. Out of curiosity, I did some experiments on the last Ekco I worked on and temporarily disconnected the feedback to see (or hear!) what the aural effect would be. As expected, the feedback introduces a subtle difference, with a better presence of mid to high audio frequencies and reduced distortion. I did notice that the feedback components were anchored on pin 4 tag of the output valve UL41. This is very naughty of Ekco as, according

Above left: Ekco U159 in cream plastic.

Above: Ekco U122 in maroon plastic.

Opposite page, top left: Illustration of Ekco U122 as advertised by Fields Radio Ltd. Doncaster.

Opposite page, bottom: This reference was found to a model U215 in an Ekco promotional leaflet from around 1951. This resembles the U159, maybe it was hastily re-numbered!

Ekco U 122 5 valve, 2 waveband, Portable AC/DC Receiver. £14/14/-

to various valve data books, pin 4 of the UL41 should always be left unconnected. Anyway, Bush got away with the same thing for years. Secondly, the output transformer boasts a humbucking winding. It is not so easy to determine experimentally how much hum reduction this contributes unless it is physically rewired. If the winding in question is recklessly shorted out, this constitutes shorted turns within the transformer leading to a massive loss of efficiency. Time to stop playing and put the crocodile clips away!

General service tips

As regards the resuscitation of one of these receivers from an 'as found' condition, repair is normally straightforward providing it has not already been 'got at'. remember that a live chassis is used so if it is being worked on outside of its casing, an isolating transformer should always be used. From experience, the drive cord will probably need re-stringing. As long as the pulley spring has not been lost, this job can usually be rattled off quite easily even without a diagram to follow. Any perished wiring should be re-sleeved or replaced. Definitely replace the mains RF bypass capacitor with a new, adequately rated componet. This will often be found to have blown anyway, with streaks of metallic goo radiating from the scene of the crime. Also replace the AF coupling capacitor to the grid of the output valve. A leaky capacitor in this position could cause serious overloading of the output valve and power supply. Remember, the heat dissipation needs to be kept to a minimum for the sake of the plastic case! It is a good idea to check all the waxed capacitors in any case. Other items I always check before applying power are the electrolytic smoothing can (may need reforming) also output valve (UL41) and rectifier (UY41) for heater to cathode leakage. These valves are very prone to this failing even if the emission is still relatively good. If I detect any leakage, the valve is immediatley replaced before any damage is caused. A heater to cathode leakage, apart from superimposing hum on the output, could flash over, putting raw AC onto the smoothing capacitors, burning out the mains dropper and blowing the dial lamps! Not possessing a valve tester, I check the valves cold using a multimeter set to the 20 megohm range. I check across the heater and cathode pins on the valve and look for the slightest deflection on the multimeter. Deflection equals rejection. I know that this method is not as definitive as if a proper valve tester were used, but it does allow suspect valves to be weeded out by those of us without this facility. Finally check resistances are within tolerance.

The correct valve line up is: UCH42, UF41, UBC41, UL41, and UY41; the two dial lamps are MES and are rated at 6v 60mA. Now let us look at the cosmetics.

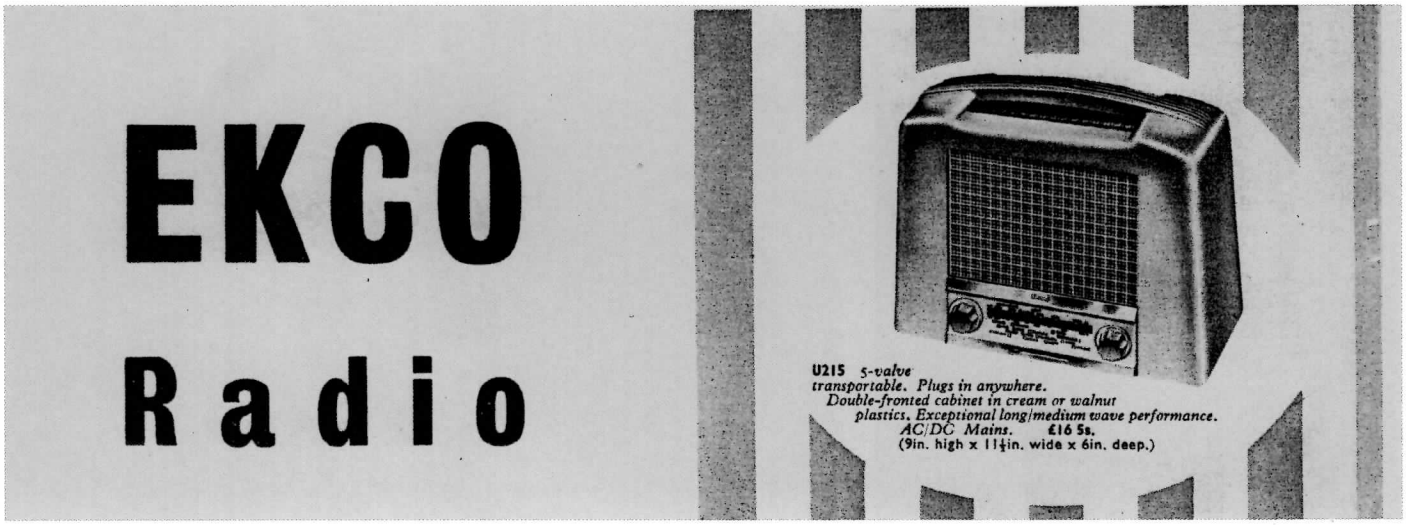
Cosmetics

In theory, providing the cabinet is uncracked, it should not be difficult to deal with. Everything is plastic including the dial and speaker grille. Invariably, the receiver would have collected many chips and scratches over its 50 or so years of existence along with the obligatory dots of white paint and BBC wavelength change stickers. The cabinet normally responds well to a wash and brush up in the sink using warm water and normal, household soap. An old toothbrush is ideal for cleaning the plastic grille. Afterwards, application of a plastic polishing paste such as Bake-O-Bryte will remove the paint dots and even polish out minor abrasions. Use a soft duster to apply the final application of polishing paste as anything harsher, even a tissue, will leave lots of tiny scratches which will show up under strong light as a haze. Finally, a gentle polish using a duster and silicone wax furniture polish will put the final depth of gloss back into the cabinet.

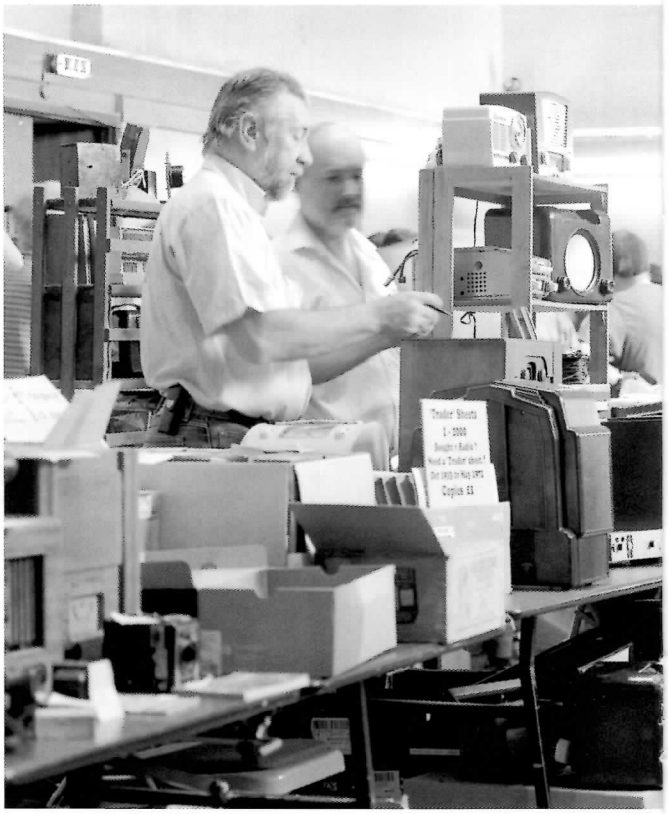
When it comes to reassembly, do not over–tighten anything. Remember that the plastic will be more brittle now than it was originally. Certain plastics shrink with age and this places stress on fixing points. This applies especially to the tuning scales on these models. Offer the tuning scale against the chassis and look carefully at the relation of the screw holes to those in the chassis. The chances are that the holes in the dial will be fractionally closer together than they should be. So carefully open the holes outwards slightly using a round section needle file, to alleviate the possibility of stress cracks developing. This particularly applies to the escutcheons used on the Bush DAC10 by the way. Similarly, the knobs were designed to be a tight fit for safety, but not overly so. Careful use of a needle file may be needed here, too, where the push-on knobs (usually U122) are too tight. All U159's I have seen use knobs with a grub screw fixing.

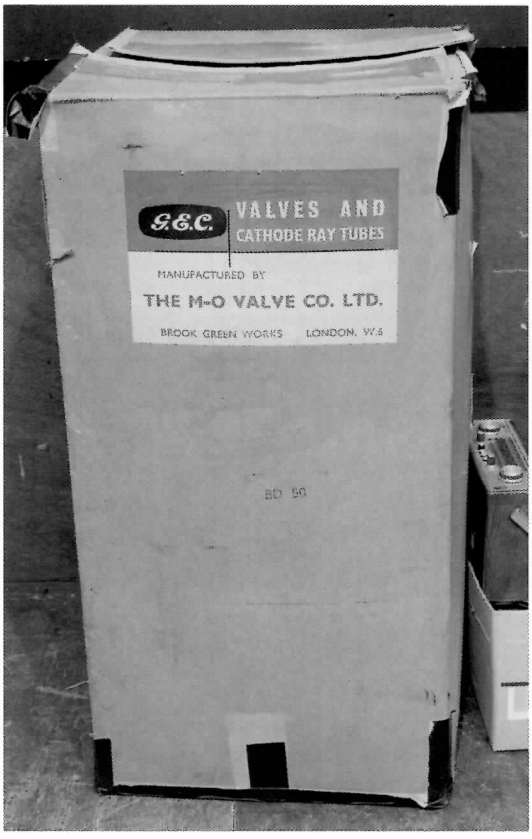
Conclusion

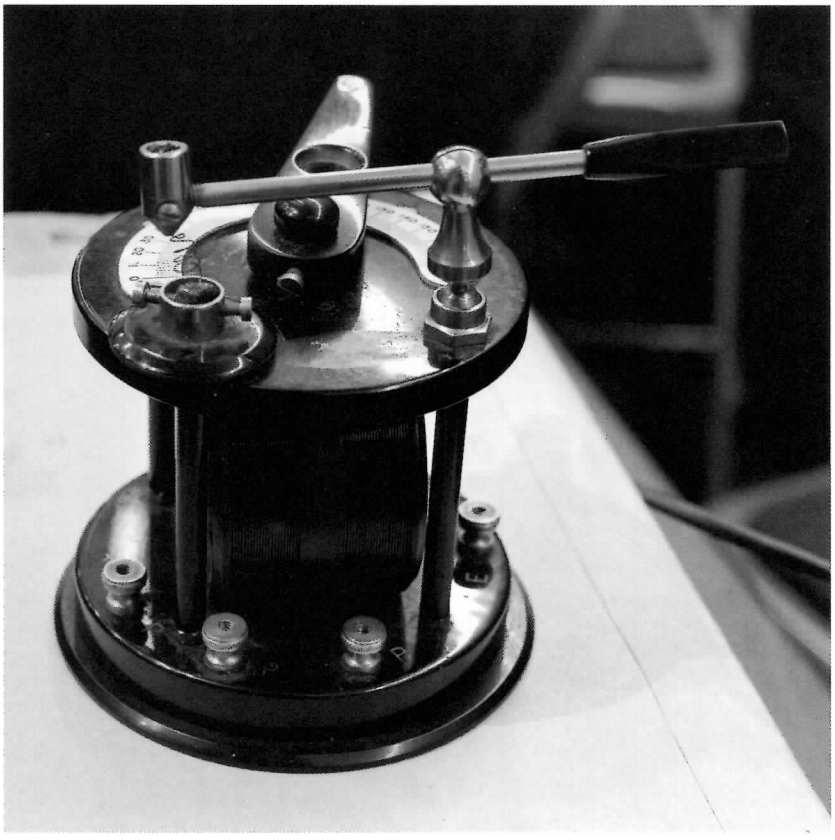
So, once everything is back together, how does it go? I have always found the sensitivity of these models very good on just the internal frame aerial. Connecting an external aerial does bring up the volume a degree on the more distant stations, but it always seems well enough on both bands without. The frame aerial is not as fiercely directional as a ferrite rod would be. Our lady of the house would have been pleased with this user-friendly advantage. Having found a niche for the set, she would not have to face it sideways to hear 'The Archers'. Selectivity is not knife edged, but again, always adequate for the conditions. The Goodmans speaker (especially designed for Ekco) delivers a tonal balance which is very pleasing for such a compact receiver, not too 'top'. All told, a very practical and attractive receiver to use.

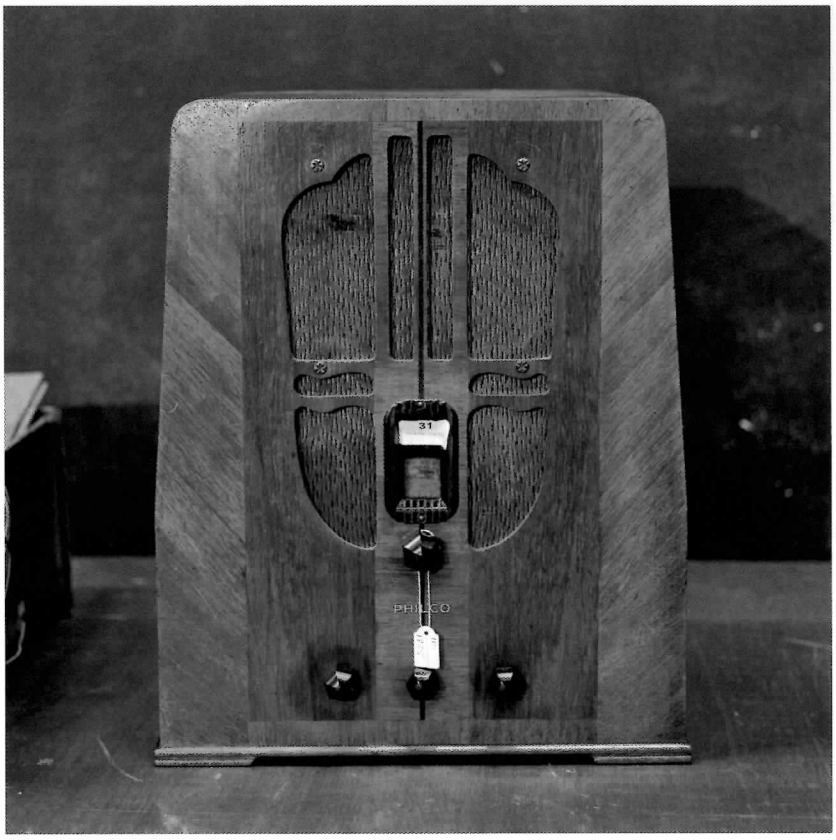


Harpenden June 2004 photographs bt Carl Glover








31
PHILCO

Rupert Loftus–Brigham 1935–2004

We have lost Rupert, who died at the end of June. He was one of our earliest members, becoming a staunch supporter of the BVWS, a former Committee member and a prominent figure at our meetings, running his stall together with his wife Sue. His special interests as a collector were with vintage marine radio and amateur or domestic equipment of the pre–broadcast era that he liked to call the 'dark ages'.

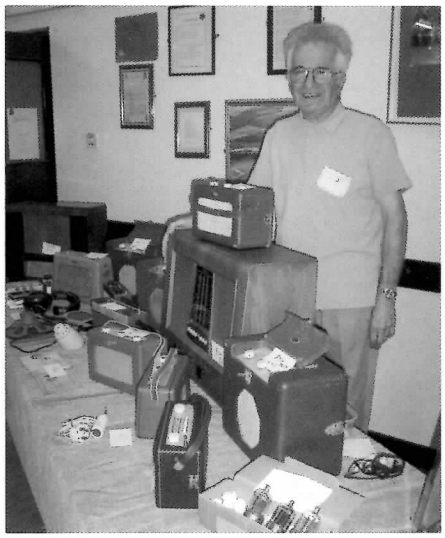
I first met Rupert in 1975. I had recently become interested in early wireless through the death of my father when I re–acquired a collection of vintage components that had seen service in his home–built sets and which I had played with as a boy. Still remembering the technology of those times, I was seized by the idea of reconstructing something of the period, as though to atone for having dismantled Dad's handiwork in the past. Then at a chance encounter in a pub I was told of a local man advertising for vintage wireless and given his phone number. He turned out of course to be Rupert, then living ten minutes walk away, so I paid a visit. After being promptly releived of £70 I came away with sundry items, including a Gecophone 'Smoker's Cabinet', admittedly less than pristine. At our next meeting, I think I encountered the unforgettable Norman Jackson, our first Bulletin illustrator, and I soon met Tony Constable and other enthusiasts who had been meeting at London street markets and antiques fairs. Then Tony formed the BVWS and the rest is history, as recorded by Jonathan Hill.

Rupert went to Kelly College, Tavistock, a school with a strong naval tradition, but left after his O–levels to enroll for a painting course at Portsmouth Art College. However, he became conscripted into the RAF where he served for a voluntarily extended term and received his formal instruction in electronics, which had interested him since boyhood. After demob he worked for a computer company in the early days of the mainframe and magnetic tape recording. In February 1976 he opened his well-known vintage wireless shop in Ealing, that soon became a regular meeting place for BVWS members, where his encyclopaedic knowledge of early radio would be expounded with gusto. The shop closed in November 1999 when Rupert and Sue retired to West Sussex.

We have many extraordinary characters in the BVWS, but Rupert stood out and will be much missed. Sadly "we shall not look upon his like again". I am grateful to his brother Gerald, whom we welcome as a new BVWS member for his help with this obituary.

Ian Higginbottom

Images from Wooton Bassett



A practical replacement for 'Magic Eye' type TV4 valves

by Don Hewlett

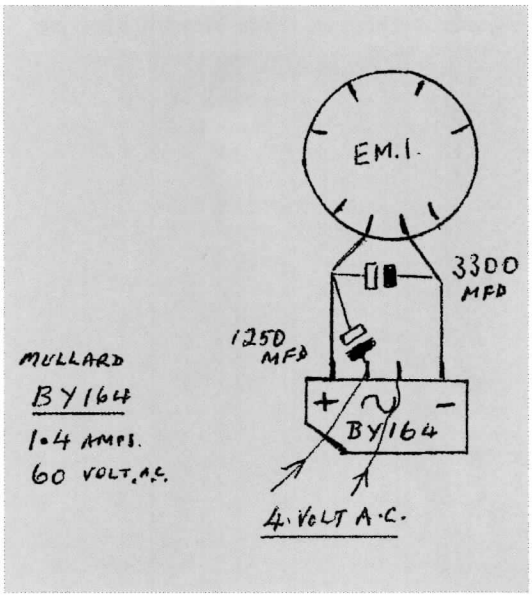
It is no secret that 'Magic Eyes' are difficult to find and pre-war types such as the TV4 with 4 volt heaters have virtually disappeared.

However, I have found in journeying around, that type EM1 with a 6.3 volt heater can sometimes be obtained and this can be utilised in place of the TV4 with a simple modification as shown in the diagram. Since both types are fitted with an 8 pin side contact 'P' base, the only alteration necessary is to increase the heater volts from 4 to 6.3. this can be achieved with a low voltage semiconductor bridge rectifier and two electrolytic capacitors and will feed 6.3 volts DC to the heater.

Having carried out this modification on several receivers with complete success, the bonus is that the visual effect is quite authentic since the EM1 produces a 'cross' display as per the original and not just the 'V' wedge as on the Y63 or 6U5G.

The components can be mounted on a tag strip or Veroboard and the only wiring change is to diconnect the heater leads from the 'P' base and then take them to the AC tags on the bridge rectifier and connect the DC tags back to the heater pins on the 'P' Base.

Similarly, the TV4A can be replaced by the EM3.



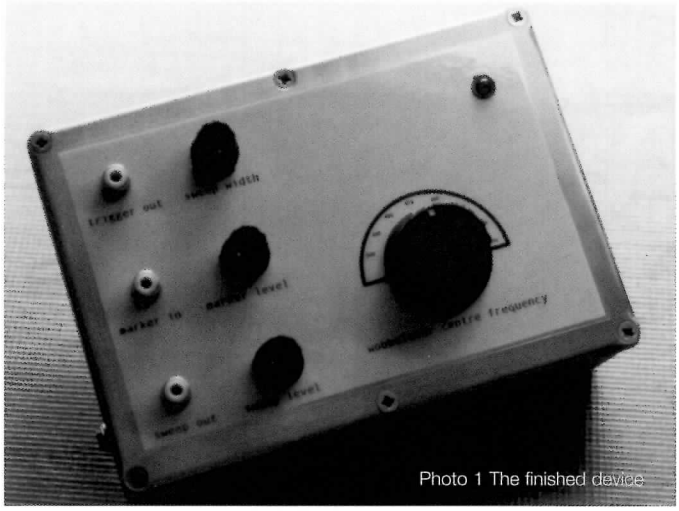


Photo 1 The finished device

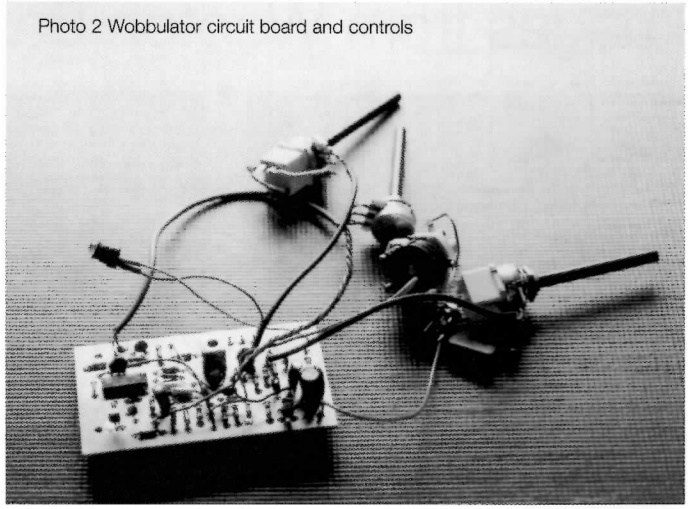


Photo 2 Wobbulator circuit board and controls

Build a Wobbulator!

by Ian Liston-Smith

In conjunction with a basic oscilloscope (and preferably also a frequency counter), the wobbulator is an extremely useful piece of test equipment for serious work on radio receiver intermediate frequency (IF) alignment, but it is seldom seen as a ready built unit. I therefore submit this constructional article to share with others.

For those unfamiliar with the device an explanation will be necessary. In essence, a wobbulator is an oscillator centred on the intermediate frequency of the receiver, but is swept across the full IF range and the receiver's detector voltage displayed on an oscilloscope.

The advantage of using this method of aligning the IF stages is that it allows the correct shape of the IF curve to be achieved. This is essential if the IF stage curve is to be accurately determined, particularly if various IF circuits are to be stagger-tuned for a particular overall response.

Many service sheets suggest that a fixed, tone-modulated frequency (tuned to the receiver's IF), is injected at the mixer stage and each IF stage adjusted for maximum audio output. This can give satisfactory results if the IF circuits are already close to the correct frequency, but there are pitfalls, especially if they are badly miss-tuned.

The first pitfall is that the single-frequency method does not guarantee a symmetrical IF response. When listening to a station, an asymmetrical IF can cause one of the sidebands to be attenuated, giving the broadcast a 'not quite tuned in' sound.

The second problem is that the IF circuits can be peaked too much giving excessive gain in the IF stages leading to instability.

Thirdly, this method can give the IF response too narrow a bandwidth, resulting in excessive attenuation to both sidebands and the audio output lacking in treble.

The wobbulator circuit described is based on one published in Radio Communication's Technical Topics and republished in Amateur Radio Techniques 6th edition. It is reproduced here with permission from the RSGB with my additions and corrections.

Circuit

The circuit shown is suitable for valve and transistor radios having an IF between 410 and 500 kHz - the majority of long, medium and short wave sets. There is no reason why it cannot be modified (by changing L1/VC1) to cover frequencies as low as 100 kHz and as high as about 3 MHz, but it is not suitable for the alignment of FM receiver IF stages.

The tuned circuit L1 and VC1 determine the oscillator's centre frequency, say 465 kHz. A voltage ramp generated by Q1/C5 varies the capacity of the varactor diodes D2/D3, which are effectively across the tuned circuit. Their varying capacity frequency modulates the tuned circuit from about 410 to 500 kHz, thus sweeping right through the radio's IF passband. The exact sweep width is set by RV2 from no sweep (where output is stable and set by VC1) to full sweep range of approximately 90 kHz.

It is possible to use 1N4001 (or similar) silicon rectifier diodes instead of varactors, but three or four in parallel will be needed to get sufficient frequency sweep.

A trigger pulse is also generated by the circuit and is connected to the oscilloscope external trigger input to synchronise the oscilloscope trace with the wobbulator sweep.

The radio's detector response is DC coupled to the oscilloscope. As the oscillator approaches the centre frequency of the IF stages, the detector (or AGC) voltage increases. The oscillator sweeps through the IF range about five times per second and the resulting change in detector output voltage is traced out on the oscilloscope display. Each IF tuned circuit may then be adjusted for the correct centre frequency and bandwidth, and the effect of each adjustment being immediately displayed. Figures 1 to 4 show typical responses.

The original design operated from a 9-volt battery, but as the battery voltage falls, the frequency drifts. This is not a significant problem, but it does mean that the wobbulator oscillator scale becomes inaccurate and overall sweep width alters. I have therefore added a 9-volt regulator and run the design from a 12-volt supply.

The inductor L1 should ideally be adjustable so that the correct tuning range is easily achieved and the best device to use here is the local oscillator coil from an old transistor radio. However, any coil with an inductance of about 1mH will be satisfactory.

C11 should be a high voltage type to protect Q2 - just in case the wobbulator's output is inadvertently connected to a high voltage point in a valve set.

Another enhancement to the original design is the addition of Q3 and its associated components. This allows an input from an RF frequency generator to be injected at an adjustable level into the wobbulator to produce a frequency marker on the IF curve (see later).

Construction notes

My preferred construction method is to work out a layout on 0.1-inch graph paper as if a printed circuit is to be

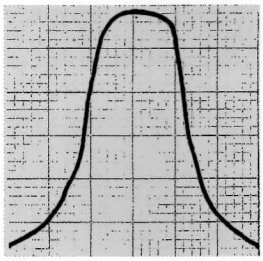


Fig 1

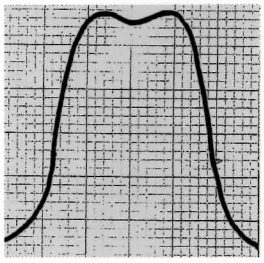


Fig 2

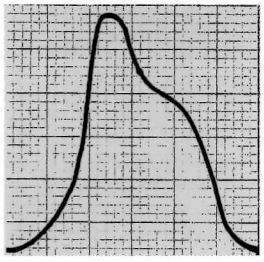


Fig 3

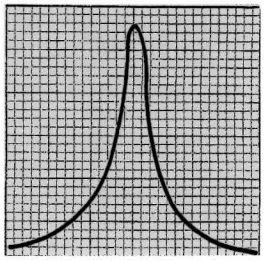


Fig 4

Fig 1: Good symmetrical IF curve
Fig 2: Good symmetrical IF curve with double hump for extra bandwidth
Fig 3: Asymmetrical IF curve requiring adjustment
Fig 4: IF bandwidth too narrow and restricting audio response

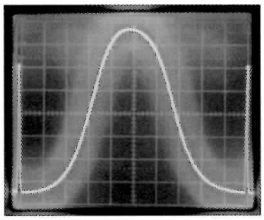


Photo 3: IF curve of correctly aligned Bush TR82 (horizontal scale 2kHz/div)

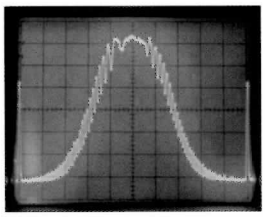


Photo 4: Bush TR82 IF curve with marker oscillator set to 470kHz

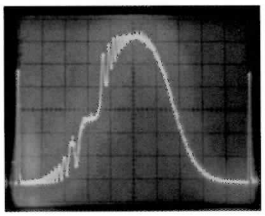


Photo 5: Marker set to 473.5kHz showing 6dB bandwidth is approx. 7kHz

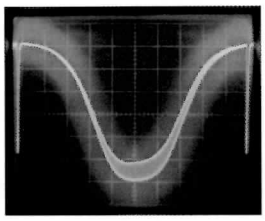


Photo 6: IF curve of correctly aligned Bush DAC90A

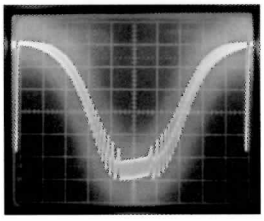


Photo 7: Bush DAC90A IF curve with marker oscillator set to 465kHz

made. This layout is then cut out and temporarily taped over a piece of single-sided copper-clad circuit board with the copper uppermost. Countersunk holes 1 mm in diameter are then drilled through the board and component leads connected underneath following what would be the tracks. The earthed component leads are soldered directly to the copper surface. This ensures a physically and electrically stable layout: although at the relatively low operating frequency of this circuit, Veroboard or other perforated board will also be suitable, providing all component leads and wiring are kept short.

Screened leads should be used to connect the trigger output socket, VR1 and VR3 to the board.

A metal enclosure is to be preferred. This ensures the RF only comes out of the output socket and does not leak through the case by radiating directly from the board.

Use

Switch radio on and allow to warm up. Set wobbulator frequency to what the radio's IF should be, with the sweep control set to minimum. A frequency counter (or digital radio tuned to the weak second harmonic e.g. 2 x 465 = 930 kHz) is useful for this. Connect wobbulator output between chassis and mixer valve grid or transistor base lead. (It may be necessary to temporarily short out the receiver's local oscillator and/or aerial input tuning capacitors with a 47nF capacitor to prevent broadcasts from interfering with the adjustments.) In some sets with a built-in frame or ferrite aerial, a direct connection from the wobbulator may not be necessary. In this case just connect a loop about 10 cm wide to the wobbulator's screened output lead and lay it near the receiver. Connect oscilloscope input (switched to DC coupling) to receiver detector output, prior to any coupling capacitor or alternatively to the AGC line. Connect the wobbulator trigger output to the oscilloscope. Adjust VC1 for maximum vertical deflection of the oscilloscope trace. This should be close to the receiver's correct IF frequency, e.g. 465kHz. Turn up the sweep control and adjust the oscilloscope controls until the IF curve appears centrally on the oscilloscope display. Adjust the wobbulator output to the minimum level that gives a clear trace, adjusting the oscilloscope input gain as necessary. Keep the level below the radio's AGC threshold or the trace may be distorted.

A lopsided trace indicates that the IF circuits need adjustment. Even if the trace is symmetrical, try slight adjustment of IF tuned circuits to determine if a little more gain or a better shape is possible. (In an old set slight adjustment will usually improve the response of IF tuned circuits as they have often drifted to a greater or lesser extent.) If an RF oscillator is available, connect this via a frequency counter to the marker input socket and set it to the receiver's correct IF frequency.
If no frequency counter is available, set the oscillator accurately using a digital radio. (If leakage from the oscillator connecting leads swamps the wobbulator output regardless of marker level settings, ensure that the radio's aerial tuning gang is shorted with a 47nF capacitor.) If the IF is already aligned accurately, a 'wiggle' will appear on the trace at the top of the curve corresponding to the centre frequency of the IF. If the wiggle is off-centre then adjust the IF tuned circuits until the peak is shifted into the right place. Moving the marker along the curve (and measured with the aid of the counter or digital radio) from about halfway up each side, will show the receiver's approximate 6dB IF bandwidth. This should normally be between about 6 and 15 kHz. The lower figure will give better selectivity at the expense of upper audio frequency and the higher figure provides better audio fidelity for the stronger signals.

If you often renovate old sets, this IF alignment technique is soon acquired and you have the satisfaction of knowing the set is working exactly as it should. This is almost certainly how the IF circuits were adjusted before the radio left the factory.

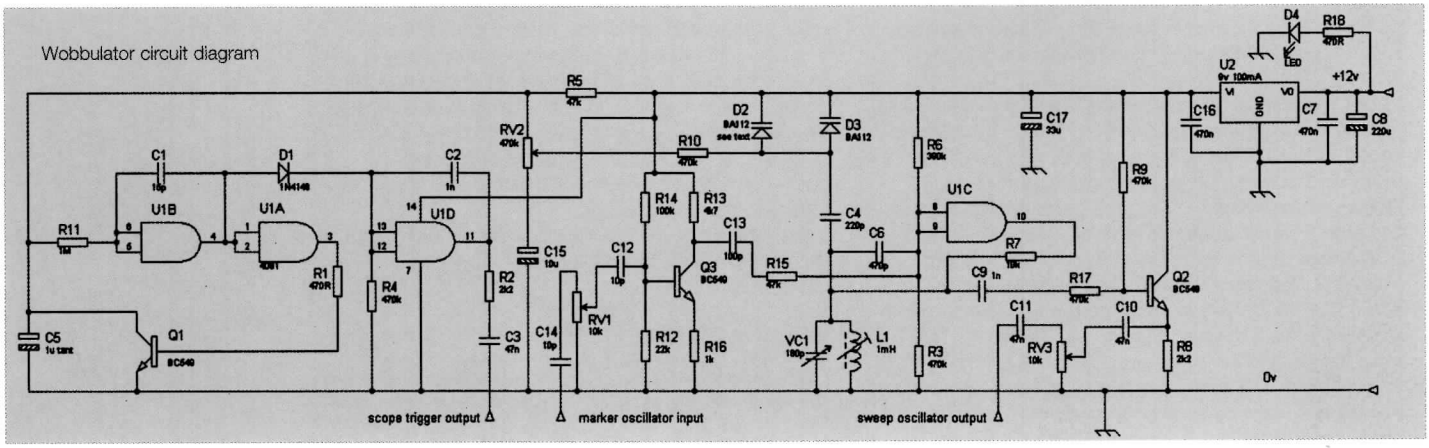
Once the IFs are correctly aligned, disconnect the wobbulator and carry out the normal alignment of aerial and mixer/local oscillator circuits with the RF oscillator and oscilloscope. (See BVWS Bulletin volume 24, number 2, page 24 for a description of receiver alignment using a cheap digital radio, RF oscillator and oscilloscope.)

Note: Although Figs 1 to 4 show a positive going trace, if the AGC output of a valve receiver is displayed the trace will be inverted.

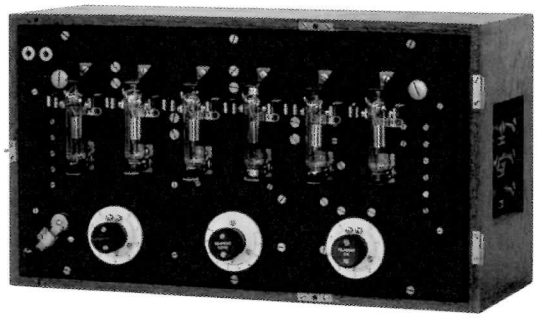
Safety note: When working on live chassis receivers, ALWAYS power them via a mains isolating transformer - especially when working with any mains operated (and earthed) test equipment.

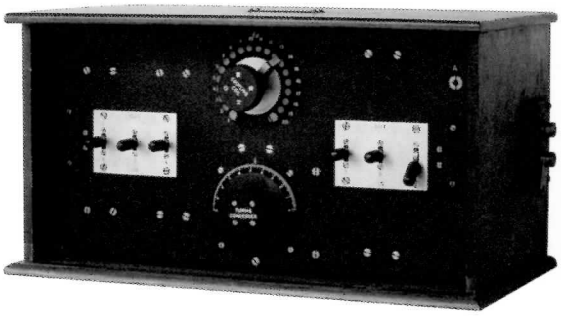
Components

	Resistors	
2	R1, R18	470R
2	R2, R8	2k2
5	R3,R4,R9,R10,R17	470k
2	R5,R15	47k
1	R6	390k
1	R7	10k
1	R11	1M
1	R12	22k
1	R13	4k7
1	R14	100k
1	R16	1k
	Capacitors	
1	C1	15p
2	C2,C9	1n
2	C3,C10	47n
1	C11	47n 400 volts
1	C4	220p
1	C5	1u tant
1	C6	470p
2	C7,C16	470n
1	C8	220u
2	C12,C14	10p
1	C13	100p
1	C15	10u
1	C17	33u
	Integrated Circuits	
1	U1A	4081
1	U2	9v 100mA
	Transistors	
3	Q1,Q2,Q3	BC549, BC109 or similar general purpose silicon NPN types
	Diodes	
1	D1	1N4148
2	D2,D3	BA112
1	D4	LED
	Miscellaneous	
1	L1	1mH
2	RV1,RV3	10k
1	RV2	470k
1	VC1	180p

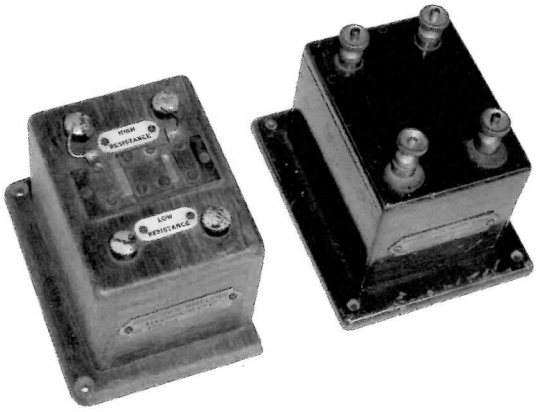


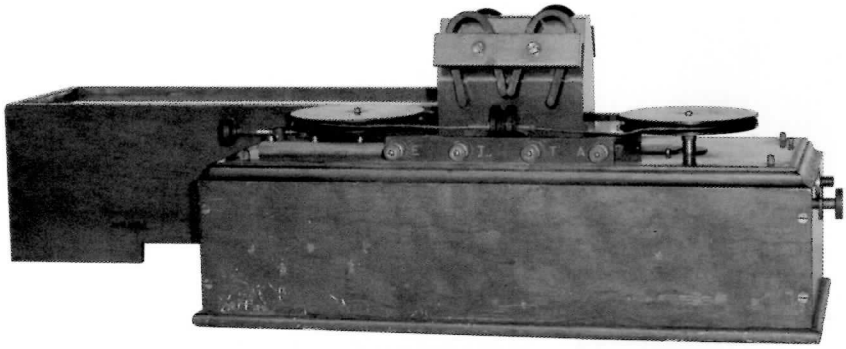
Sleeping foxes catch no poultry





It is a story of creativity and perseverance. It is proof that good finds can be made if you do the necessary efforts





This little story is related to the photograph of the Marconi Amplifier A.G.I. on the cover of this Bulletin. It has been provided by our Belgian member Fons Vanden Berghen who is known for his telegraph collection. Fons has indeed found this amplifier and the other Marconi items that are pictured here plus others as well in an attic at one location.

It is a story of creativity and perseverance. It is a proof that good finds can be made if you do the necessary efforts: "sleeping foxes catch no poultry" as Fons added. It is also proof that you don't always need to spend big money to get special items: he got it all for free!

But it didn't go by itself. At the start there was some lateral thinking Fons explained. It started by asking myself 'where is there a chance that one can find such kind of items, untouched during all those decades and whereby there is a good chance that the actual owner does not have any interest in them'.

The next step is to "attack". The target was an institution with some fame...You need some guts to do it and then you have to go through the hierarchy in order to find the real responsible person. In this case several people at several levels were finally involved which complicated the situation a lot. About six months went by in order to find out.

The next step: convince them to accept your visit. Most of them were first not willing to be disturbed regarding this "old stuff". It took a lot of efforts and time, well over one year, to persuade them to accept Fons crossing their doorsteps. Indeed they delayed and delayed it again probably in the hope of getting rid of this strange man.

Then came the phase whereby he had to convince the owners that he was "the good home" for it. Here Fons has the advantage that he has good arguments for it as he could prove that he has participated in many exhibitions, is giving lectures on early telecommunications, writing articles and above all could present his book *Classics of Communication*. He could convince them that he could give that old stuff a new life. But anyway, also here a lot of perseverance was necessary though: this phase took about one year.

And then at last came the big day whereby the owner "surrendered": a day of glory and deep happiness.

PS. Fons would like to know what the two little Marconi boxes are on one of the pictures. Also more background info on the A.G.I. amplifier is welcome. Note that valves 1, 2, 3, 4 and 6 are V24's and valve 5 is a QX. Info can be sent to the Editor, Carl Glover.

Images from May NVCF

by Carl Glover


WIRELESS WORKSHOP
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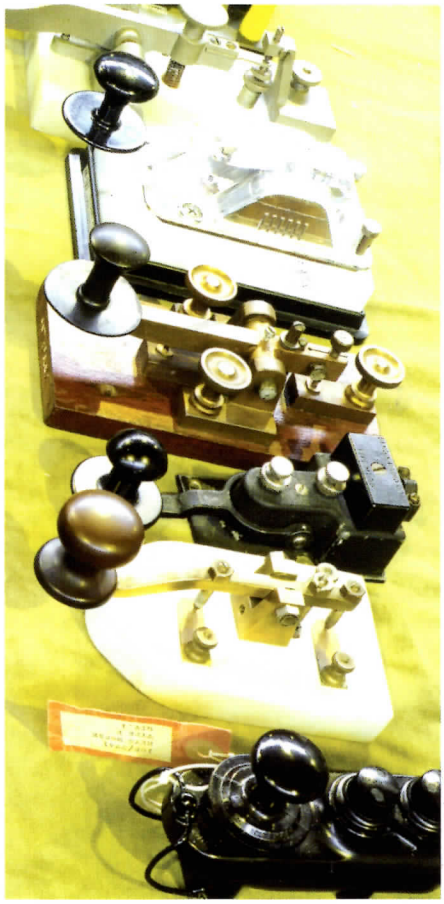
Radio Shack
Coca-Cola
RADIO


8944
Electronic Video Cassette Recorder




EKCO
GOSSOR
CLASS 1
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An early 25 inch Hybrid Colour receiver

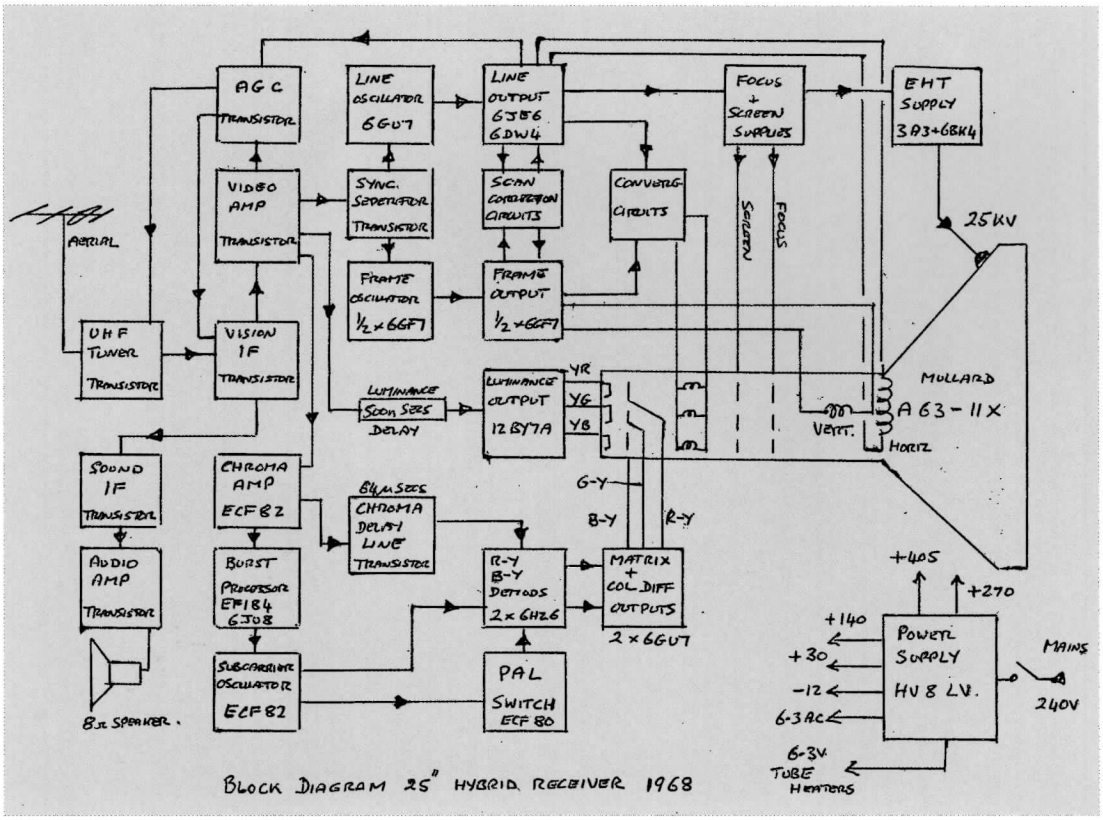
by Graham Dawson

Those readers who read my article in the Vol 27 No2 Bulletin on an early 21inch round tube colour receiver, may remember my stated intention to build a rectangular tube set at some future date. The most important item for that set was of course the tube, and these were not easy to come by in the mid 1960's, even for quite large sums of money, there not being any replacement tube market at this time. Why did I want to build another receiver ? Well aside from the technical developments that had taken place while I was building the first set, the problem with presenting a rectangular image on a round tube is the information that is cut off in the corners. Unless one heavily underscans a round tube, some 15% of the total picture area is lost.

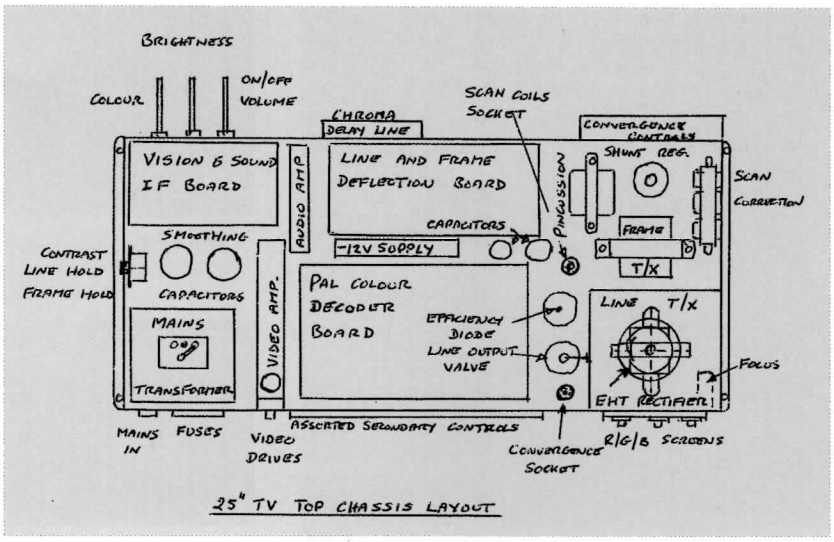
The possibility of building the new receiver depended on acquiring a rectangular tube at a reasonable price. Fortunately I still had contacts at RCA, where I had worked in the colour TV department before they closed it down. Most of the test equipment had been shipped back to the USA if it was of no use to other sections at Sunbury. Any components that could be used elsewhere were retained and, as they wanted the storage space, the rest of the stock was either thrown away or offered to the staff at reduced prices. Very fortunately for me (as it turned out) there was a brand new Mullard A63-11X 25" tube on offer, and a complete set of RCA rectangular tube scanning components, which had been sent to the lab for evaluation just before it closed down. The cost of shipping these items to the US was not economic, so they were offered for sale. My friend asked me if I was interested ! Of course I was. These were the very parts I needed.

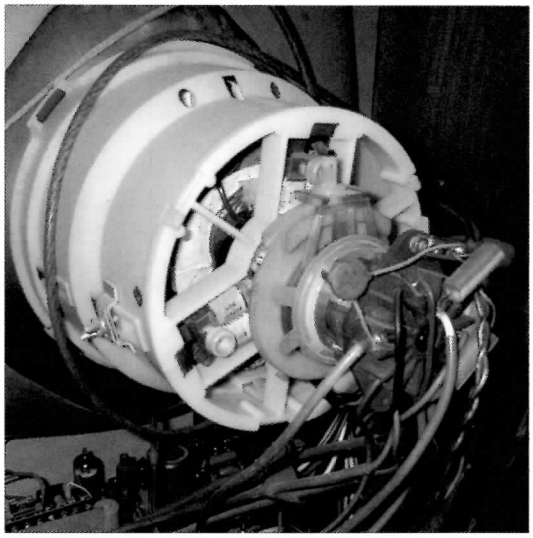
To almost anybody at RCA they were of no value at this time. It was a bit like offering a jet engine for sale in a car breaker's yard. Who had a car to take it ? So I told my friend to offer £10 to the company for both items. They refused initially, but he finally got them, and a few useful valves as well, for £15. This was a fraction of their true cost, and even though £15 was quite a lot of money in 1966, these were what I needed to start on a new set. Now I was back to the same point as 2 years before; a whole set to be built around a few major components and a blank sheet of paper for the circuit and construction.

In fact it wasn't really a blank sheet of paper. The scanning components dictated the latest RCA circuitry, and this was quite a large chunk of the



BLOCK DIAGRAM 25" HYBRID RECEIVER 1968





design already decided for me. British and American colour TV set design differed considerably at this time. Most manufacturers in the USA favoured a transformer to feed heaters and HT plus LT supplies, whereas the norm in the UK was series heaters with about a 250Volt HT line rectified off the mains. RCA favoured a 400V HT line, and 6.3 volt heaters which meant a large transformer was needed. More on this transformer later. The first UK colour sets were all dual standard, and used transistor IF strips with a transistorised PAL colour decoder feeding valve output stages to drive the tube. Not only were high voltage, high frequency transistors expensive, they were also liable to fail if the tube flashed over inside, which many early tubes did. Like the earlier set I decided not to go for dual standard working, since by the time it was completed there was a good chance that BBC1 and ITV would be on 625 in colour. I was however not sure about building a transistor colour decoder. The modified RCA valve NTSC decoder had performed really well, and even though it meant building a printed circuit board from scratch, at the time I felt this was preferable to making a transistor version. Shortly after I took this decision, Mullard published a complete book of application notes on the design of a dual standard receiver, which included all construction details for a decoder. I had by then however started down the road to a valve model.

So the layout of the set looked like this:-

Mechanical push button UHF tuner; no point in fitting a VHF tuner without any 405 line capability.

Transistor sound and vision 625 line IF strip based on a Fairchild application note, with coil winding details.

Germanium class B audio amplifier of about 3 watts from a proven simple Hi Fi circuit.

Transistor video amplifier and sync separator feeding a valve luminance output stage coupled to the tube cathodes; this to be driven from the luminance delay line.

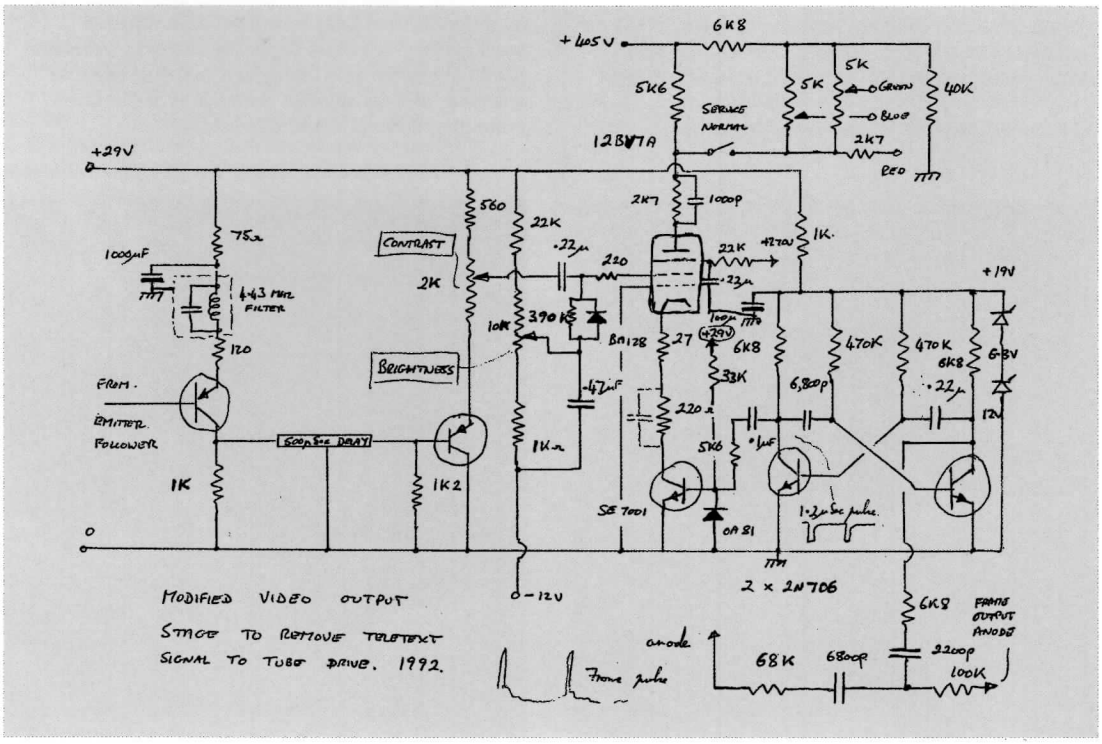
Valve PAL decoder with colour difference output stages feeding the tube grids.

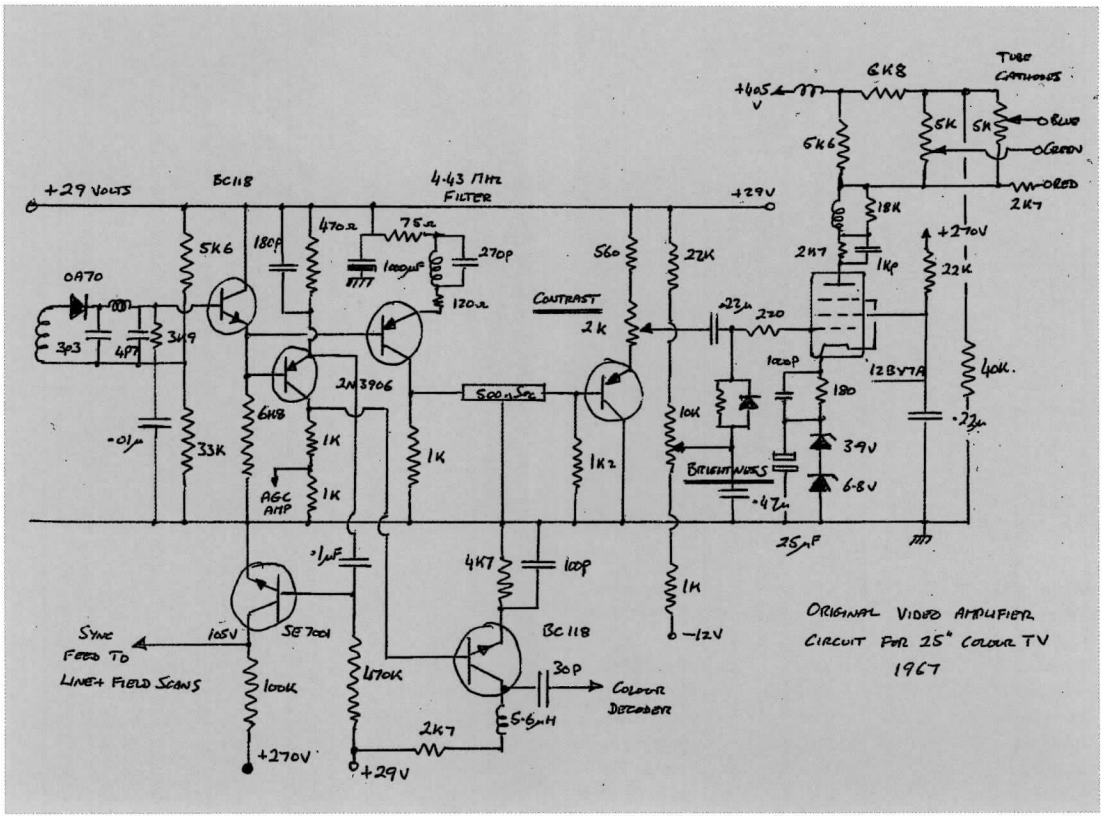
RCA design geometry corrected line and field scanning with focus volts and shunt regulated EHT.

RCA convergence circuitry with coils and magnets integral to the scan coil housing.

A suitable power supply to feed all the above circuitry.

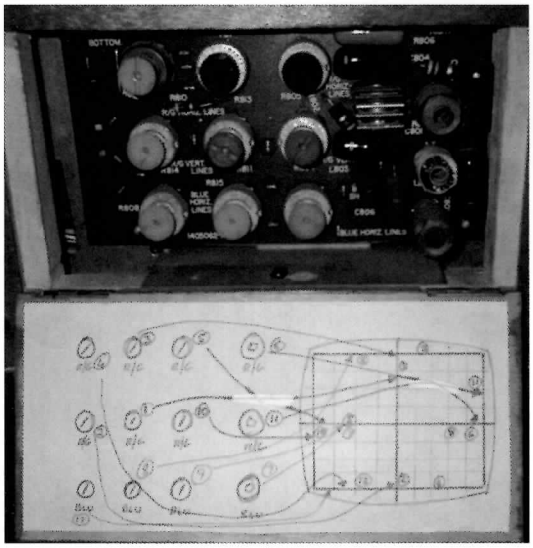
Having decided on the circuit format, the layout of

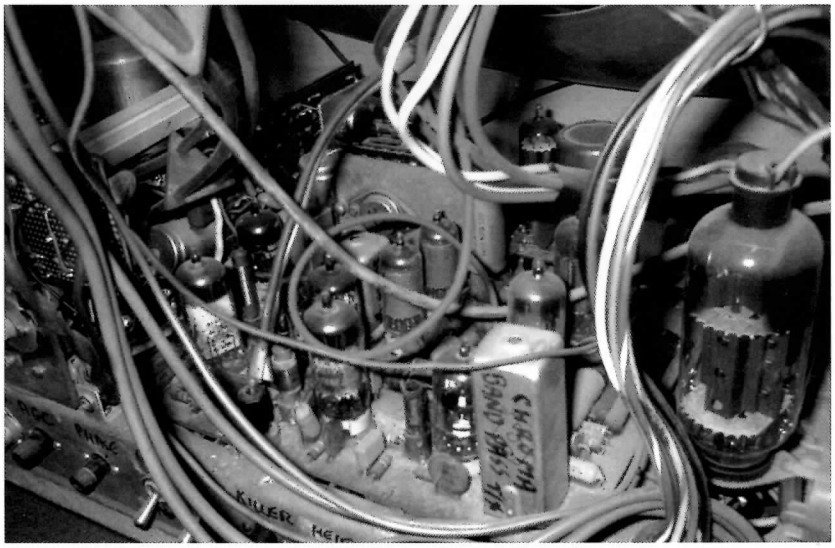


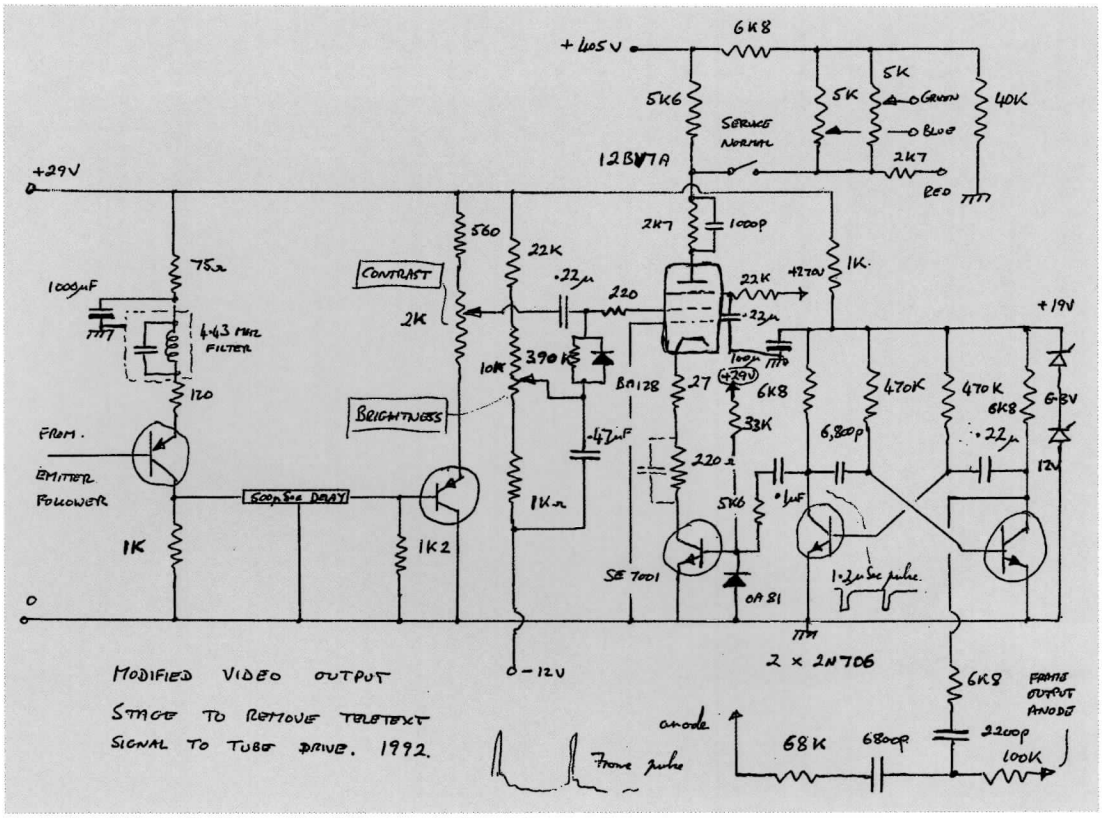


the various sub sections was the next step. All of the scanning and high voltage stages occupied about one third of the total chassis area. The colour decoder had next to be laid out as it was being built on a home designed printed circuit. Then the video amplifier and sync separation, followed by the IF strip, audio amplifier, AGC and finally the power supply.

At this point I would like to give more details of the power supply. I consider this to be one of the most important details of the receiver, as a good supply helps ensure trouble free running of the other circuits. The basic design had been determined, and the supply requirements were as follows: 6.3 volts for all the valves, with an isolated winding for the tube heaters. 405 and 270 volts for scannning and tube drives, plus colour decoder. +30V and –12V for the various transistor stages. Total consumption of the set I estimated at about 300 watts. These rather odd supply voltages made it necessary to have a special transformer wound and since I did not know the exact current requirements of each winding, some allowances had to be made to give a safety margin. The cost of a "one–off" professionally wound transformer was £8, which was nearly what I paid for the tube. However skimping on such a vital component would have been false economy, so I paid up. Series regulation was used for the +30 and –12 volt lines, but I found two unexpected problems besides. The tube heaters flared up at switch on, due to their low initial resistance and the low source impedance of such a large transformer. Also without a load, the HT line rose to 450 volts until the valves warmed up. This put a strain on the electrolytics, so a delay circuit was devised to give a 2 stage start up. When first power was applied, the tube heaters had 10 ohms in series. The HT line was fed through a thermistor. These two components were switched out by a double pole relay energised after about 6 seconds from a simple capacitor charging transistor driver. It was fail safe because if the relay failed to energise, the resistances were left in circuit thus protecting both tube and capacitors.



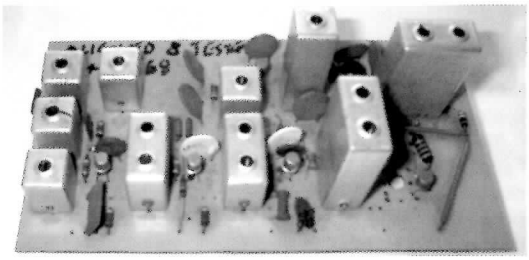


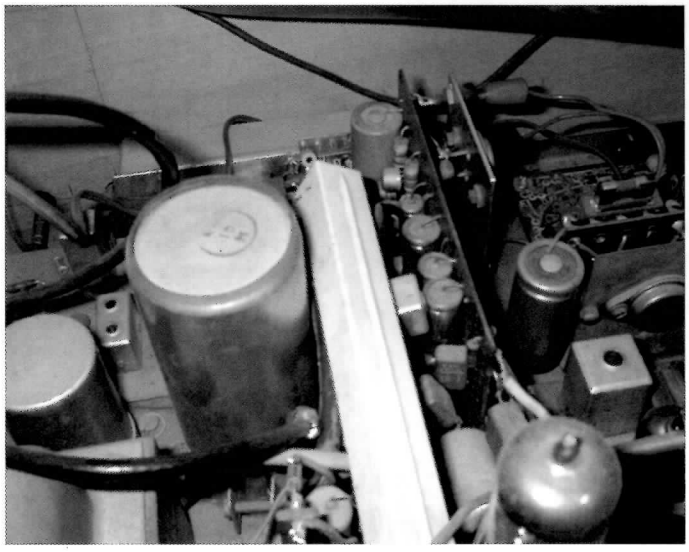


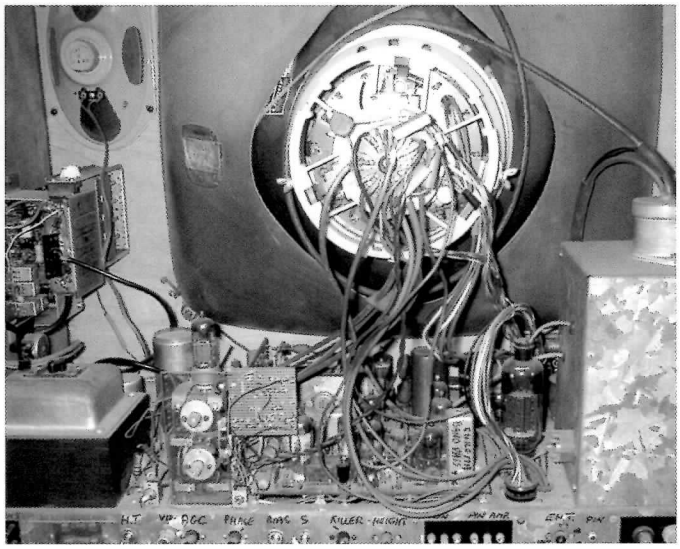
The space taken up by the circuit boards and components was less than the previous all-valve design. This was due in part to transistorisation, but also by a more careful laying out of the various boards and components. However I retained the principle of double insulating high voltage areas, and keeping hot components away from other circuits. I decided again to employ a galvanised steel chassis for strength and the ability to solder some supports directly onto it. Compared to the original set, the chassis dimensions were reduced by about 2" in width and depth, meaning a smaller cabinet could be constructed even though the tube had a larger frontal display area. More details of the cabinet later.

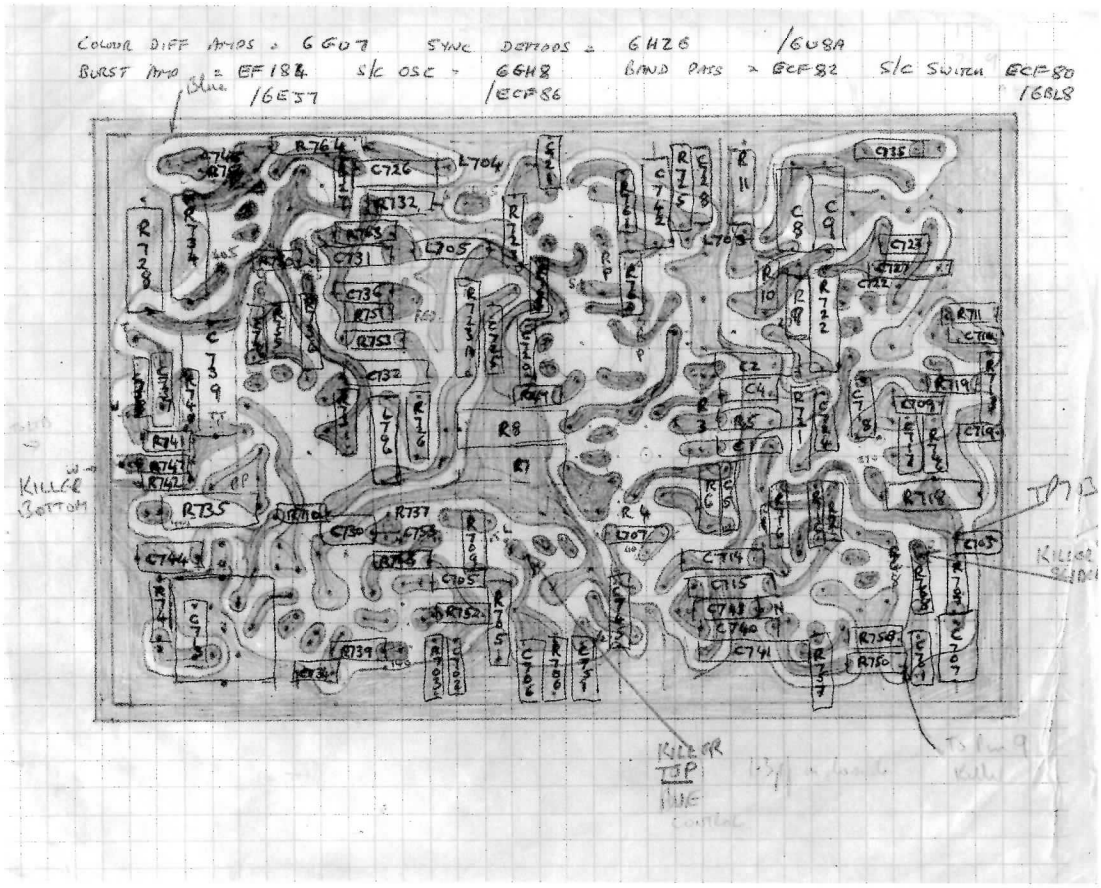
This time cutting out valve base holes was done with a punch, and apertures for printed circuit panels with a jig saw fitted with a very fine blade. Although this saved some time, the drilling cutting, and bending of the chassis still took many hours of part time work and occupied some 2 months in total.

Concurrent with chassis construction as a little light relief, was the drawing of the printed circuit for the PAL decoder. This was done by physically placing components on a full size piece of cardboard, cut to the anticipated size of the finished panel. Since the circuit was almost identical to that used in the earlier receiver, the area required was similar, but the shape was made less of a rectangle and more of a square to fit better on the new chassis layout. Tracks were drawn to interconnect the components, although some trial and error was necessary to optimise the layout and use as few wire bridging links as possible.









Above: Layout of the decoder

Once everything had been placed, a check was made to see that there were no wrong tracks and then the actual track plan was traced onto a transparent film and painted. This negative was sent to a prototype board manufacturer who produced two circuits from the drawing; a main and a spare. When returned the etched board had to be drilled to take the valve bases, coils, and all the Rs and Cs. This was also quite a long job and involved many hours at a pillar drill after centre popping all the holes. Luckily there were no mistakes except the omission of one capacitor which had to be wired on underneath. Provision was made for external test signals to be fed to the decoder for line up.

The IF strip board was available pre drilled, which helped to ensure it would work to specification and not go unstable at high amplification gains. It was possible to align and test this unit after assembly and before fitting to the chassis, which greatly eased the final testing of the complete receiver. In fact good BBC2 pictures and sound were obtained on a black and white monitor long before the bulk of the receiver was completed. A year into the project and things were progressing nicely.

With the chassis nearing completion and the circuit boards built, the time had come to construct a cabinet. The width was determined by the tube and loudspeaker, which would be mounted side by side, and the height by the tube and chassis which sat beneath. In addition I had decided to mount the convergence controls behind a door below the tube at the front, and the main controls (on/off+ volume, brightness and colour) at the bottom right of the cabinet. The 4 tuner push buttons were situated below the speaker. This worked out quite nicely and gave a cabinet 31ins wide, 25ins high and 14ins deep. A significant reduction in size on the previous set, but now with a much larger screen area. Rather than chipboard, blockboard was used as the construction material, and the completed cabinet was later veneered. Mounting of the "push through" tube consisted of placing it face down on the front panel in the correct position and drawing round the rim band with a pencil. If tubes were supplied as DIY fittings there would be a paper template and mounting screws in the box, but they are not, so it was done by trial and error. The "hole" was cut slightly undersize with a jigsaw and then opened out with a rasp until the tube would just push through. Fixing it in place was by means of 4 countersunk bolts from the front, with nuts and washers securing the lugs at the back. A plywood trim panel front was fitted to conceal the bolt heads, provide a door for the convergence controls, hide the speaker fret and give a finished appearance to the set. It also concealed a rubber seal round the tube edge. Once again the cabinet was reinforced at the corners with aluminium angle and short but stout legs screwed into plates on the bottom. The whole assembly was made as strong as possible and the tube mounted ready for testing.

When wiring of the chassis was virtually complete the power supply was tested on dummy loads to ensure it would work reliably. All supply lines were fused to save possible damage in the event of a short circuit. Next the colour decoder was connected to a source of colour bars and aligned. No real problems arose, though there was less chroma gain than on the original RCA board, probably due to hand wound coils and transformers having less "Q" than commercial units. The pre-aligned tuner and IF strip were connected to the decoder and luminance output and signals checked all the way through to the tube feeds. A few AOT values were fixed and it was time to fire up the line and field scanning stages ! Up to this stage all tests had been performed with the chassis on the bench. Now that it was time to run the tube, the chassis had to be stood on end at the back of the cabinet, and certain leads extended to reach. Both the scan coils and convergence board plugged into the main chassis via octal connectors, which could be extended with adaptor leads. Having fitted these, this was the crucial moment with untried circuitry and a lot

Teletext on flyback problem

When the set was first completed there were no visible flyback lines. Back in the 1960's about the only thing in the field blanking interval was the occasional vertical interval test signal on low number lines. The field timebase in this set had a fairly slow flyback time, and if blanking signals were removed from the luminance output stage, the lines during retrace were clearly visible at the top of the screen. However in the early 1970's the BBC and ITV were experimenting with transmitting teletext on lines in the vertical interval. These data signals were at almost peak white amplitudes, and of sufficient "strength" to overcome the existing blanking. This was not a problem while confined to low number lines, but as time went by, more and more lines of text were added, until almost the whole of the vertical interval carried data. The top third of the picture was now covered with diagonal lines of dots, and most annoying to watch. It was not practical to try and alter the frame scanning circuits, so the time had come to take action and improve the blanking so that it removed all these unwanted signals. Basically a pulse had to be inserted into the luminance output stage which extended from the last line of picture to the first active picture line of the next frame. This could be done by building a field rate multivibrator with a non symmetrical on-off time, and inserting the resulting pulses into the cathode of the luminance output valve to turn it off during scan retrace. The trigger for the multivibrator was taken from the field scan output, so it started as flyback began. The blanking time was determined by altering the R/C feedback coupling ratio, and set using an oscilloscope to last until the first line of picture. The extra circuitry occupied a small veroboard using 3 transistors, and was mounted alongside the luminance output stage. A diagram is included to show how the modification was incorporated in the existing circuit. An identical unit was also fitted to the older 21" set, which had a similar circuit, at the time of its restoration and renovation some years ago, because it too had the same problem. I am sure many readers will have seen something similar on older black and white and even some early colour sets.

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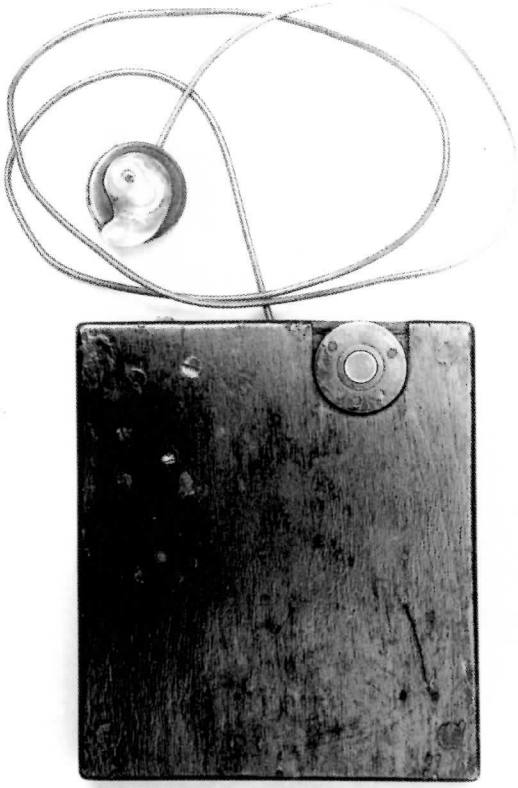
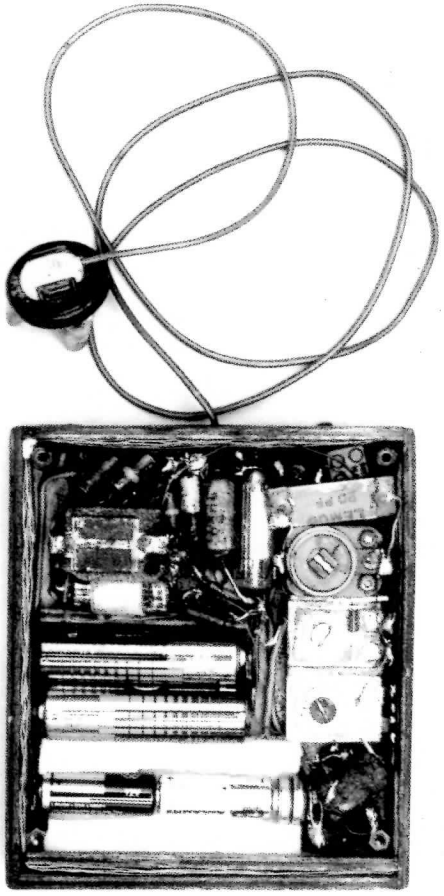
Some Schoolboy Projects – A Miniature Radio & A Multimeter

by J Patrick Wilson





Top left: Front of miniature radio showing recessed hearing aid volume control and earpiece. The LT on/off function and station switching were performed by opposite ends of a single lever, just visible at the top, which could be gathered by fingernail and moved to the required station.

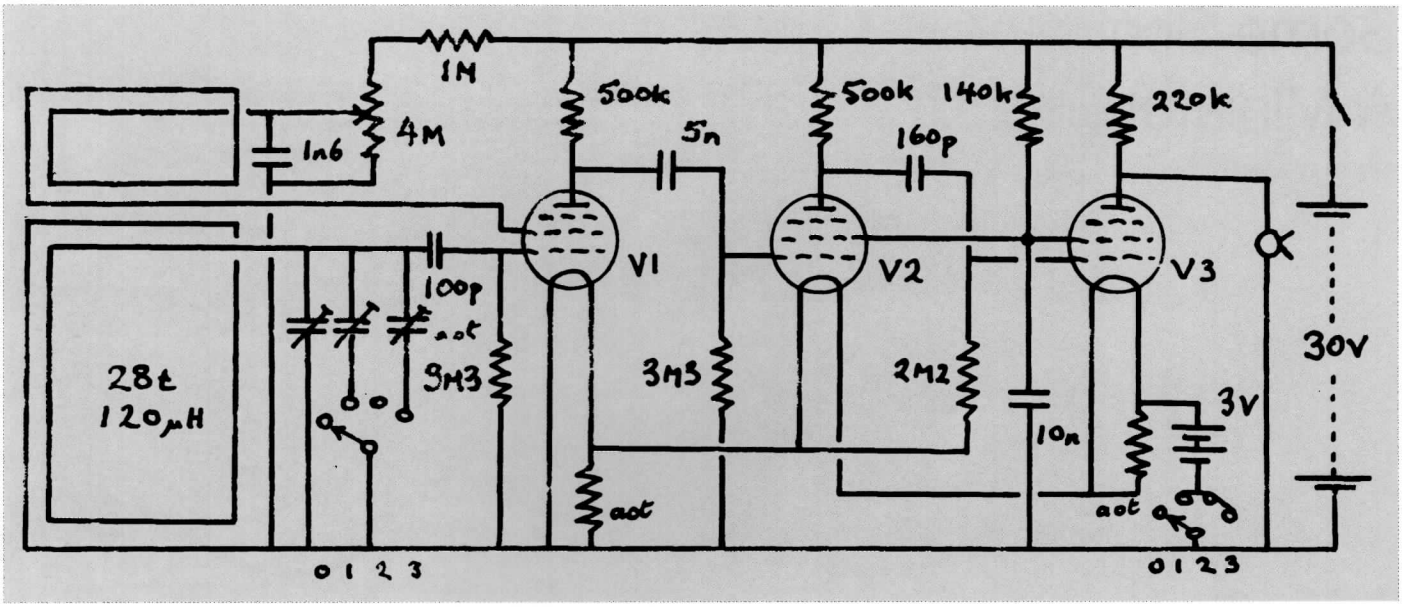
Top right: Inside miniature receiver. The 30V battery occupied the whole volume outlined by the white foam packing for the two 12V batteries and two button cells. To the right of this, parts of V1 are just visible behind the waxed capacitor, V2 is above the two AA cells, fixed by medical tape. V3 is vertical above the right hand end of the AAs. To the right of this is the ceramic trimmer for 'Light' mounted back-to-back with the other ceramic trimmer for 'Third'. Below this is the mica compression trimmer for 'Home' (the bottom mica trimmer is spare).

Growing up in the 1940-50s provided many opportunities for interesting electrical and electronic projects. The high street of every town had at least one shop devoted to ex-military equipment at prices that even an impecunious schoolboy could afford. Much of my knowledge and experience was gained simply by purchasing and dismantling items 'which looked interesting' such as gyro devices, aircraft instruments, an altimeter, and electronic devices of known or unknown function. Many items contained components that could be recycled - a few were even put to their intended use for a few months before this took place - in particular an MCR1 'Spy' set which impressed me by how much was packed into a small volume, and the circuit which, if I remember correctly, covered the medium and long waves in one band. I also liked the No.18 receiver, part of which will reappear later. Both these items were eventually condemned for requiring batteries that I could not afford to keep replacing.

My father awoke my interest in things electrical and mechanical and helped me in my early radio experiments. Until I left home to go to university we never had a commercially made radio in the house apart from when my grandfather came to live with us with his Bush radio, which always seemed to be tuned-in to cricket. Perhaps it was this early deprivation of manufactured sets which now makes them attractive? In recent years I have obtained a Bush P.B. 63, which I think is the same model that my grandfather had, as I liked the rotating light for logging SW stations.

My early efforts with crystal sets and one or two valves were soon frustrated by that new-fangled (re)introduction just after the war - 'television' - why you might ask? - because we lived in Warner Rd, right under the aerial of 'Ally Pally'. (As an aside this was useful in my other passion - cycling - I never needed a map to find my way home!). The frustration caused by the frequent buzzing (fortunately TV was far from 24hrs in those days) was not helped by having a television engineer, working at that detestable place, living next door! My brother and I were rather amused one day when our cat knocked on his front door (in fact this was also how 'Tommy' had become our cat). Mr Redmond and his wife were working in their garden, and in those days it would have been unthinkable to answer the door in gardening clothes! So one of them got changed to greet our cat sitting there. Many years later I met Sir James & Lady Redmond at an IEE Dinner but, hardly surprisingly, they did not recollect that trivial incident of over 50 years earlier.

My father and I constructed several superhets, including one behemoth with a huge mains energised speaker. I thought I might be able to improve this by stiffening its cone by sticking layers of newspaper over it. I cannot recollect whether this actually was an improvement - it certainly wasn't a disaster and started my interest in acoustics. About this time we moved to Yorkshire and I used to drool over the beautiful Wharfedale loudspeakers with their cloth surrounds in a shop in Bradford. Some years later I had saved up enough to buy one (by this time with a roll surround). This was a disaster - it sounded awful - I tried a variety of cabinet designs - recommended, or otherwise, but to no avail - eventually I tried the newspaper treatment again, but it didn't work this



Circuit diagram of miniature radio. V1 functions as detector, reaction and screen controlled AF amplifier. Switch position 0-off, 1-Home, 2-Third (the hole for the ceramic trimmer is on the front and has to be adjusted first as it was always in circuit), 3-Light.

time. Later when I had access to B&K measuring equipment I could see that it had serious resonances in the critical 2-4kHz region. Anyway I did learn that loudspeakers should be judged by ear and measurement, not by visual aesthetic appeal. I am not condemning all Wharfedale speakers - I have heard good ones, and Gilbert Briggs was, I believe the first to give large public demonstrations of live versus recorded sound.

Before my loudspeaker purchase, however, the DTN Williamson amplifier design had come out and was obviously an essential item to occupy the ground floor of the aforementioned behemoth. A minister's salary did not stretch to all the specified new components, so we obtained a relatively cheap version of the output transformer made I think by the Leeds Radio Supply Co., and improvised or recycled everything else. Originally the output valves were from an 1154 transmitter with about 600V HT, but father did get round to substituting proper KT66s after I left home. The earlier triodes in the circuit, however, remained 4V four-pin jobs throughout. It worked well in all its manifestations. I still have the O/P transformer if anyone is interested - rather dirty with bat or bird droppings from the loft, but it still comfortably exceeds the designer's specifications for primary and leakage inductance.

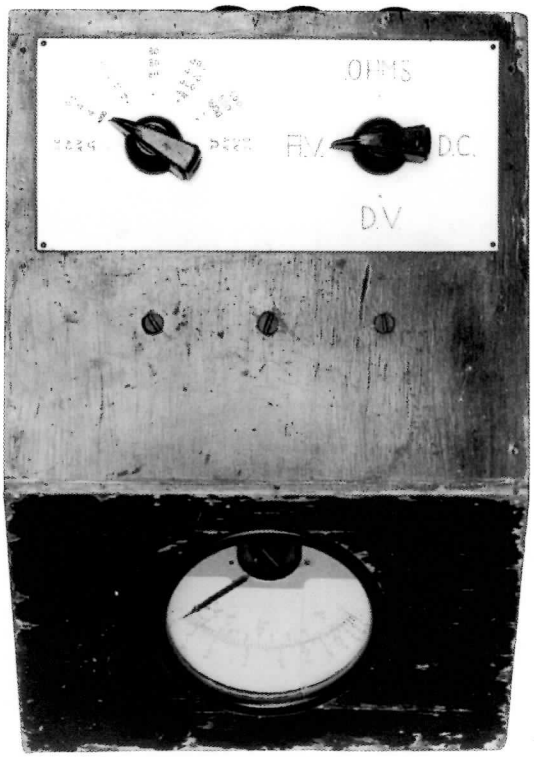
The first Walkman Radio? (or perhaps more accurately - the Cycleman!)

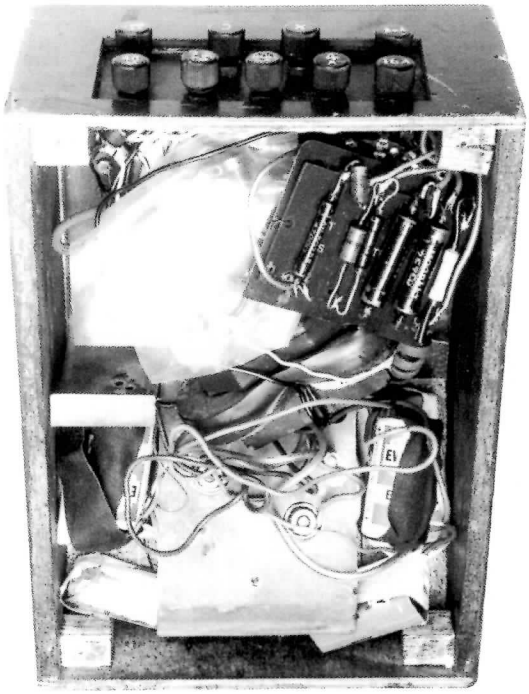
One of the core items of these ramblings is a miniature valve radio, which in order to invite challenges, I will claim was the smallest radio in the world at the time (1952) before the era of the transistor. It was inspired by a particularly boring school speech day - I determined that next year I would have alternative entertainment. I measured my inside jacket pocket and settled on a size of 11cm high by 9.5cm wide, and 2cm thick to accommodate the batteries (in fact smallness was not the end in itself - if I had been an American it would have been designed for a shirt pocket!). The case was made from plywood in order to be able to screw on some of the components, corners were well rounded, and it was finished in black paint (the only conceivable colour at the time!). I always intended to rub it down and give it a second coat but never got round to it.

As I'd not heard of ferrite aerials then, it had to be a frame aerial within the perimeter of the box. This I made using my beloved Litzendraht wire (it gains it's capital letter as a German noun meaning [individually-insulated] stranded wire - not an invention of Herr Litz!). This reduces the skin-effect at RF and increases the Q-factor of the coil - I once made a short-wave coil using 7-strands of Litz - a nightmare to ensure that every strand was soldered at both ends. As I could find no sufficiently compact variable capacitor, it had to be preset tuning which also added to the convenience. As sub-miniature multi-switches were not readily available either, I decided on a single stage of tuning using a home made switch and fixed reaction to sharpen the tuning. Thus there were two controls - an unindexed four-position switch for LT off, Home, Third and Light Programmes, and a volume control combined with an on/off HT switch .

The volume control, three valves, HT battery and crystal earpiece were surplus from the hearing aid industry. It had to be inconspicuous to avoid detection, just as hearing aids have always aimed for invisibility. It is interesting that the 'Walkman' had to be seen as a fashion item worn by celebrities before it took off commercially. Unfortunately I am not certain of the valve types and don't want to risk breaking their delicate leads to see whether identification is still visible. It is possible that V1 was DF66, V2-DF70 and V3-DL66. I have an unused Raytheon CK505AX which looks somewhat similar to V1, but is longer. I know that V1 required 0.625V at 15mA, V2 0.625V at 25mA and V3, 1.25V at 15mA. Series connection of the filaments was chosen to provide grid bias and increase battery life. It was not necessary to use special miniature resistors and capacitors but I did remove some bakelite casings from some capacitors. Most were mica except the final paper screen decoupling capacitor. Experiment showed that three valves were necessary to give the required volume and sensitivity. The RC coupled AF circuits were built for minimum current requirements rather than maximum gain. I have always been obsessional about battery consumption, feeling that electrical and electronic manufacturers were often in league with battery manufacturers, and devices can rapidly consume more than their initial cost in batteries! So my radio ended up consuming 0.17mA of HT at 30V and 25mA LT at 3v, giving a potential battery life of about 500h and 40h, respectively (if the batteries were about 100mAh and 1Ah).

The fixed reaction was determined by experiment - I wound more turns than necessary, and then removed them until it no longer oscillated on any setting. I devised what I believe was a novel volume/reaction control by using the screened grid of the first valve, which proved extremely satisfactory. Revisiting the circuit after 52 years, I was puzzled by the 160pF





Right: Photo of meter from top showing range and function switches. The zero presets for x100, x1 & ~100 ohms are below.

Far right: The terminals can be seen at the back, the polythene insulation has been removed to reveal the DV swamps, part of the rectangular ferrite core of the current transformer can be seen wrapped by four turns of enamelled wire for the 4A AC range. The two HP2 batteries are hidden behind the two SP11s and two 15V batteries replace the 30V battery. The meter, switches and presets are mounted on a No.18 set front panel. Surprisingly the crammed untidy layout has never given any trouble in over 50 years.

coupling capacitor to the output stage, which would give high-pass filtering at 400Hz. Shorting it with a larger capacitor soon revealed the reason - LF instability. In fact the tonal quality sounds quite reasonable for a crystal earpiece, which being capacitive, does not need a coupling capacitor at this voltage.

Adequate volume and selectivity were obtained in the Leeds and Bradford area. I remember taking it on cycle rides in the Yorkshire Dales and finding places where reception was poor. The last recollection I have of using it was when I cycled to Oldham in another house move in Sept. 1954 where of course reception was excellent over the Pennines near Holme Moss. In fact I normally go cycling to enjoy the countryside and the last thing I want to do is listen to the radio, but that particular road is boring! This last date is interesting in retrospect because it was just one month before the world's first transistor radio, the Regency TR1, came out (and which was considerably larger). And yes, I did indeed use it for the intended speech day without detection.

I have long been curious to try it out again but the original DH523 30V battery was obsolete. I have recently come across some small, inexpensive 12V batteries, designed for alarms, which in combination with two button cells from 'The Pound Shop's pack of 40 assorted alkaline cells for £1, gave 27V. Unfortunately, the Home, Third and Light Programmes (330m, 194m, and 247m respectively, 1, 2 & 3 on the circuit diagram) have long since disappeared. However, I found I was able to retune to Radio Stoke, Signal Radio & Virgin Radio with results much as I remember them. The volume was not up to modern standards, as one might expect from only 250mW, but was clear and intelligible.

My next radio project was as a student adapting a VHF FM pulse-counting circuit given in Wireless World. Although low-distortion, it was subject to spurious whistles and burbles which were only just audible on mono but became intolerable when I later tried adding a stereo decoder. This was used for a year in the States with a Mullard 5-10 amplifier and a Stentorian loudspeaker. I then 'cheated' and bought a Heathkit tuner. Unfortunately this produced an unacceptable level of hiss on stereo, so was soon replaced by a Trio which gives satisfactory service to this day.

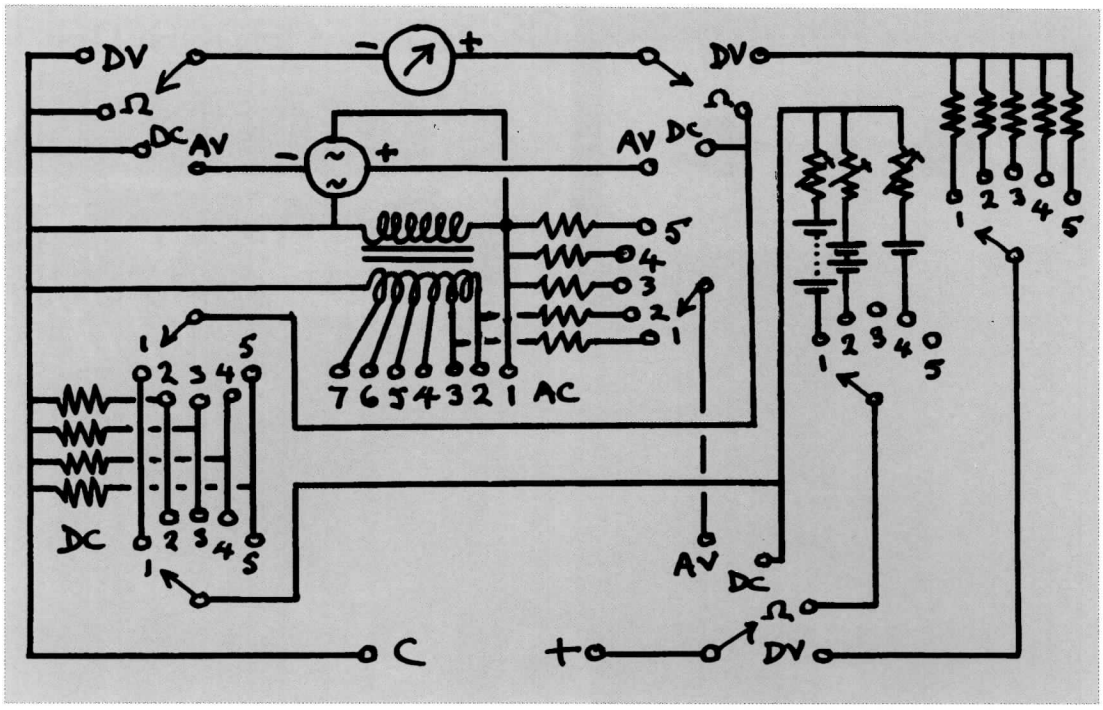
Meter Ranges (nominal/revised fsd (meter resistance including movement)

	DC	DV	AC	AV	Ohms
1	0.8/1mA (119Ω)	4/5V (5kΩ)	0.888/1.11mA	4/5V (100Ω)	x100
2	8/10mA (12Ω)	16/20V (20kΩ)	8/10mA	16/20V (2kΩ)	x1
3	80/100mA (1.2Ω)	80/100V (100kΩ)	40/50mA	80/100V (90kΩ)	-
4	400/500mA (0.12Ω)	400/500V (0.5MΩ)	160/200mA	400/500V (450kΩ)	÷100
5	1600mA/2A (12mΩ)	800V/1kV (1MΩ)	800mA/1A	1600/2kV (1.8MΩ)	-
6	-	4/5A	-	-	
7	-	-	16/20A	-	-

A Multimeter

My other main schoolboy project was a multimeter. I had always been impressed by the school AVO (probably a Model 7) and was allowed by the science teacher to borrow it from time to time. On one occasion this was to repair the gym master's radio at his home - I never actively sought repair work - but I had been recommended by the physics master (probably to the former's disgust). Anyway all went well, I received handsome remuneration, and was never again picked on for my lack of sporting prowess. I realised at this stage that I had to have a multimeter of my own, but of course an AVO was quite out of my price bracket, and I was unimpressed by the cheapo makes that I might have afforded. In fact I soon found that even a nice surplus 1mA movement was rather pricey - surplus shops seemed to know which items were more desirable!

At this point an idea occurred to me - instrument makers are careful in their specifications, e.g., the 1% accuracy of an AVO is 1% of the fsd, not the actual reading. This means that for a scale of 100 divisions, the accuracy is plus or minus one division, so that at '10' this would represent 10% (this limitation makes sense if the movement becomes 'sticky'). It rather offended my democratic principles, however, that



Circuit diagram of multimeter in final form (originally there was no current transformer and single pole switching for DC).

voltages or currents just above fsd were not going to be measured accurately on the next range. The answer seemed to be that a nonlinear movement could give a constant percentage accuracy over the working part of the scale. Furthermore, non-linear meters were cheap (i.e., perhaps 1/6d instead of 10/6d) because they were scaled for peculiar purposes.

I extended the tip of the pointer with an aluminium foil 'knife edge', rebalanced the movement for all orientations, and replaced the scale and hand calibrated it using the school AVO. I angled the front of the instrument because this is easier to read than horizontal. It was positioned with the pointer downwards to place the most open part of the scale at 25-35% of fsd (ideally it should have been at 20-25% for 5x and 4x range ratios). The nonlinearity originated from a slice cut off the cylindrical pole piece.

I inscribed the scale numbers in green, red or black according to whether the fsd was a decade multiple of 4, 8 or 16, colouring the switch markings correspondingly. I have since used commercial instruments where it has been quite difficult to work out what the scale markings actually represent! One could write a book on choice of ranges. The 1, 2, 5 sequence for all decades would give good coverage, can be read easily with a single set of scale markings and three sets of numbers, but would require many switch positions (e.g., 17 ranges for 50mA to 10A). All meters seem to be products of what is convenient to provide and what is most likely to be needed by the user, sometimes extended by a ÷ 2 button which doubles the deflection on all current and voltage ranges. My own mostly used alternate values from the 1, 2, 5 sequence (i.e., 1, 5, 20, etc., see table). I think the ideal arrangement might be decade switching for volts and amps with a ÷ 3 switch and separate scales for 100 and 30, but of course digital meters have now taken over. I think AVO can claim the most perverse scale of all - I have a model 40 version where the ohms ranges say 'Use at K=2' where you have to multiply every reading by 2 even though there are no K=1 ranges!

In spite of the above innovations, however, there were things I did not understand about accurate measurement. Firstly, I used old solid carbon resistors below the value required, which I then filed to give the right reading using the appropriate AVO range. What I later learned, however, was that these are not stable with temperature or age. Secondly, on current ranges I realised that the universal-shunt switching (where the shunts form a chain with the movement and at a chosen tapping the lower values form the 'shunt' and the remainder, a 'swamp' with the movement), as used in many commercial multimeters, wasted voltage drop*, so opted for simple shunt switching - not realising that on the high current ranges, switch contact resistance could cause appreciable error and variability. Thirdly, that the high temperature coefficient of the copper meter coil (~4%/10°C) compared with the negligible coefficient of resistance wire would vary the shunt ratio. I did realise that the movement becomes unshunted between ranges (unless a make before break switch is used) but was prepared to switch off whilst changing range. For the ohms ranges I used two U2 (later HP2) cells in parallel on the 400mA range, two U10 (later SP11) cells in series on the 8mA range, and a DH523 30V hearing aid battery on the 0.8mA range to cover from 0.1 ohms to 2M ohms, with batteries soldered in. Zero ohms were adjusted by simple series rheostats, which unlike the AVO circuit, do not compensate fully for changes of battery voltage.

Although the primary aim was accuracy and function, I also wanted the outside to look neat and workmanlike. As originally finished and cellulose sprayed in dark metallic grey, the corners of the wooden case (17cm wide, 25cm long, 9.5cm + knobs high) were perfect and joints were invisible and the scale and range markings as neat as I could do by hand. For the inside, however, it was a case of out-of-sight, out-of-mind, although I must say that I think the same philosophy has been applied by some radio manufacturers over the years. Instrument makers, on the whole, seem to have had more pride for the appearance of the insides. As an example of the crudity of my meter, I recycled the front panel of my No 18 receiver as the chassis, very roughly hacked and bent to shape. The swamp resistor panels simply dangled on wiring and were prevented from spurious contact by wrapping in plastic.

Later as a physics student I came to terms with current transformers and incorporated one constructed on a ferrite core using a pair of old intervalve transformer windings for the secondary, and carefully counted turns for the primaries. In order to

*this was not necessarily a major factor: if the most sensitive DC range is 10x the basic movement fsd, the voltage drop is increased by only about 11%. In the AVO Model 8 III, however, the 10A range drops 0.5V at fsd whereas only about 90mV appears across the movement (benefitting temperature stability of course).

avoid a complete rebuild, I simply brought the primaries out to separate terminals on the back with the switches set on any AV range. I also used the 8mA and 40mA AC ranges for the 16V & 4V AV ranges, respectively, so that scale linearity would not be compromised, as in the AVO. At this stage I also replaced the solid carbon resistors with high stability ones (any small adjustments to these were made with ordinary resistors in series or parallel without compromising overall stability). Switching for the direct current ranges was changed to two-pole, putting the switch contact resistance outside the shunt and allowing range changing on load (but still not addressing temperature stability). This instrument has served me faithfully for over 50 years and has only been relegated to the cupboard relatively recently since I started collecting measuring instruments.

Some years ago I found, as I have with most moving coil meters, that the sensitivity had dropped beyond the range of the magnetic shunt. I considered remagnetising it using thick wire and a car battery but have been put off by tales of boiling magnets in oil or beating them with birch twigs, or whatever it is that manufacturers do to 'age' magnets. Instead I recalibrated the dial, extending it so that it ran from 0-1mA rather than the original 0-0.8mA (Thus the calibrations extend beyond the nominal ranges). I also lost my coloured range indications at this stage. A recent test of the basic movement was within -1.5 to +0% from 20% of fsd upwards, the DV swamp resistors were within ±0.5% and AV within 0 to +2% and AC ranges within ±1%. I never bothered recalibrating the DC ranges in view of likely temperature errors and these are now -4, +9, +6 and -2% for the 8, 80, 400 and 1600mA ranges, respectively (no democracy for amps !). I had considered using copper shunts but these would need to be large to avoid heating in use, which could have caused even greater errors than those arising from changes in ambient temperature.

My interest in electronics has continued throughout my working life and I have always enjoyed the respite of devising a circuit for a particular purpose. Most have been conventional, but a few have been published: A high-speed analogue multiplier (Electronic Eng **39**, 11-14 (1967)); High-quality electrostatic headphones (Wireless World **74**, 440-443 (1968)); A sub-miniature capacitive [vibration] probe (J Sound Vib **30**, 483-493 (1973)); A comb-filtered noise generator (IEEE Trans Biomed Eng BME-**26**, 43-47 (with Narins, Evans & Pick, 1979)); Audio induction technology for the deaf (Electronics World+Wireless World (Sept 1993, 723-724)); I also devised a method for obtaining a 90°±2° phase shift over any frequency range and built one covering 0.1Hz to 100kHz but cannot recollect now how I did it! One of these covering the audio range is still in use for pseudo-quadraphony.

'An early 25" Hybrid Colour receiver' continued from page 32

of power to hand. Having checked the wiring for the Nth time a meter was inserted in the cathode of the line output stage. There was an inductor to be adjusted for minimum current, and in no circumstances should the value exceed 240 milliamps. Time to switch on. I had provided a toggle switch in the HT line so the heaters could warm up before applying full HT. With bated breath the switch was made and the meter read 220 milliamps, followed by the crackle of EHT from the tube. A quick look at the screen and a fuzzy picture was visible, very impure and twisted, but there nevertheless. First I adjusted the inductor until 205 milliamps were registered, then I set the focus control to give a sharp raster, twisted the scan coils to straighten the picture and set the convergence magnets to align the three beams in the centre. It was not looking too bad. I put up a white field on the test generator and pulled the scan coils back to give best purity, which was poor. Then I remembered I had not yet installed any auto-degaussing for the tube; it was magnetised. So I switched off the set and waved my large de-gaussing coil around the tube, withdrawing it slowly until switch off. Next the set was re-powered and surprise, surprise, the picture was almost white. Things were looking very promising; definitely time to put up colour bars and see what happened. Ah, I almost forgot to grey scale track the tube first. So kill the colour circuits and align the screens for cut off. Next brightness is set for the blacks, and then the drives to the cathodes to give a good grey scale. Still a lot of geometry errors round the edges, but let's look at colour bars. Yes they look about right; maybe an adjustment here or there, but nothing serious. This means time to check convergence and pincushion correction. Put up the grid pattern; ugh not very pretty, still as yet no adjustments other than centre convergence had been made, so there was a lot to do before everything was optimised. A quick run through every control made things a lot better and indicated there was no real fault, just patient set up required. Inside an hour I had proved the set was working, so now it was time go through each set-up stage, in order, setting everything for optimum.

One problem was setting the EHT for 25kV. I made a probe using plastic tubing and high stab. resistors, but had no means of calibration. Then an idea came to me. If I took the meter and probe to work and observed the reading on a colour monitor there, then provided I set the EHT to a similar reading, it should be about right. This I did, and some years later when using a calibrated probe I found I had only been about 500 volts out.

To spare readers the full time–consuming routine, I will just say that eventually all was working as it should, and quite good pictures off BBC2 were obtained in black and white, which ironically is one of the most severe tests of a colour set. The time had come to tidy up and put the chassis in the cabinet. When all was finished (another 2 weeks or so) I ironed veneer onto the blockboard and fitted a well ventilated back.

The project had consumed about 18 months and had involved building 3 complete printed circuit boards, lots of tag board type wiring, a huge amount of metalwork and woodwork, and a veritable spaghetti of interconnection wiring. The large and expensive power supply however never faltered, and is still working to this day with all its original components, thus justifying my design decisions. Like the earlier set, this one has proved very reliable. A few years ago I fitted a new tube because I was offered a brand new one free, but in many ways I wish I had retained the original one, as it was still giving good pictures. I hope after my death the sets find a good home, because they represent a unique period in television development. To the best of my knowledge they are probably the only colour sets still working in this country with all valve PAL decoders. And before anybody asks; I never built another TV after this one. This represented the summit of my electronic equipment construction phase.

Bootfair Bargains

by Brian Slade

Sunday morning was a real scorcher and the three hundred stall boot fair was crowded with holidaymakers. Walking slowly along the rows I suddenly spotted between a stall's legs the familiar shape of a bakelite wireless with the G. Marconi logo emblazoned across the top. Whilst trying hard not to look excited or even remotely interested I casually asked the stallholder how much he was asking for the old radio.

"Eight pounds" he replied.

I had a closer look, it was surprisingly clean and complete, all the valves were intact too.

"Does it work" I enquired.

"I've no idea" replied the stallholder.

"Oh well, I'll take a chance" I replied.

As I handed over the eight pounds I joked that it was a pity that he couldn't give me a working guarantee with it.

"I'll give you a written guarantee that it's a radio" he grinned.

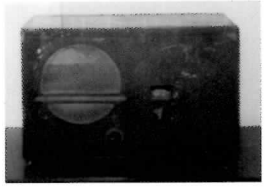
Upon getting the set back home and into my 'Radio Shack', I was suprised and puzzled that there was no model number on it, not even on the cardboard back, yet, stuck on the inside of the cabinet was a diagram showing the positions of the valves!

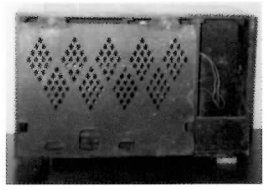
The mains lead felt very brittle and I suspected it may be of the dreaded line cord variety. As it happened it wasn't, it was simply stiff with age, this set had a mains transformer – a quality job! The valve line up was X61M, KTW61M, DH63M, KT61, U10, LMS wave. Upon checking the set with a multimeter I discovered the mains lead was open circuit, further tests revealed a wire detached from the loudspeaker and a burnt out resistor in the output valve circuit. Otherwise everything was ok, even the smoothing capacitors which tend to break down with age.

One annoying discovery, however was that the drive cord was broken. I put my hands inside and manually turned the tuning capacitor vanes to see if the set would work or whether I'd missed something else?

Top left: Brian Slade's Bakelite Marconi wireless, model number and date unknown.

Above: Rear view of Marconi set on test-bench.

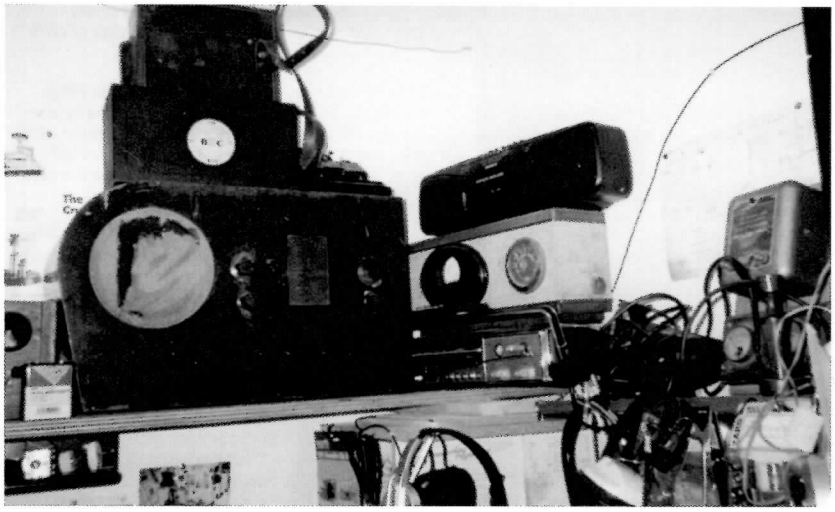




Above: Front and rear views of HMV model 148

Above: Front and rear views of Murphy model B45

Left: A view inside Brian Slade's 'Radio Shack'



Above: Another view inside Brian Slade's 'Radio Shack'

I wasn't about to plug the set into the mains just yet, that would be asking for trouble. I replaced the mains lead and wired a 40 watt lightbulb in series with the set and the mains supply in order to give some protection; my radio shack has mains cutout for live testing purposes. With the mains supply off I plugged the set in, switched the set on, then turned on the power. There were no pops, bangs, flashes or funny smells, just a quiet hum and reception static. Reaching inside the cabinet I turned the tuning capacitor vanes and bingo! A quality found only on valve sets: deep, booming resonant (live) orchestral music filled the air. The Marconi was a goer once more. I wonder what model it is? Well worth £8.

On a similar hot morning to the one where I found the Marconi I was back at the boot fair. My wife Dorothea nudges me, pointing out some familiar shapes beside a pile of old clothing on the ground next to a stall. It was not one, but two wooden-cased vintage sets.

Kneeling beside them I asked the stallholder how much he was asking for the two sets.

"Ten pounds for that one and fifteen for the other" he replied.

Switching into my 'disinterested' mode
I stood up moved away from the stall, then hesitated mid-stride. In a stage-whisper to my wife I said "They are terribly dirty, the speaker cloths will need replacing, the cabinets will have to be repolished and no doubt some electrical components will have to be replaced" all within earshot of the stallholder.

"Are you interested in them?" He asked.

"Yes" I replied, "but not at that price, what's the very lowest price you will take for the two?"

"How about ten pounds"

"OK" I replied "I'll take a chance on them, if the worst comes to the worst I can always strip them down for spares."

What I'd purchased were two 1930's HT, GB battery and accumulator powered wirelesses; a Murphy B45 from 1938 and a HMV Model 148. Both receivers were tatty, but component–complete and all valves were present and correct. Well worth my while restoring both of them.

At the very same bootfair I also purchased more than 500 1930s 'Wireless World' magazines for £5; a wonderful nostalgia trip down memory lane and a great source of information for all things vintage wireless related.

'ON MY AERIAL' (By Radio Rex)

by John Rose

The 1920s must have been an exciting time for those hobbyists who took up the Wireless Craze,and there was plenty of helpful literature and advice for them to digest. The Wireless correspondent for the 'Southern Times' called himself Radio Rex. Usually sensible and reliable, occasionally he came up with what we now would classify as real howlers.

This technical explanation is exactly as written; I am not sure if he meant to use 'crystal' twice in the second sentence.

SOUTHERN TIMES FEBRUARY 1927
"Listeners-in who keep crystal and tube receiving sets in the same house sometimes complain that they have trouble in getting the crystal set to work properly. The reason is that the crystal set absorbs the energy before the crystal obtains enough to operate it. The same effect has been noticed when two tube sets operate close to each other. The more powerful set acts as a sort of shield for the receiver with the smallest number of tubes."

In the 1920s sexism wasn't a political issue. Man and woman knew their place - it was down to mum to keep the home homely, so that dad could relax in it after work. No questions, no comments, no dreams. Again - just as written.

SOUTHERN TIMES APRIL 1927
'SPRING CLEANING FOR SET'
Ought the wireless set to be spring-cleaned with the rest of the family effects? This enquiry has reached me from several sources. I reply "It depends on the cleaner." I have heard of sets taken down and re-assembled during this upheaval by well-meaning women; the last state of these sets reminded me of my father's pet model ship, re-rigged with the best intentions by myself and a fellow criminal aged nine. (And you cannot deal with the lady of the house and her accomplices as my father dealt with us.) There was once a housewife who "put back all the wires", connecting the LT terminals to the HT battery. but we will not go on with the story: it is too tragic.

"Don't invite trouble: disconnect the set yourself and lock it up - in the safe if you have one. And when the womenkind have done their worst, start in yourself. Dust should be removed from between condenser plates either by blowing or with a feather or pipe-cleaner. Go over all connections, particularly those of flex. Brighten contacts of switches and keys, applying a knifeblade or very fine file (don't let the metallic dust get into the set.) Then take down the aerial and clean the winter's deposit of soot off the insulators."

A brief resumé of British (and several overseas) Finished goods & component manufacturers (as at January 2004) part 2 by Dave Hazell

B&K. Brand of B&K Manufacturing Co, 3726 N, Southport, Chicago, Illinois (in 1955). By 1965, the company was a division of Dynascan Corporation and located at 1801 West Belle Plaine Avenue, Chicago 13, Illinois. Maker of the famous B&K CRT rejuvenators. Still going. Distributed in UK by Radio Supplies (Components) Ltd, PO Box 27, 39 Whitby Street, Hartlepool, Cleveland,TS24 7BR, tel 0429 75750. In 1965, the newly appointed UK distributor was Canadian Instruments & Electronics Ltd, 35 Waverley Street, Nottingham.

B & R Relays Ltd, Temple Fields, Harlow, Essex (in 1970). Originally Besson & Robinson Ltd?. In 1961, a subsidiary of The Gas Purification & Chemical Co Ltd.

B & W Electronics, moved from Littlehampton to Meadow Road, Worthing, Sussex, in 1972. Loudspeaker manufacturers. Bowers & Wilkins. In 1985, B&W Loudspeakers Ltd, Elm Grove Lane, Steyning, West Sussex.

BBC - British Broadcasting Company. On 14th November 1922, the Marconi Company formally handed over radio station 2LO to the BBC. The company became a public corporation, with a royal charter, a couple of years later.

BC - Brand name of **BC Components**, created in November 1998, by the buyout of a large part of the passive components business of Philips. BC stands for Beyschlag and Centralab. Taken over by Vishay (of the USA) in December 2002.

BCC - British Communications Corporation Ltd, Gordon Avenue, Stanmore, Middx (in 1948 & 50). Established in 1946. Maker of loudspeakers. In the 1950s, they diversified into radio communications. In 1959, they were taken over by Radio & Television Trust Ltd (who also owned Airmec). By circa 1960, were at South Way, Exhibition Grounds, Wembley, Middx. In 1962, they relocated their admin, development and sales departments from High Wycombe to Neasden Lane, London, NW10. In 1965, they were still at Exhibition Grounds and a member of 'The Controls & Communications Group'.Taken over by Racal in 1969. In 1981, Racal-BCC, South Way, Wembley, Middx.

BG - see British General Manufacturing Co Ltd

BEC. The British Electrolytic Condenser Co Ltd, 52 Vicarage Lane, Ilford, Essex (the Plessey Company Head Office). A Plessey brand (in 1948). Maker of electrolytic capacitors.

BHC. A new company, formed circa 1986, from the electrolytic capacitor business of STC (which included Daly, Erie and Hunts). I don't know what 'BHC' stands for! They had plants in Mold, Wrexham and Weymouth. BHC was taken over by the long established American Aerovox company in the 1990s. They seem to have only one plant now - in Weymouth. BHC Aerovox, 20-21 Cumberland Drive, Granby Industrial Estate, Weymouth. The BHC Aerovox web site states that the Weymouth plant has been in operation since 1968 (when it was Daly). BHC Aerovox Ltd, was bought from Aerovox Inc in 2002, by Evox-Rifa OY of Finland. BHC's parent company, Aerovox, was insolvent and was under US "Chapter 11" bankruptcy protection law. The company is now called BHC Components Ltd.

BICC. British Insulated Callender's Cables Ltd. Formed in 1945 by the merger of British Insulated Cables Ltd and Callender's Cable & Construction Co Ltd - two cable manufacturers. BICC manufactured a huge range of copper cables, including equipment, power, HV and coaxial types. BICC also marketed a domestic 'all wave' radio aerial in the 1940s. They also made capacitors. Later on, they diversified into fibre optics and construction - they owned Balfour Beatty. BICC also owned Vero Electronics Ltd and Burndy Connectors for some years. In the 1990s, BICC decided to concentrate on construction and they sold off all their cable operations (mainly to Corning and Belden - both of the USA). They renamed themselves Balfour Beatty plc. BICC designed and erected the original (1949) 750ft Sutton Coldfield BBC TV mast.

BMB (Sales) Ltd, Dept 66, Bescobel, High Street, Crawley, Sussex (in 1957). Manufacturer of 'BMB' brand sylii. A division of British Manufactured Bearings.

BPL - British Physical Laboratories, Houseboat Works, Radlett, Herts (in 1948). Maker of test equipment.

BSA Radio Ltd. A subsidiary of Brimingham Small Arms - gunsmiths and motorcycles, etc. Maker of radios in the early years.

BSR. Birmingham Sound Reproducers Ltd, of Claremont Works, Old Hill, Bilston, Staffs, was first incorporated as a private company in October 1932, to acquire from Dr Daniel McLean McDonald the electronic equipment manufacturing business founded by him at Blackheath, near Birmingham in 1932 (with start up capital of £300). Dr McLean McDonald already had an engineering degree when he qualified as a doctor in 1942 but he never practised medicine. BSR made electronic test and public address equipment, disc recording equipment, microphones, motors and turntables and pickups. By 1952, BSR's principal activity was the manufacture of record changers, gramophone units and pickups. In 1954, the directors were: Dr D Mclean Mcdonald (Chair, MD and founder), P Shephard, W Mcdonald & K Moseley. Perhaps that is why some of their products were later branded BSR-Mcdonald.

Later on, in the 1950's, they moved to Monarch Works, Powke Lane, Old Hill, Staffs. (same place, new name?). In 1957, BSR became a public company. The company name changed to BSR Ltd by 1962. In 1970, BSR Ltd, Monarch Works, Cradley Heath, Staffs. By 1955 they also had a factory at Lone Moor Road, Londonderry, Northern Ireland (leased from the Ministry of Commerce) and had expanded their Old Hill site to cater for increased 'Monarch' auto-changer demand. In 1970, discussions took place between Plessey and BSR, with a view to a take-over by Plessey, but it came to nothing. BSR were then famous for the manufacture of 'Monarch' (vinyl/shellac) record decks and cartridges. They also made a very popular open reel tape deck, the 'Monardeck' which was fitted to many tape recorders produced by UK names in the early 1960s (the TD2 and TD12). Tape and record decks seem to be the main (only) product by the 1960's. In the 1970's, BSR also made 8-track cartridge players and turntables under the 'BSR McDonald' brand. By 1976, BSR produced around 65% of all record decks in the world (240, 000 per week!) and exported most of its production - to the USA and also Japan. Also in the 1970's, BSR diversified into domestic appliances, with the purchase of Goblin, Tower, Judge and Swan (BSR Housewares). BSR Housewares Ltd, Albion Works, Albion Street, Birmingham, B1 (in 1978). Originally the Swan (Bulpitt) factory. In 1982, at Midland House, New Road, Halesowen, West Midlands.

They withdrew from turntable manufacture in the early 1980's and diversified into switch-mode power supply manufacture, under the ASTEC brand. The housewares business was sold in the early 1980s. BSR then changed its name to Astec (BSR) plc. Emerson Electric of the USA subsequently bought Astec in the late 1990's.

BT-H. British Thomson-Houston Co. Based in Rugby, Warks. In 1946, the BT-H London office was at Crown House, Aldwych, London, WC2.

Initially established in the UK as The American Electric Co Ltd in 1886, then Thomson-Houston Electric Co and in 1894, British Thomson Houston Ltd. In 1896, The British Thomson Houston Co Ltd - a subsidiary of General Electric USA. General Electric USA had to call their UK subsidiary this, due to the already existing General Electric Company in the UK. GE (USA) was created in 1892, when Thomson-Houston merged with Edison General Electric. BT-H took over Edison Swan in 1928, a year before it, along with Metropolitan-Vickers, came under the umbrella of a new holding company - Associated Electrical Industries (AEI).

Thomson-Houston Co Inc (of the USA) was set up by General Sam Houston and Elihu Thomson (Thomson was orignally from England).

There was also a French subsidiary of the American organisation, part of which is now known as Thales and another part which is now called Thomson (previously known as, over the years: Thomson-CSF, Thomson Houston Hotchkiss Brandt and Compagnie Francaise Thomson Houston).

Amongst many other products BT-H manufactured lamps (Mazda), radio components, radar (in Leicester), loudspeakers and complete radio sets (in the early days) and later on, germanium diodes. Other products included magnetos for cars and aircraft, power switchgear, torpedoes, jet engines and electric motors. The BT-H company continued largely independently until 1960, when it was fully integrated into AEI and all products were thereafter branded AEI.

BTS. British Television Supplies, Faraday House, London, WC2. In the 1930's, a maker/supplier of coils for radio sets.

BVC Ltd, Ermyn Way, Leatherhead, Surrey (in 1973). PA equipment. Successor company and same location to Magenta (BVC) Ltd, 725 Fulham Road, London, SW6 (in 1964) and 61 Parsons Green Lane, SW6 in 1967 - maker of 'Magenta' public address, background music and time recording equipment.

Bach-Simpson Ltd, 19 Nortoft Road, Chalfont St Peter, Bucks (in 1967). At 331 Uxbridge Road, Rickmansworth, Herts (in 1970). In 1975, at Trenant Estate, Wadebridge, Cornwall. Simpson test meters and meter movements.

Backer Electric Co Ltd, Fitzwilliam Road, Rothrham (in 1964). Electrical heating elements.

Baird Television Ltd, Lancelot Road, Wembley, Middx (in 1952-3). Maker of tape recorders and TV sets. In 1954, amalgamated with the Hartley group of companies and was then known as Hartley-Baird Ltd. Hartley group included Hartley Electromotives Ltd and Duratube & Wire Ltd. In 1955, Hartley Baird acquired Ambassador Radio & Television Ltd. R N Fitton remained as MD of Ambassador Radio & Television and became a director of the parent company. Hartley Baird was then taken over by Camp Bird Ltd - a mini conglomerate. Baird Television looks to have relocated to the Brighouse Works, according to the address shown on a Bair mid-50s service manual. The Baird TV making operation fizzled out by 1960, when Radio Rentals acquired the brand to use on sets of their own manufacture. The Radio Rentals 'Baird' sets were made by their subsidiary, Mains Radio Gramophones Ltd. An earlier company, Baird Television Ltd, set up by J L Baird, went into liquidation, ca 1940. It re-emerged as Cinema-Television Ltd (which was controlled by Mark Ostrer - owner of the Odeon cinema chain). The Odeon chain was bough by J Arthur Rank, circa 1945 (?) and Cinema-Television Ltd, came with Odeon cinemas. The company later chaned its name to Rank Cintel .

Baird Television Distributors Ltd, Empire House, 414 Chiswick High Road, London, W4 (in 1964). Distributors to the retail trade of Baird TV, radio & radiogram products. Owned by Radio Rentals Ltd.

Bakelite. A very famous moulding material, invented by Leo Baekeland in the US in 1907. He formed the Bakelite Company in 1926. In 1939, his company was acquired by Union Carbide (US). Bakelite was much used in the 40's and 50's by TV and radio manufacturers, to produce cheap cabinets (compared to wood). Bakelite was also used to make many other products outside the TV & Radio industry. In 1946 and 1966, Bakelite Ltd, 12-18 Grosvenor Gardens, London, SW1. In 1955, H V Potter was Chairman & G W Hodds was MD, of Bakelite Ltd. HV Potter had been with Bakelite and its predecessors for >40 years. With the availability of injection moulded thermoplastics from the 1950s, the use of Bakelite for radio cabinets declined. In 1963, Union Carbide merged its UK subsidiary Bakelite Ltd, with The Distillers Comppany's Xylenite, to form Bakelite Xylenite Ltd (BXL). BXL made a wide range of moulded materials, including laminate for printed circuit boards. I have seen boards overprinted with 'BXL'. In 1970, Distillers sold its share of BXL to Union Carbide, who later sold it to BP Chemicals in 1979. The name was then changed to BXL Plastics Ltd.

Baker (PW) & Sons (Sales) Ltd, 146 Windmill Road, Sunbury-on-Thames, Middx (in 1955). Maker of domestic appliances and heating controls.

Bakers. Bakers 'Selhurst' Radio, 75-77 Sussex Road, South Croydon, Surrey (in 1948). In 1958, at 24 Dingwall Road, Croydon, Surrey. Manufacturer of moving coil loudspeakers and amplifiers. In 1964 Baker Reproducers Ltd, 523 London Road, Thornton Heath, Surrey. In 1971, Baker Reproducers Ltd, Bensham Manor Road Passage, Thornton Heath, Surrey (same firm?).

Balcombe (A J) Ltd - see Alba.

Balun Ltd, Crawley Road, Horsham, Sussex. Tel. Horsham 3232/3 (in 1957). Maker of wideband transformers.

Bang & Olufsen UK ltd, Eastbrook Road, Gloucester (in 1979). Importer of Danish made audio test equipment and TV, radio & HiFi. UK subsidiary of A/S Bang & Olufsen Produktionsselskab, Struer, Denmark (in 1965). Company established in 1925. In 1967, one of the directors (and co-founder?) was Jens Bang.

Banner Electric Co Ltd, Burford House, Burford Street, Hoddesdon, Herts (in 1964). Transformers and rectifiers. Possibly the UK arm of a US company?

Banner Radio & Television Ltd, Langley Park, Slough, Bucks. A 'Sobell' brand.

Bardic Ltd, Bond Street, Northam, Southampton (in 1964). Handlamp manufacturers, including the multi-colour type used on the railways to despatch trains, etc. Later taken over by Chloride Group.

Baronette. Brand used in 1955 for a small table radio - made (?) by Trinity Electric Co Ltd, 30 Selhurst Road, London, SE25.

Barr & Stroud Ltd, Caxton Street, Anniesland, Glasgow (in 1970). Maker of electronic intsruments and equipment. They also once made binoculars. Later taken over by Pilkington - at least by 1979.

Bauch (FWO) Ltd, 49 Theobald Street, Boreham Wood, Herts (in 1969). UK distributors for various firms, including Sonneschein, EMT, Revox (from 1976). Also made uninterruptible power supplies. Went bust in the late 80's/early 90's.

Beam Echo Ltd, Witham, Essex (in 1957). Manufacturer of HiFi equipment. Used the 'Avantic' brand. They also made the amplifiers for the Bel Ami jukebox. By 1959, they were a member of the Thorn group and had relocated to Essex Works, Essex Place, Newhaven, Sussex (anything to do with the former Champion factory in Newhaven?).

Bearman (Philip H), 6 Potters Road, New Barnett, Herts (in 1983). Supplier of valves, etc.

Beck Electronics Ltd. Formed in 1986 as a management buyout from STC Components Division. Based in Great Yarmouth, the company manufactured ceramic capacitors and filters. Became a member of the Oxley Group in 1996.

Beckman Instruments - US semiconductor and hybrid circuit maker. In 1959, they formed a new subsidiary: Shockley Transistor Corporation. In 1964, Beckman Instruments Ltd, at Glenrothes, Fife, Scotland. In 1971, their UK office (factory) was at Queensway, Glenrothes, Fife. In 1965, the US HQ was at Fullerton, USA.

Bedco Ltd, Datum Metal Products Division, Colne Way Trading Estate, Watford By-Pass, Watford, Herts (in 1967). Instrument cases. Merged with Imhof in 1969, to form Imhof-Bedco Ltd.

Beethoven Electric Equipment Ltd., of Beethoven Works, Chase Road, North Acton, London, NW10 (in 1945 & 48) - radio manufacturer. Chapel Lane, Sands, High Wycombe (in 1950) - amplifiers. In 1952, 89 Reddish Lane, Gorton, Manchester 18 - maker of radiograms and TV. Connected with Raymond Electric Ltd?

Belcher (Radio Services) Ltd, 59 Windsor Road, Slough, Bucks (in 1954). TV aerial maker and installer. Possible manufacturer of Westminster brand radios? Westminster was certainly sold in Currys shops in the 1960's. Also operated a TV repairs network. In 1968, Belcher Electronic Services Ltd, Kings Mill, Loudwater, High Wycombe, Bucks. Taker over by Currys Ltd (1970s?) and later renamed Mastercare. Currys was itself taken over by Dixons (circa 1985). In 2002, Mastercare is still used for the Currys/Dixons service division.

Belclere - trade name of John Bell & Croyden, 117 High Street, Oxford (in 1954). In 1957, simply Belclere Transformers. In 1961, at 171 Cowley Road,Oxford. In 1965 & 78, Belclere & Co Ltd, 385-387 Cowley Road, Oxford. Transformer manufacturers.

Beldray - brand name used by Bradley & Co Ltd, Albion Works, Bilston, Staffs (in 1957). Maker of a swivel top TV trolley.

Bell & Howell A-V Ltd, Wembley, Middx (in 1973). The UK subsidiary of an American company. Distributors of video equipment. Later absorbed by JVC? In 1968, Bell & Howell Ltd, Lennox Road, Basingstoke, Hants - thick film microcircuit op-amps.

Belling & Co Ltd. Charles Reginald Belling was born at Bodmin, Cornwall in 1884. He served an apprenticeship in electrical engineering with Crompton & Co of Chelmsford. He subsequently joined the staff of Ediswan at Ponders End. In 1912 he started his own business in Lancaster Road, Enfield, manufacturing electric heaters. In 1913 he acquired additional factory space at Derby Road, Edmonton. The range of products widened to include electric water heaters (1913) electric cookers (1919) and immersion heaters (1920). A new purpose-built factory was opened at 'Bridge Works', Southbury Road in 1924. The premises have since been progressively enlarged. A second factory was opened at Burnley, Lancashire in 1956. In 1958-64, at Bridge Works, Southbury Road, Enfield, Middx. Mr Belling died on 8th February 1965, aged 80. Belling & Co went bust in the 1980s. The brand is now owned by Glen Dimplex plc.

Belling & Lee. In 1922, C R Belling (see Belling & Co) formed a partnership with Edgar M Lee to manufacture mains powered radio sets. (B.B.C. radio broadcasting started in 1922). Maintenance problems caused the firm to temporarily abandon mains powered radio sets in 1924, production being switched to crystal sets. The original factory was at Queensway, Ponders End, moving to new premises on the Great Cambridge Road in 1932. The product range was widened to include fuses and fuse holders (1929) electrical gramophone pick-ups (1933) and radio aerials (1935). During World War II much of the production was switched to radar components and V.H.F. aerials for use on aircraft. The post war years saw a huge demand for television components. In 1961 an office block was built, followed by a big extension to the factory in 1964. Following the death of Mr Belling, the company sold 74% of its share capital to Ada (Halifax) Ltd, a sudsidiary of Philips Electronic & Associated Industries. Thus, the company became part of the Philips group in 1966. Mr Lee died in 1972.

Mr Lee retired as MD in 1970 but remained as Chairman for a further year. Since 1932, based at Great Cambridge Road, Enfield, Belling & Lee manufactured fuses, Band 1, 2, 3, 4 & 5 filters and splitters, connectors, valveholders, interference suppressors, thermal overload trips, aerials and Faraday Cages! Their famous TV aerial connector is still going strong - as the industry standard in Europe. In 1950, they acquired a factory on the Netherton Trading Estate, Liverpool, for the manufacture of TV aerials. In 1966, the division was formed into a separate company - Belling-Lee Aerials Ltd, Heysham Road, Nethereton, Bootle 10, Lancs.

Belling & Lee's aerial operations were sold to Antiference in the late 60s. In 1982, Belling-Lee became a CEI company (see CEI entry). Recently, the business appears to have been closed down. Some Belling Lee products continue to be made at the old Pye Electro Devices/Varelco/Newmarket site in Exning Road, Newmarket, Suffolk (now known as BLP Components Ltd- Belling Lee Pye) but their classic TV coaxial plug is no longer in production (only inferior alternatives!). BLP is a Roxboro Group company.

Bemex Instruments Ltd. In 1967, they made a TV pattern generator.

Bendix Corporation (USA). A very large and diverse group. In 1966, they made transistors. Taken over by Allied Corporation in 1981. Allied became Allied-Signal, then acquired by Honeywell.

Bendix. Washing machines and refrigerators. In 1958 & 60, Bendix Home Appliances Ltd, Albion Works, Kingsbury Road, Birmingham 24. Later became a Thorn brand, then Electrolux (Tricity-Bendix).

Benkson Ltd, 351 Oxford Street, London, W1 (in 1964). Importer of 'Benkson' branded transistor radios.

Bentley Acoustic Corporation Ltd, 38 Chalcot Road, London, NW1 (in 1957 & 66). Seller of valves - later with their own brand 'Bentley' on them.

Bepi - see Pye.

BERCO - see British Electric Resistance Co Ltd.

BEREC - see Ever Ready (GB).

Berg Electronics NV, Holland. In the US, Berg Electronics Inc, York Expressway, New Cumberland, Pennsylvania 17070 (in 1971). Maker of connectors.

Bernstein (Cyril) Ltd, Irk Mill, Middleton, Lancs (in 1952). TV & radio cabinet makers.

Berry's Electric Ltd, Touchbutton House, Newman Street, London, W1 (in 1946 & 58). Maker of Berry's 'Magicoal' fires, switchgear, light fittings, water heaters, etc. In 1964, Berry's Electric Magicoal Ltd, Touchbutton House, 85-86 Newman Street, London, W1 and 2nd Way, Exhibition Grounds, Wembley, Middx. In 2002, the brand is owned by Glen Dimplex Ltd.

Bescol Electric Ltd, Birmingham 8 (in 1958). Maker of electric kettles and convector heaters.

Best Products Ltd, Felix Works, Felixstowe, Suffolk (in 1958). Maker of electric kettles.

Beulah Electronics Ltd, 138 Lewisham Way, New Cross, London, SE14 (in 1961). At 126 Hamilton Road, West Norwood, London, SE27, in 1964 & 69. Maker of CCTV and test equipment. By 1966, a member of the DTV group.

Bexford Ltd, Manningtree, Essex (in 1967). An associate company of Ilford and Bakelite Xylonite. Manufacturer of photgraphic and reprographic film based materials.

Bib HiFi Accessories Ltd, PO Box 78, Hemel Hempstead, Herts (in 1974). In 1978, Kelsey House, Wood lane End, Hemel Hempstead. Bib HiFi care accessories. A subsidiary of Multicore Solders Ltd. The name Bib was used as early as 1955 to market a magnetic recording tape slicing block and the wire stripper & cutter hand tool.

Bill Switchgear Ltd, Aston Lane, Perry Barr, Birmingham 20. 'Bill' brand switchgear. By 2003, owned by Eaton Corporation of the USA.

Berco. The British Electrical Resistance Co. Ltd, Queensway, Ponders End, Middx (in 1948 & 65). A maker of power resistors, wirewound potentiometers, rheostats, 'Regavolt' variacs, etc. Established in 1927. In 1940, it formed a subsidiary, The British Power Transformer Co Ltd, to manufacture power transformers. In 1973, Berco Controls Ltd, Baird Road, Enfield, Middx. Taken over by Claude Lyons Ltd, in 1975.

Beswick. Kenneth E Beswick Ltd. of Alert Works, Frome and Warminster. K.E. Beswick started the company in Essex in 1924. It relocated to Frome in 1939, to escape WW2 bombing. Beswicks made cartridge fuses of all descriptions. The trade name was 'Alert' - seen on many older 1" cartridge fuses. Beswicks changed hands a couple of times from 1959, but in 1970, they became part of the Dubilier group. Around 1990, Beswicks was sold on to Cooper Industries (Texas, USA), who already owned Bussman fuses. At the time of writing (2001), Cooper-Bussman has announced that the Frome factory is to close.

Binatone - brand name for cheap radios, etc, used by J Parkar & Co Ltd, Parkar House, Beresford Avenue, Wembley, Middx (in 1974).

Bird. Sydney S Bird & Sons Ltd, of Cambridge Arterial Road, Enfield, Middx. (in 1948). Founded in 1920 by Sidney S Bird (who was 80 in 1965). In 1955, they relocated to Cyldon Works, Fleets Lane, Poole, Dorset. The 1964 'Trader' yearbook list them at: 3 Palace Mansions, Palace gardens, Enfield, Middx. Manufacturers of trimmer capacitors under the 'Cyldon' brand (later on, also TV and radio tuners). Bird also made 'Cyldon' spools for cine film. By (circa) 1970, they appear to have diversified into audio equipment and car radios, as 'Bird Audio'. In 1965, the parent company was Astaron-Bird Ltd., also of Poole. In 1967, Astaron-Bird made marine radar equipment. In 1967, it acquired the design, manufature and marketing rights to a range of professional television monitors previously handled by Television Instruments Ltd, of Boreham Wood, Herts (maker of). Now believed defunct.

In 1971, a company called Electronic Laboratories (Marine) Ltd, was at Cyldon Works, Fleets Lane, Poole... any connection, other than the same address? Similarly, Coastal Radio Ltd was also at Fleets lane, Poole, in 1967 (marine radiotelephones).

Birmingham Electronic Products Ltd, 1 Lodge Road, Birmingham, 18 (in 1960). Maker of the 'Norfield' tape recorder.

Black & Decker Inc. Power tool manufacturer. Established in 1910 by Alonzo Decker (Snr) and Duncan Black, in Baltimore, Maryland, USA.

Black Star Ltd, 9a Crown Street, St Ives, Cambs (in1981). Supplier of 'Sabtronics' T&M instruments. Later masde their own. Taken over by Thurlby Thandar, circa 2000.

Bliley Electric Co, Union Station Building, Erie, Pennsylvania (circa 1940s). Maker of quartz crystals.

Blue Spot - Blaupunkt in Germany. Blaupunkt werke, a subsidiary of Robert Bosch GmbH, Stuttgart, in 1958.

Bonella (D.H.) & Sons Ltd, West Hill, Hoddesdon, Herts (in 1965). Switch manufacturer and distributor (incl. Cherry of the USA).

Bond (V C) & Sons Ltd, Progress Road, Eastwood, Leigh-on-Sea, Essex (in 1964). Cabinet manufacturers.

Bosch Ltd, Radio & Domestic Appliance Division, 205 Great Portland Street, London, W1 (in 1964). In 1968 a new factory and office complex was opened at Rhodes Way, Radlett Road, Watford, Herts. In 1975, the name changed to Robert Bosch Ltd. UK site for the German firm. Also handled Uher products in the UK for many years.

Bosch (Robert) - Fernseh Division, D-6100 Darmstadt, Germany (in 1977). Bosch owned Fernseh GmbH, in 1968. Broadcast TV equipment (later merged with Philips' operation to form BTS - Broadcast Television Systems).

Bostik Ltd, Ulvercroft Road, Leicester (in 1964 & 2002). Adhesives manufacturer.

Bourns (Trimpot) Ltd, 1-27 High Street, Hounslow, Middx (in 1970). Makers of the 'Trimpot' range of multi-turn pots. Also marketed other manufacturer's products in the UK. Bourns (Trimpot) Ltd, Hodford House, 17-27 High Street, Hounslow, Middx (in 1970). UK office of Bourns USA.

Bowker (S O) Ltd, S O Bowker Ltd, Warstone Lane, Birmingham 18 (in 1946). At 19 Warstone Lane, Birmingham 18 (in 1964). In 1982, Tenby Electrical Accessories Ltd, 17-21 Warstone Lane, etc. Maker of 'Tenby' electrical wiring & installation accessories.

Bowmar Arizona Inc, 2355 West Williams Field Road, Chandler, Arizona 85224, USA (in 1975). Maker of IC's.

Bowthorpe. Goodliffe Electrical Supplies, in 1936, was the first company to be founded by Jack Bowthorpe. Bowthorpe Holdings Ltd, formed in 1948 as the holding company for a variety of companies engaged in the electrical manufacturing industry, including Hellerman (Paul Hellerman GmbH, of Germany). Bowthorpe Holdings Ltd acquired Paul Hellerman GmbH in 1957. In 1964, Bowthorpe Electrical Co Ltd, Gatwick Road, Crawley, Sussex. Tyton Corporation established in USA, in 1969. Jack Bowthorpe died in 1978. Company renamed as Bowthorpe plc in 1992. Penny & Giles acquired in 1992. In 1997, the company decided to focus on high technology markets and some disposals resulted, including Hellerman-Deutsch Ltd (now Deutsch Ltd). Bowthorpe plc renamed itself Spirent plc in 2000.

Bradley (G & E) Ltd, Mount Pleasant, Alperton, Wembley, Middx (in 1957). In 1964 & 69, G & E Bradley Ltd, Electrical House, Neasden Lane, London, NW10. Electronic engineers and maker of test equipment (incl. 'scopes). By 1965, a part of Lucas. In 1985, known as Bradley Electronics Ltd, same address.

Bradmatic - Bradmatic Ltd, Station Road, Aston, Birmingham 6 (in 1950 & 58). Manufacturer of tape decks, tape deck amplifiers and tape heads. By 1962, the company was called Tape Heads Ltd - formerly Bradmatic Productions Ltd and a member of the BSR group. In 1962, it relocated to High Street, Wollaston, Stourbridge, Worcs.

Brandenburg Ltd, 139 Sanderstead Road, South Croydon, Surrey (in 1964 & 69). In 1973, at 939 London Road, Thornton Heath, Surrey. Maker of HV dc power supplies. Founded in 1948. Taken over by Astec (BSR) plc in 1987 and relocated to the West Midlands.

Brandt. As at 2004, this brand (at least for consumer electronics) is owned by Thomson of France.

Braun. A German consumer electronics and electrical appliance manufacturer. In 1968, based in Frankfurt. Acquired by Gillette around that time.

Brayhead. Brayhead (Ascot) Ltd of Full View Works, Kennel Ride, Ascot, Berks (circa 1955) and Karatepi Works, Ascot, Berks (circa 1968). They also had a works at Pinner, Middx in 1957. Brayhead made 405/VHF TV 'turret' and VHF/FM radio tuners in the 1950s. They also made valve holders and valve/RF coil screening cans. Circa 1957, H T Mote acquired control of the Brayhead group. Around 1960 entered into a joint marketing agreement with Plessey. The 'Trader' 1964 yearbook also shows: Brayhead Electronic Components Ltd, Green Lane, Dronfield, Nr Sheffield, Yorks. (also in W.World in 1965) - maker of l.f., i.f. and r.f. coils and transformers and circuit modules. Now believed defunct.

Brenell Engineering Co Ltd, 231-235 Liverpool Road, London, N1 (in 1965-77). Tape transport (and in 1969, a tape recorder) manufacturer. In 1957, at 2 Northington Street, Grays Inn Road, London, WC1. In 1958 and 1964, at 1a Doughty Street, London, WC1.

Brentwood Transformers Ltd, 243A High Street, Brentford, Middlesex (in 1937). Maker of 'Breco' condensers.

Bridges (S N) & Co Ltd, York Road, Battersea, London, SW11 (in 1960). In 1955, at Bridges Place, Parsons green Lane, London, SW6. Maker of power tools. Later taken over by Stanley Tools and used the trade name Stanley-Bridges.

Brierley - J H Brierley Ltd, 46 Tithebarn Street, Liverpool (in 1947). Maker of pickups.

Brimar. 'BRItish Made American Radio valves'. Originally introduced by Standard Telephones and Cables (STC) in the 1930's. They were made in Footscray and Rochester, in Kent. STC was the UK arm of the American company ITT (International Telephone and Telegraph Corporation). They made US nomenclature type valves, domestic CRTs and Brimistors (thermistors in the 'CZ' series). Early transistors were also made by STC. Based at Footscray, Sidcup, Kent - until sold to Thorn, in 1960 - who formed a new company for the acquisition - Brimar Electronics Ltd, Footscray, Sidcup, Kent.

The STC associate, Kolster-Brandes (KB) - also at Footscray, used Brimar valves in their chassis until the Brimar brand was sold to the Thorn-AEI valve/semiconductor joint venture ca. 1961. STC continued to make industrial valves under the STC or ITT brand - at their Paignton, Devon factory. Apart from valves for consumer electronics, Brimar (under Thorn-AEI and later successor owners/companies) also made a large range of specialist CRTs for avionics, oscilloscopes and industrial applications. Thorn acquired the AEI holding a few years later and in the 1970s a separate company Thorn Brimar, was set up. This included the former Ferranti industrial/military CRT operations. Thorn EMI later sold Brimar to the Rank Organisation. Rank later pulled out of technology businesses and Brimar became independent. It is now based at Middleton, Manchester.

Britannia Electric Lamp Works Ltd, 17-21 Sunbeam Road, Chase Estate, London, NW10 (in 1964). Electric lamps.

British Central Electrical Co Ltd, 6-8 Roseberry Avenue, London, EC1 (in 1956). Maker of the 'Briticent' range of gripper handlamps.

British Communications Corporation Ltd, Wembley. See BCC.

British Domestic Appliances Ltd. Was this the joint EMI and AEI-Hotpoint company for domestic appliances (1960s/70s)?

British Ebonite Co Ltd, Nightingale Road, Hanwell, London, W7 (in 1964).

British Electronic Industries Ltd, the merger holding company for Pye Ltd and E K Cole Ltd. Created in 1960. See Pye & E K Cole. It was soon changed to Pye of Cambridge Ltd.

British Ferrocart Ltd - a subsidiary of Salford Electrical Instruments Ltd, in 1954.

British Ferrograph Recorder Co Ltd, 138 Sloane Street, London, SW1 (in 1952). UK models commenced in 1949. In 1953, the tape deck looks the same as a Wearite one reviewed in WW Mar 53. So, perhaps part of Wright & Weaire from the outset? Certainly shown in a WW ad (Jan 57) as a subsidiary of W & W. In the 1964, 'Trader 'yearbook: Ferrograph Co Ltd, Simonside Works, Leam Lane, South Shields, Co Durham. In 1965, 84 Blackfriars Road, London, SE1 (sales office - 'Shure' was also there at that time) - W & W also there and advertising their tape decks (without electronics). In 1969, The Ferrograph Co Ltd, Mercury House, 195 Knightsbridge, London, SW7 - a member of the Wilmot Breeden group - maker of tape head demagnetiser and tape recorders. In 1970, The Ferrograph Co Ltd, The Hyde, Edgware Road, Colindale, London, NW9 - makers of tape recorders and amplifiers. In 1972, they moved to: Ferrograph Co Ltd, Auriema House, 442 Bath Road, Cippenham, Slough, Bucks - maker of the RTS2 audio test set and a member of the Wilmot Breeden group. See also Wilmot Breeden Electronics Ltd. In 1974, another company, the Ferrograph Professional Recorder Co Ltd, at Auriema House, was also in operation to sell the new Studio 8 range of machines. In 1978, Ferrograph test equipment was now branded as Neal Ferrograph, Simonside Works, South Shields, Tyne & Wear (tel 0632 537227) - had Neal bought the Ferrograph business from Wilmot Breeden? By 1982, the founders of Neal - Alan Helliwell & Duncan Mitchell - had formed Lee James Electronics Ltd, to manufacture Neal cassette recorders; whilst Ferrograph recorders were to be made by Spencer & Co Ltd - and another company, Ferrograph Spares & Service, will manufacture and sell Ferrograph spare parts; Ferrograph test equipment is to be made by Park Naval Engineering Ltd, in Blackburn, Lancs. All these companies are to be represented by one sales ansd service centre - Audio Visual Marketing Ltd (all this on p72 of Wireless World, March 1982).

British General Manufacturing Co Ltd, 38 Glasshill Street, London, SE1 (in 1964). Maker of 'BG' electrical plugs and sockets, etc. In 2003, B G Electrical Accessories Ltd, Highpoint Business Park, Ashford, Kent, TN24 8DH. PRIVATE "TYPE=PICT;ALT="

British Lighting Industries Ltd, established (by 1964), when Thorn acquired the lighting businesses of E K Cole and AEI. Initially, it was jointly owned with AEI, but by 1968, Thorn had total control. On 1st April 1968, the three former sales companies (Atlas, Ekco & AEI) were merged. It later became Thorn Lighting Ltd, then Thorn EMI Lighting, which was sold to GE (USA) circa 1990.

British Mechanical Productions. See Clix.

British National Electrics Ltd, Newarthill, Motherwell (in 1948). Maker of tabletop electric cooker.

British Radio Corporation Ltd, 21 Cavendish Place, London, SE1 (in 1960 & 62). The Thorn company formed in 1957, as the marketing company for HMV and Marconiphone products, following EMI's withdrawal from the manufacture and sale of consumer TV & radio products. On 1st January 1960, the two marketing companies: HMV Radio & TV Sales and Marconiphone Radio & TV Sales, were wound up and BRC took over this activity. In 1965, BRC expanded to include Ultra and Ferguson brands and manufacturing, relocating to 284 Southbury Road, Enfield, Middlesex (the former Ultra premises at Eastcote, Middlesex and the HMV/Marconiphone premises at Cavendish Place, were vacated). In 1972, they had a radio/audio development lab at Chigwell, Essex: 43-49 Fowler Road, Hainault, Ilford, Essex. In 1973, the audio/radio locations were also at Colwick, Nottingham; Harold Hill, Essex (a new HiFi factory opened circa 1973); Southend, Essex and Chigwell, Essex (now also at 62-70 Fowler Road).

Other locations :- 145, Kentish Town Road, London, NW1; Thorn House, Derby Street, Cheetham, Manchester 8; 284, Southbury Road, Enfield, Middx. EN1 1TJ, and Great Cambridge Road, Enfield, Middx (in 1976).

In 1973, the name changed to Thorn Consumer Electronics Ltd. In 1981/2, the name changed to Thorn EMI Ferguson Ltd (to reflect the merger of Thorn with EMI). It was sold to Thomson Grand Public (of France) in 1987 and was renamed Ferguson Ltd. It is now called Thomson Multimedia.

British Rectifiers Engineering Co Ltd, Vernon Place, Bath Road, Cheltenham (in 1937). Maker of 'Carfax' battery chargers.

British Relay Wireless Ltd (in 1953) combined with Link Sound and Vision Services (the latter jointly owned by Pye & Murphy). I think British Relay was the ongoing company. In 1962, known as British Relay Wireless & Television Ltd. By 1967, Pye had a significant interest in the company. Also in 1967, the Central Engineering Division was at 1-7 Croft Street, Deptford, London, SE8, concerned with Pay and colour TV. In 1968, British Relay Ltd, British Relay House, 41 Streatham High Road, London, SW16. In 1973, British Relay (Electronics) Ltd, 41 Streatham High Road, London, SW16. In 1976, British Relay Wireless & Television Ltd, Overline House, Crawley, West Sussex. In 1968 & 77, the R&D unit was at British Relay (TV) Ltd, Cleeve Road, Leatherhead, Surrey. CATV systems. Became part of the Electronic Rentals Group (incl. Telefusion and Visionhire) by 1979. ERG was taken over by Granada (early 1990's?).

British Vacuum Cleaner and Engineering Co Ltd, Goblin Works, Leatherhead, Surrey. Makers of vacuum cleaners, washing machines, Teasmades, (and radios-see p368 of WW Oct 1947). See also Goblin (BVC) Ltd and BSR. In 2002, the Goblin brand is owned by Glen Dimplex.

Britmac - see Dorman Smith Britmac Ltd.

Broadcast Relay Service Ltd - the parent company of Rediffusion. Established in 1928, to relay wireless programmes to subscribers' homes by cable. See Rediffusion.

Bromley Batteries Ltd. In 1940, a dry cell battery manufacturer.

Brookdeal Electronics Ltd, Myron Place, Lewisham, London, SE13 (in 1963). At Market Street, Bracknell, Berks in 1972. Maker of instrumentation. In 1973, Ortec Brookdeal - an EG&G company.

Brook Motors Ltd, Empress Works, Huddersfield (in 1964). Electric motors - later taken over by Crompton Parkinson/Hawker Siddeley.

Brookes Crystals Ltd, 10 Stockwell Street, Greenwich, London, SE10 (in 1950). Previously Brookes Measuring Tools (in the early 1930s). In 1961, Brookes Crystals (1961) Ltd, relocated to Ilminster, Somerset. Maker of crystals. Taken over by Euroquartz in 1988.

Brookhirst Switchgear Ltd, Chester (in 1946). Merged with Igranic Electric Ltd, to form Brookhirst Igranic Ltd, which was at one point a Thorn company (1968) but later sold to Cutler-Hammer (US). C-H in turn taken over by Eaton (US).

Brown (S G) Ltd, Victoria Road, North Acton, London, W3 (in 1947). Established by Sidney George Brown in 1910. Browns made headphones and horn loudspeakers. In the 1920s, the firm sold 'crystal amplifiers' based on electromagnetic devices. In 1950, at Shakespeare Street, Watford, Herts and maker of headphones and sapphire pickup needles. By 1962, S G Brown Ltd, King George's Avenue, Watford, Herts - was a Hawker Siddeley company. In 1968, at Devonshire Works, Duke's Avenue, London, W4 - still Hawker Siddeley. However, in 1972, S G Brown Communications Ltd, of King George's Avenue, Watford, Herts was advertised as a Racal subsidiary - acquired in the same year. It appears these were two separate companies... In 1978, S G Brown Communications Ltd and Racal Amplivox Ltd were merged by their parent company, Racal plc, to form Racal Acoustics Ltd.

Bruel & Kjaer. Danish firm, specialising in sound measurement. Co-founded by Dr Per V Bruel. In 1967, B & K Laboratories Ltd, 4 Tilney Street, Park Lane, London, W1 (the UK company) - sales and service moved to Cross Lances Road, Hounslow, Middx in the same year.

Brunswick Ltd - subsidiary of Decca Record Co Ltd. Decca consumer electronics products were also sold under this brand.

Brush Crystal Co Ltd, Hythe, Southampton (in 1960 & 64). In 1962, control of the company passed from Charterhouse Industrial Holdings to Clevite Corporation of Cleveland, Ohio, USA. The company was thus renamed Brush-Clevite Co Ltd.

Brush-Clevite Co Ltd, Thornhill, Southampton (in 1970) and Hythe, Southampton, in 1965/66. Owned by the American company Clevite Corporation, formed in 1952 by the merger of Cleveland Graphite Bronze Corp with Brush Development Company. Brush developed the first crystal pickups in the 1930s and in the late 1940s, made some of the earliest magnetic tape recorders. In 1966 & 70, B-C made ceramic filters and piezoelectric ceramics in general and copper foils for printed circuits. In 1965, they ceased the manufacture of semiconductors, selling the business to ITT. In 1966, they introduced a piezoelectric gaslighter. In 1967, they opened a new factory at Thornhill, Southampton. In 1967, the US piezoelectric division was at Clevite Corp, 232 Forbes Road, Bedford, Ohio, 44014. In 1970, they also distributed Sansui Hi-Fi in the UK. This was due to the US company Gould National Battery Co, taking over Clevite circa 1969. At the time of the takeover, the new merged group became Gould Incorporated and Gould sold Clevite's piezoelectric division to Vernitron of the US. In 1970, the UK company name changed to Vernitron Ltd, same address. Vernitron also handled 'Sonotone' cartridges. Vernitron changed its name to Axsys Technologies Inc., in 1996.

Bryans Amplifiers Ltd, 18 Greenacres Road, Oldham, Lancs (in 1970). Maker of HiFi amps and tuners.

Bryans Southern Instruments Ltd, Willow Lane, Mitcham, Surrey (in 1974). Transducers and X-Y recorders. Later taken over by Gould Advance Ltd.

Bryce Capacitors Ltd, Helsby, Cheshire (in 1975). Industrial capacitors, e.g. Power Factor correction.

Bulgin. A F Bulgin & Co, 9-11 Curistor Street, Chancery Lane, London, EC4 (with a works at Chiswick) - in 1923. Their first product was a battery switch and they used the 'Decko' brand name at that time. In 1937, they were at Abbey Road, Barking, Essex. By 1945, Bulgin had relocated to Bye Pass Road, Barking, Essex (and still there in 2002, I believe). The spelling of the word 'Bye Pass' is taken from some of their older advertisements. The company was founded by Arthur Bulgin in 1923. He died in 1974, aged 75, whilst still company chairman. He was one of the founders, in 1932, of the Radio & Electronic Component Manufacturer's Federation. Bulgin made a very wide range of connectors, fuses, lampholders, tag strips, switches, rf and if coils and transformers, vibrators, etc. In the 1970's, became Bulgin PLC. By 1978, they had a subsidiary, Soundex Ltd of Park Lane, Broxbourne, Herts - maker of Peak Programme Meters.

Their once famous slogan was 'the choice of critics'! They are still going, but they have concentrated more on power supplies of late. In September 2001, the holding company name was changed to Elektor plc (goodness knows why!).

Bullers. Bullers Ltd., of 6 Laurence Pountney Hill, London, EC4 (in 1948), with a works at The Hall, Oatlands Drive, Weybridge, Surrey (in 1945). In 1954, same London office, porcelain works at Milton, Stoke-on-Trent and iron works at Tipton, Staffs. In 1969, Bullers Ltd, at Milton, Stoke-on-Trent. Manufacturer of ceramic parts and materials for the electronics industry.

Bulpitt & Sons Ltd, St Georges Works, Birmingham 18 (in 1964). Maker of Swan brand small electrical appliances. Taken over by BSR circa 1970. The Swan brand was later acquired by Moulinex, who went bust, circa 2001.

Bunker Ramo Corporation (USA). Formed in 1964, when the Electronics Division of Martin Marietta merged with the TRW Computer Division. The new company was a jointly owned subsidiary. By the mid-1970s Bunker Ramo owned Amphenol. In the 1980s Bunker Ramo was taken over by Allied Signal (USA) - later known as The Signal Companies. Amphenol seems to have been sold on thereafter, or spun off.

Burco Ltd, Rose Grove, Burnley, Lancs (in 1958, 64 & 82). Maker of Burco boilers, washing machines, etc.

Burgess Products Co Ltd, Microswitch Division, Dukes Way, Team Valley, Gateshead 11 (in 1964). In 1966 & 68, they had an electric tools division that included 'Weller' type soldering guns, at Sapcote, Leics.

Burgoyne. Burgoyne Wireless (1930) Ltd, York Road, Kings Cross, London, N1. Still going in 1946. Radio manufacturer.

Burne-Jones, Sunningdale Road, Cheam, Surrey (in 1958). Maker of pickup arms, pickups, etc.

Burnham & Co., St Pauls Wharf, Deptford - in business in the 1910's as a maker of signs for shops. Mr Witt Burnham, a son of the owner of Burnham & Co, started making radio sets, in conjunction with F C Phillips. The radio side of the business was transferred to a new company - Burndept Ltd, circa 1921. Premises were at Aerial Works, Blackheath, London, SE3. Burndept also made radiograms, loudspeakers and radio components, such as coils. They also made the 'Ultra' range of radio sets under the 'Sterling' brand, for the Sterling Telephone Company. The company went public, circa 1924. Burndept's fortunes later took a dive, due to various technical problems with their radios. A receiver was appointed in 1927. The company was reformed as Burndept (1928) Ltd but a receiver was again appointed in 1932. The Burndept name and the Greenwich business was bought by Mr Robertson (formerly of Lissen) - wasn't it T N Cole, who did this? The business was relocated to Erith, Kent. Manufacture of radio sets carried on under the Vidor brand name.

Burndept Electronics Ltd, St Fidelis Road, Erith, (in 1964). Also at Riversite Building, High Street, Erith, Kent (in 1964).

Burndept Electronics (E.R.) Ltd, St Fidelis Road, Erith, Kent (in 1969 & 1976). The E.R. stood for Ever Ready (who bought the electronics side of the Vidor/Burndept businesses in 1969 - see BVWS articles). Maker of radio telephone systems and electronic equipment. In 1972, they bought the mobile radio-telephone business of Ultra Electronics Ltd. '50 years experience' - in WW Feb 1973 ad. In 1979, the NEB (UK government vehicle) acquired 51% of the company - the rest was still owned by Berec Group Ltd. By the 1990s, the Burndept radio business was part of FKI Communications Ltd, which became Signature Industries (later, a subsidiary of an American company).

Burr-Brown International (in 1975). In 1974, Burr-Brown Research Corporation, International Airport Industrial Park, Tuscon, Arizona 85734. Maker of microcircuits. Taken over by Texas Instruments in 2000.

Burroughs, Cumbernauld, Scotland (in 1979). Maker of computers (based in USA). Later merged with Sperry-Rand to form Unisys.

Burroughs Machines Ltd, 512 Purley Way, Croydon, Surrey (in 1980). R & D for microprocessor based terminals.

Burwell Products Ltd, 116 Blackheath Road, London, SE10 and later at 205 Deptford High Street, London, SE8 (both in 1957). Maker of indoor TV aerials.

Bush and St Clair Ltd, 822 High Road, Finchley, London, N12 (in 1958). Maker (or marketer) or 'Diadem' sapphire stylii.

Bush Radio Ltd. In the 1930s at Woodger Road, Shepherd's Bush, London, W12, tel Shepherd's Bush 2050 - later 5341 (N.B. says 'Gaumont-British Products' on catalogues and service manuals of that era). On a 1933 (?) TV catalogue says 'Sole manufacturer and distributor for the Baird Television Company' - they made Baird system mechanically scanned TV sets for Baird. They also established a site at Power Road, Chiswick, London, W4 (in 1945, 62 and 82). Bush was established in 1932, by Gilbert Darnley-Smith (-who was previously involved with the failed Graham Amplion company). William H Harrison joined at its formation and became Chief Engineer, then a director in 1952. He became the Technical Director of Rank Bush Murphy upon its formation in 1963, until his death in 1965, aged 58. W T Deuchrass was also with Bush Radio in its earliest days (1932) and he became a director in 1952, remaining with Bush after it merged into Rank Bush Murphy. He retired in 1968. Darnely-Smith secured financial backing from Gaumont-British Pictures Corporation to establish Bush Radio Ltd, in 1932. G-BPC was controlled by the Ostrer brothers, who also owned the Odeon cinema chain. They later acquired the Baird Television company. GB was taken over by J Arthur Rank in 1945, hence Bush Radio Ltd was to later become 'a division of the Rank Organisation'. Gilbert Darnley-Smith remained on the board of Bush Radio Ltd into the 1950's. In 1961, Dudley Saward became Managing Director Designate. He was MD of Texas Instruments Ltd (UK), which he was with since its formation in 1956. In 1962, Rank took over Murphy Radio Ltd and the two companies were merged by the end of the year, to form Rank Bush Murphy Ltd (see Rank Organisation entry). Dudley Saward was then the MD of RBM. In 1965, he resigned as MD of RBM and as a director of other Rank Organisation companies. He was succeeded by C C Moore, who was previously assistant MD of RBM (he was appointed assistant MD of Bush Radio Ltd, in 1952 and had been with Bush since 1931). In 1973, Rank decided to merge its consumer electronics operations (e.g. Bush, Murphy, Leak, Wharfedale, Arena, Dansette & Heco) into one single company, called Rank Radio International Ltd. RRI became a loss-making business and, following a failed joint venture to make TV sets with Toshiba (Rank Toshiba Ltd) in the late 1970's, RRI was closed down in 1982. The Plymouth factory was sold to Toshiba and the Bush/Murphy spares stock sold to Currys Ltd. The Bush name was sold by Rank for (allegedly) £1 million. The name survives today (2003) - owned by Alba plc, but is used only on imported products.

Bussman Fuse Co, St Louis, Missouri. Maker of fuses. By the 1970s a division of the McGraw-Edison Co. Now part of Cooper Industries?

Bylock Electric Ltd, 109 South Street, Enfield, Middlesex (in 1964). Electrical appliance maker. Also BE Service facilities Ltd, Cartersfield Road, Waltham Abbey, Essex.

Letters

Dear Editor,

Recently I bought the residue of a collection of radios and many thousands of valves, all of which went to auction, except a few bits and pieces that the auctioneer did not recognise or deem to be of any value. Amongst the items was a licence for Wireless Telegraphy, 'To use Wireless Telegraphy for Experimental Purposes' dated 21st October 1912, reference number 222000, issued to Edwin Turner Cottingham of The Limes, Midland Road, Thrapston, Northampton, a Jeweller.

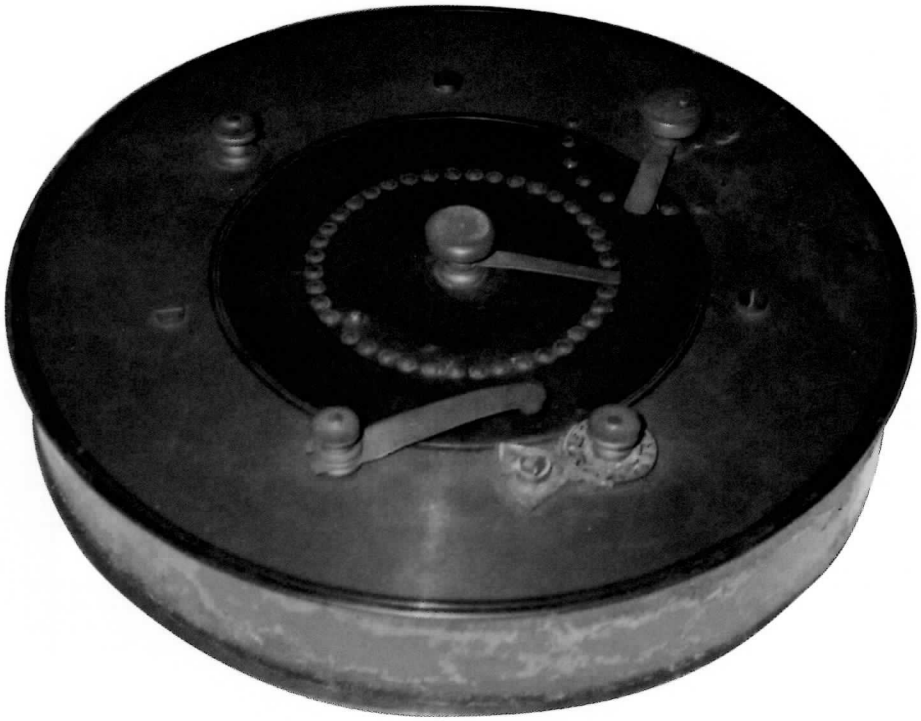
In about 1880, as a small boy, Edwin Cottingham was apprenticed to a tailor in Ringstead, but he preferred making clocks and watches to cutting out cloth so he went to work for a watchmaker. He gained a wide reputation as a clock and scientific instrument maker and one of his special clocks was used as the standard timekeeper at Greenwich Observatory where it had a mean daily variation of only 1/200th of a second. He made three more astronomical clocks, one for the 1924 British Empire Exhibition at Wembley, another for Hong Kong and one in Mauritius. At the time they were the only British Riefler escapement clocks in existence. He looked after the Admiralty chronometers and several other famous clocks. He died on 20th March 1940 at the age of 70.

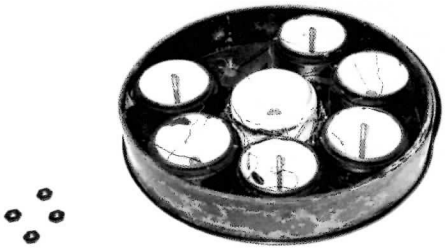
In a box addressed to Mr Cottingham is the strange item illustrated here. It is not clear whether he made this or had it sent by another experimenter, but the box also contains a letter from a J.W Hobley of Wellingborough to a Mr Pankhurst dated 20th September 1938 which says 'I have enclosed the crystal detector (a nicely made little detector by 'Standard' is also in the box) I spoke about yesterday. I made it in 1912 and used it up until the time of the war. I used to receive Pola in Austria, the record at that time, regularly. I also took down the full report of the wedding of the German ???? (this word is illegible) and the messages to all German ships at sea and in port to return to Germany or German ports. I find I had a grand clearance of all old stuff for which I am now very sorry. Hoping you will have a successful exhibition. I am etc...'

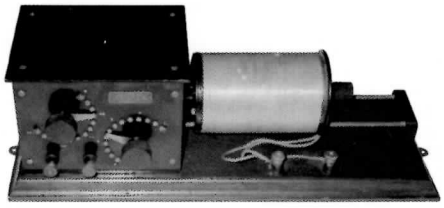
Was he sending the little detector, or the wireless set or both, what was the exhibition being planned by Mr Pankhurst and could this item have been made by, or for Edwin Cottingham?

The device consists of a tinplate drum on each side of which is a 10 inch single sided gramophone record, under one of which are six ceramic coil formers, on the other there are tappings and sliders and a crystal, set in the backplate of a watch of about 1800. Just the thing that a watchmaker would have to hand. The detector used by Mr Hobley may have had nothing to do with this piece of equipment. From the same source, but not necessarily associated with either of these items, is another early item of which I enclose a photograph for any member to identify.

Yours faithfully,
RJ Wyatt







Dear Editor,

May I please enter a heartfelt plea to members? Can any member please come to my aid?

For the past week or so I have endured insomnia, frequent interruptions when trying to read my book and a regrettable relaxation of the culinary skills in the kitchen. I really can't take much more, I have even taken to strong drink, in considerably greater quantities than is my custom; and that's a lot!

The reason for this? Well, I made a big mistake. The interference with my usual peaceful domestic routine has been the result of my wife, Thelma, giggling, chortling and sometimes laughing uncontrollably - and all because I made the stupid mistake of suggesting that she should read Gerry's book, 'Obsession'. So, chaps, if you want to enjoy peace and quiet in the nuptial boudoir and a nourishing diet, don't let your dear wives loose with Gerry's book! They'll never stop laughing.

To be truthful, well done Gerry, it's a great story. Many thanks for giving us both so much of interest to read and for creating such an amusing, witty document.

Yours sincerely,
Julian Alderton.

Dear Editor,

I found Ian Sanders' excellent exposition of SG Brown's 'Frenophone' in the Summer 2004 Bulletin very fascinating because it covers mechanical amplification of audio signals.

The first to apply the principle was Edison, who invented the Electromotograph transducer from 1875 to sidestep the Bell electromagnetic receiver patents. His device used a piece of chalk impregnated with electrolyte rubbing on the hand cranked diaphragm actuator. This was so succesful that it became known as the 'shouting telephone' with discrete conversations becoming almost impossible!

The patent standoff was ended with a deal between the Edison and Bell interests, with Edison's carbon microphone giving the original electrodynamic Bell telephone 'continental' range and resulting in the classic telephone still widely used today.

More recently in the 1960s, GEC developed an electro-friction actuator using a rotating cylinder of very high resistance partially pyrolysed cellulose carbon. This used spring steel friction bands as a high impedance, high speed actuator for early computer printers. Also tested was an experimental high power friction transducer with a one metre steel plate diaphragm as an aircraft noise simulator

which could generate up to 10kW of acoustic power. This device worked so well that it was dangerous to nearby personnel, further development was dropped.

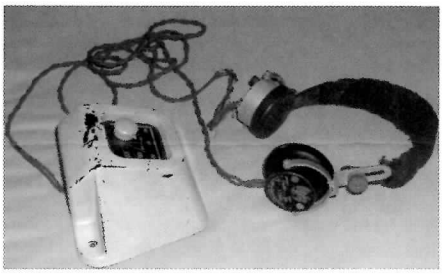
Thus the Frenophone takes its place in an evolving story.

Yours sincerely
Anthony Hopwood

Dear Editor,

The story of a crystal set with a dual personality.

From inside the damp dark cellar of a friend, emerged a rather sorry looking black box containing *The Cutie Crystal Wireless Receiving Set*, whose lid was near collapse and the paper cover badly torn. It was one of those 'if you can do anything with it you are welcome to it' offers.



Had it been a large radio I might have refused, but as it was a manageable size I decided to try and repair it as best as I could. I began by carefully soaking off the black paper covering from the lid to expose the wood frame so that it could be glued back, then hoping to preserve the *Cutie* label, I soaked that from the inside. Suprise, suprise, underneath the *Cutie* label was another telling me it had been *The Recepto Radio Receiving Set*.

Neither labels give a manufacturer's address other than being 'British Made', but *The Cutie* does have a *Registered Design Number 808152*. The reassembled set measures
7" x 5½" x 3¾" with the lid closed. Tuning is by variable inductance, the coil being wound on a flat piece of wood with the wiper arm sweeping an arc over the coil; excess noise is generated by the woodworm that infest the timbers.

Another crystal set for your records

This one also escapes any reference in any of the books. It is the *Winrad* crystal set, a wedge shaped bakelite case over painted cream with holes for wall mounting. The dial is black with white numbers 0-120, the tuning knob is also white. Inside the tuning is by solid dielectric variable capacitor, the coil is a fixed one and detection is by a glass diode. An engraved number on the back 847115 is probably the registered design. The directly–soldered headphones are odd, one being Western Electric 2000 ohm BBC approved, the other, a Sterling Mk. 3 2000 ohms. Aerial and earth connections are by wander plug sockets in the back panel.

And one that got away

At the viewing of a recent auction was a Jewel radio and an AJ Prior and Co. Priorphone Single valve crystal set No.161 in a walnut case 8¾" wide. The unusual feature of this receiver was a buzzer, otherwise the layout was similar to many of the sets featured in 'Tickling the Crystal' with a four pin valve holder on the surface and a space for a 4.5 volt battery. The case did not have a BBC approved label but it did have a transfer with 'Priorphone' in letters enclosed in an hourglass shape. Needless to say, my bid did not come close to the final figure of £520. (The Jewel set went for £55)

I should be interested in any information on these sets. My address/email is in the handbook.

Yours sincerely
Peter Logan

Letters continue on next page

Dear Editor,

A case for and against an 'ether'.

ignotum per ignotius (the unknown by the still more unknown)

Over the last hundred years or so mention has been made of an all pervading ether. In the later part of the 19th and early 20th Centuries it was almost accepted as the norm in wireless engineering. People spoke of it jokingly in normal conversations as "oh dear! Blame the ether" It was even mentioned in schools, as a possible reason for wireless communication. I think most of

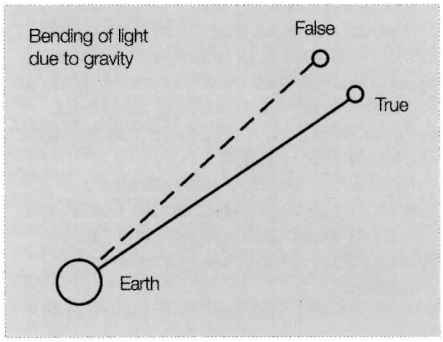


Fig 1

us older collectors remember the old story of the father and son at a pond's edge, the father dropping a pebble into the water. "There my boy - that's how wireless waves travel" referring to the rings in the water. But the boy looks back at his father and says, "but dad where is the ether?" Looking back at these old ideas and of what we know today, it is a great wonder. Or is it? I think there is still a mystery here about the so–called ether. It seems to be something about the way Electromagnetic Radiation (ER) travels. Scientists have speculated about a link between gravity and ER. For instance they speak of light being bent when passing near to large bodies in space. (fig 1)

There is also Einstein's theory of curved space. But how can something be curved when there is nothing there. I once heard a hypothetical story about; 'placing two astronauts back to back in space, as one of them shines a powerfull light ahead of them. In theory if space is curved the other astronaut should see it after X number of years.'

There were experiments to find the ether. One theory was that as the Earth travels along through space, it could produce an ether-wind. With the right kind of laboratory equipment, tests could be carried out. Sir Oliver Lodge carried out such tests using an optical machine with negative results were obtained (1). Also another such experiment by Michelson using his interferometer (2) proved unsuccessful at the time as well. (fig,2)

Up to the present time some proof exists to explain why (ER) travels from A to B. Today we accept and are taught that electromagnetic radiation is 'Radiated' through space (3) and arrives at its destination, be it light, radio, or heat propagation. The great Clark Maxwell's theory was involved in this.

Another odd thing is the Lorentz contraction. (this sounds painfull!) but not really. Light slows down from 2.997x108 metres per second in vacuo. (4) to a slightly slower rate in air. So we have all these strange effects such as bending, slowing down, etc of Electromagnetic Radiation. This seems to suggest it's being influenced in a way by something that we cannot see. So say what causes these effects to happen? The latest theory to date is that gravity plays a part in all this. Gravity is like the 'Holy-Grail' of modern physics. No one knows. If we did the World would now be completely different. To my mind scientists seem at a loss to explain these effects.

Way back in the 1960s I read a book that not only explained how Electromagnetic Radiation travels, but how all things in the

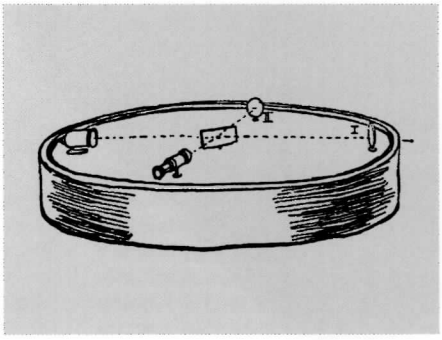


Fig 2

Universe are related to one Universal theory. The author was connected with companies involved in the invention of the Hovercraft, and AVROs experiments, 60s style! The book he published then was not very popular with the establishment, but was interesting enough for NASA to prick up its ears at the time. You can still go to the website: <www.leonardcramp.x5g.com> When I read the book back then, one thing stuck in my mind, and now 35 years later still bothers me. It was the theory that perhaps an ether exists after all. Albeit in a completely different form than you could ever imagine.

The author wrote about his own work with new ideas of the time, mainly connected with the technology of the day. What was interesting for me was a section about another person who had a theory about the ether. The name mentioned in the book was a certain Englishman; Antony Avenel of Yorkshire. The author of the book was, L.G. Cramp, the book was entitled 'A Piece For A Jigsaw'. I will explain Avenel's theory to you after the quoted text from his book. We are only concerned with this part as it highlights all you need to know, as the rest is too lengthy for this article.

'A Piece For A Jig-Saw' was first published by L.G. Cramp in 1964. The 'Unity Of Creation Theory' is introduced in this book by Avenal. 'Avenal' may have been a pseudonym.

Antony Avenel's theory

'the theory that I put forward is that the ether and space are the same, and that space is formed out of nothing by a grid of extremely high frequency rays (probably having a wavelength of less than 10^{-13} cm). Space must be distinguished from 'nothing'. Space -even if it is empty-possesses the same qualities of length, breadth, thickness and time. 'Nothing' has no qualities whatsoever, and cannot support any material or ray. In other words, creation of the universe takes the form of making space out of 'nothing', and the method adopted for making space is a network or grid of rays, which I call 'creative rays'.

Outside The Universe

"Taking the 'universe' to mean all created space, there is 'nothing' outside the boundaries of the universe.The old problem of imagining the boundaries of the universe, outside which stretched empty space-which space must have boundaries, and what was outside that?-should not arise. 'Endless space' is a contradiction in terms. Space has dimensions and boundaries and cannot be

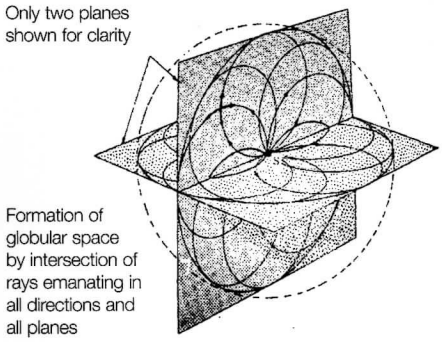


Fig 14

endless. The hand of creation has not touched the 'nothing' outside the boundaries of the universe, and that 'nothing' has no dimensions and therefore no boundaries".

Avenel then goes on to describe the Universe as:

"You cannot visualise 'nothing' for obvious reasons; it has to be accepted. Space or Ether is formed by the creative rays which emanate from one source in all directions and all planes," Fig,14(a) (in Cramps Book) Reproduced above.

'Each creative ray covers a circuit from source (S) in Fig.14 (a) back to Source, and each circuit is probably the same size. In this way space with boundaries of globular shape is built, and whatever point is taken in space, creative rays travel in all directions towards the source.'

The book then goes on to describe other things that the 'Creative Rays' would be linked to in physics generally, e.g. gravity for instance. I think it's an amazing theory. And have known of it since the 1960s. So here is a brief transcript of what Avenel is saying: The Universe is made up of lines of force, and each line is spaced to the value of 10^{-13} cm. (5) If for clarity we take one line, then the journey it takes from Source back to Source is equal to its journey around the known Universe. All intersections i.e. where a line interacts /crosses another line, an Atom is formed. This is explained in the book. So the 'creative rays' are in effect binding matter together. He goes on to write that these rays are on the move, at the speed of light. i.e. (2.997×10^8 m/sec) in vacuo. This is interesting as (ER) travels at this speed in a vacuum too. It slows down in air etc, (Lorentz effect). So the grid of rays match our present day understanding. The up to date theory of (ER) being radiated could be wrong if this theory were ever proven. This would mean that our act of

'Operating' something in our three dimensional World, or space, be it light, Radio, or electro-magnetic field etc. disturbs the 'creative-rays', and takes a 'piggy-back ride' on something already moving and there, the creative rays. Likened to the drawing I have made in fig. 3 or like placing a stick in a stream of running water to create a disturbance, the water now representing the moving 'creative rays'. I have done this more plainly in fig,3

As we are unable to qualify what the 'creative rays' consist of, so it's back to square one again. Moreover, what is the source, and where is it in outer space? I wonder where Avenel got his theory from?

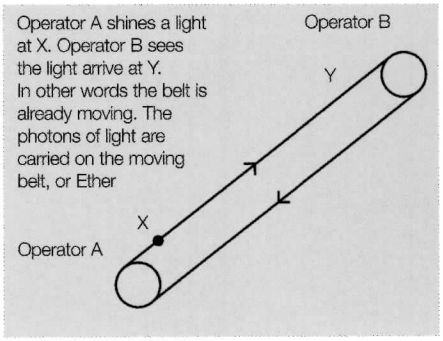


Fig 3 The 'Mill-Belt' idea as how (ER) travels

It seems to have some kind of religious meaning to the word 'creative' in relation to our Universe. I don't want to go down that road!

There is this one last puzzle about this. It is the value Avenel places on the distance between his lines or rays i.e. 10^{-13}cm. By chance (?) its the same value as the diameter of an Electron (!) (6) In Harmsworths, Sir Oliver Lodge writes that, lines can be seen radiating away from the electron in all directions (7). This invisible force Avenel writes about can be likened to magnetic lines of force. We know it is there, but unable to see it. He writes that the rays have a 'wavelength'. So do they have a 'frequency' as well? At the value stated it's going to be very short indeed. What kind of device can produce such a value. The 'Source' perhaps?

Avenel writes that when the "'creative rays' cross/interact with each other an Atom is formed". If we imagine all these lines crossing each other in the universe, (at that value, 10^{-13}cm.) and atoms forming, then it would remind me of another effect called the 'Scaler Effect'. In other words atoms would only exist in our own universe, and not outside of it.

What other theories are there about the ether? Tesla was known to be interested in it (8) and did some experiments too. It is known already that he carried out tests at the Wardencliff Tower to try and produce among other ideas, a kind of 'death-ray'. This was eventually stopped by the US government. There is also the 'Tesla Scaler Wave System' or 'Earth Capacitor'. This was mentioned in a modern book of Tesla patents. It draws comparisons between Tesla's scaler wave effect, and the US Starwars programme.

On Cramps website you will find further reading on all this above work. And is well worth a read. In the past two hundred years the ether has been associated with the paranormal as well. But that's another story.

References

(1) Harmsworths Wireless Encyclopaedia, p882 Sir Oliver Lodges ether and matter experiment.

(2) 'You and the Universe' by Paul Karlson c1938. p179 His Interferometer. Also Harmsworths p882.

(3) Chambers 20th Century Dictionary ...to Radiate, ...to emit rays, ...to diverge from a point or points, ...to transmit by wireless etc.

(4) Antoon Lorentz,the celebrated Dutch theorist. (Paul Karlson) p194

(5) Avenel, in Cramps book. p74 'wavelength of 10^{-13} cm' (I presume the distance between lines, as equal to a wavelength.) writer.

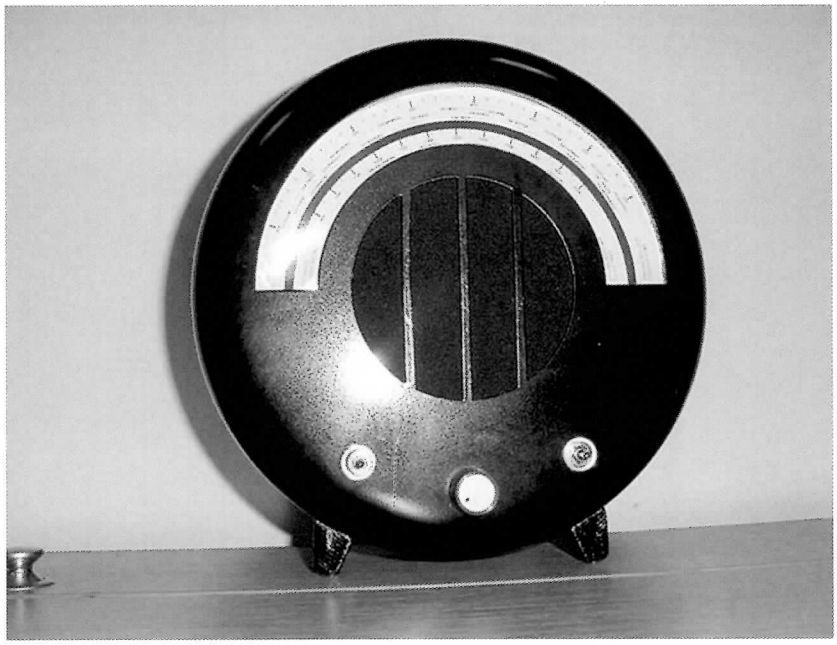
(6) Harmsworths Wireless Encyclopaedia, p846. ...a little sphere 10-13 cm Dia....Electron.

(7) Harmsworths Wireless Encyclopaedia, p845 Electron theory.

(8) The Fantastic Inventions of Nikola Tesla. by David H. Childress. Adventures Unlimited Books, Stelle, Illinois, USA.

Yours sincerely,
Reginald Dykes. Tech,Eng

Novelty AD65 Saucepan Special - with DAB Digital Tuner!



To make a 2/3 scale mock-up, start with one Woolie's £16 pan, remove curry sauce, and biff off the handle. Rifle a copy of AutoCAD from work, and make a pukka scale drawing of the hole cut-outs, working from your copy of the 1977 exhibition cover, in the absence of the real thing. Send pan and floppy disk for CAD/CAM hole-cutting by Control Waterjet of Chesterfield (01246 284000) - why water? Because lasers don't enjoy cutting ally. Persuade dubious HK chinaman that you wish to buy only 10-off DAB radio boards for prototyping purposes. Purchase same for US$44 each. Evade UK Customs VAT by stroke of luck and guile. Trick bits of gear these Radioscape RS200's - RF in and audio out, and all decoded by software - some speed !. As used by all major manufacturers. Simply wire some buttons to the unit, feed 5V and play through an amp!. Garnish with an LCD display if you haven't already blown the budget. Infill with chipboard frame-come-baffle, and whittle some wooden legs. Observant readers will note that the 'snout' of the set is missing - I will liberate a suitably thick piece of pipe to cut to a sliver when I see one. Incidentally, if cutting is to be for 10 or more pans then the unit cost will be a sensible £12 each - anyone interested? John Marshman bond@equipe.fsnet.co.uk

Minutes

Minutes of BVWS Committee meeting held on Friday 28th May 2004 at 5 Templewood, Ealing. (Postponed from 13 May)

Present: Mike Barker (chair), Graham Terry, Ian Higginbottom, Guy Peskett, Terry Martini, Paul Stenning.

1. Apologies for absence: Jeremy Day.

2. The minutes of the meeting held on Friday 27th February 2004 at 13 Warneford Road, Oxford were accepted as a true record.
Matters arising (not dealt with later);
Item 9 (viii) The Society's offer to distribute J F Alderton's "The Tannoy Story" was still pending the receipt of stock, expected at Gerryís Garden party.

3. GT reported that the number of members (Ordinary, Complimentary, and Honorary) stood at 1671. 90 of these are new members. He also reported that an improved SQL database had been implemented without problems.

4. MB announced formally that since the last meeting of the Committee Jeff Borinsky had resigned the post of Treasurer. MB proposed that Jeremy Day be co-opted to serve as Treasurer from early July and that in the interim he would stand in. This was agreed. MB then reported that the Society's balance stood at £24,721. The Committee expressed its gratitude for Jeff's precise and efficient six-year tenure.

5. MB proposed the cooption of Jonathan Evans to serve as an ordinary member of the committee until the next AGM. This was agreed.

6. The long-term project to scan service data and ephemera (so that it can be distributed to members) is starting to take off. MB agreed to act as clearing house for the distribution of originals to the scanning team, Paul Stenning, Jon Evans, and Chris Colebrook. The first material to be addressed will be less readily available service data.
PS suggested that as players could now be obtained for as little as £30, the 5 CDs issued so far should be consolidated onto a single DVD. This was agreed for a future venture.

7. PS reported on the continuing development of the Society's web site. New items about to be introduced are; more information in the publicity for forthcoming events, reports on auctions held with prices realised and pictures of the more important items, and selections from the catalogues of forthcoming auctions perhaps also with some pictures.
MB will generate copy outlining the Society's policy and terms on auctions; GP will provide a note on the advertisements scheme, which is to be extended to include items of significant interest for sale by non-members at the discretion of the Advertisements Secretary.

8. Valve Centenary celebration at the October NVCF. TM presented a floor plan of the hall and pointed out the most suitable area for the display cabinets and possible seating for video presentations. The amount of space to be allocated is a trade off between that needed to put on a good show and the loss of revenue from tables. TM and MB will decide the amount of space and define the layout after investigating the hire of cabinets. The amount of display space will determine how many items can be exhibited. Their selection and presentation is to be organised by Phil Taylor and Rod Burman. Video presentations will also be arranged for the display.
It was noted that the notional cost of £6,000 for mounting the exhibition mentioned in the previous minutes was a ball park maximum and that the actual cost was expected to be closer to £4,000.

9. TM tabled a financial summary for the May 2004 NVCF showing a net profit of £3,994. He drew the Committee's attention to a number of points (i) The hall hire charge (which is beyond our control) continues to rise at about 4 times the rate of inflation and the stall income at current rates no longer covers it (ii) The stall bookings were up compared with the previous fair but there were still some not taken (iii) The Collectors Guide is a significant loss maker (iv) The number of early entry admissions had increased slightly and now contributed about 30% of the door income despite the rise in price.
The overall message is that irresistible costs are rising and this inevitably means that fee income and/or the numbers of participants will also have to rise. What is uncertain is the extent to which any rises in fees will deter stallholders and visitors.

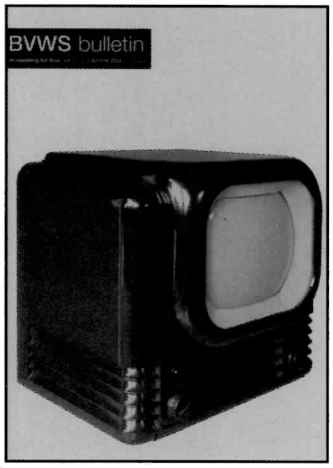
10. AOB
(i) TM reported he had received a splendid batch of films from Andy Emmerson to transfer to DVD. These included stock from Mullard, GEC, Rank-Bush-Murphy, and Formica (on PCB manufacture).
(ii) MB proposed that the mileage allowance for travel on Committee business be raised to 25p. This was not opposed!
(iii) MB tabled an evaluation copy of a book entitled "Attaché Case Radios" by Mark Johnson. The committee was impressed by the content and presentation. It was agreed that the Society would distribute it if asked.
(iv) Martin Constable has been chosen as the artist for Gerry Well's portrait. The fee was expected to be in the area of £1,500.
(v) MB reported that several auctions were in prospect after the two currently planned. He also mentioned that there were about 500 pieces in the auction store, which was "nearly full".

The next meeting will be on 23rd July at either Ealing or Swindon.

The meeting closed at 11.36pm.

Back issues

Vol 10 Numbers 2, 3 & 4 Inc. The KB Masterpiece, Extinct Species "A Monster Defiant".
Vol 11 Numbers 1, 2, 3, 4 Inc. BTH VR3 (1924) receiver, Marconi's 1897 tests, Origin of the term 'Radio', Baird or Jenkins first with TV?
Vol 12 Numbers 1, 2, 3, 4 Inc. the Emor Globe, The Fultograph, Ekco Coloured Cabinets.
Vol 13 Numbers 1, 2, 3 Inc. Direct action tuning, The Philips 2514, Noctovision.
Vol 14 Numbers 1, 2, 3, 4 Inc. Cable broadcasting in the 1930's, The story of the Screen Grid.
Vol 15 Numbers 2, 3, 4 Inc. The wartime Civilian Receiver, Coherers in action, Vintage Vision.
Vol 16 Numbers 1, 2, 3, 4 Inc. The Stenode, The Philips 2511, Inside the Round Ekcos.
Vol 17 Numbers 1, 3, 4, 5, 6 Inc. Wattless Mains Droppers, The First Philips set, Receiver Techniques.
Vol 18 Numbers 3, 4, 5 Inc. The First Transistor radio, The AVO Valve tester, The way it was.
Vol 19 Numbers 1, 2, 3, 4, 5, 6 Inc. The Birth of the Transistor, Super Inductance and all that, reflex circuits, A Murphy Radio display, restoration.
Vol 20 Numbers 1, 2, 4, 5, 6 Inc. Radio Instruments Ltd., Japanese shirt pocket radios, Philco 'peoples set', notes on piano-keys, the story of Pilot Radio, the Ever Ready company from the inside, the Cambridge international, the AWA Radiolette, this Murphy tunes itself!
Vol 21 Numbers 1, 2, 3, 4 Inc. Marconi in postcards, the Defiant M900, GPO registration No.s, Personal portables, the transmission of time signals by wireless, the Ekco A23, historic equipment from the early marine era, the birth pains of radio, inside the BM20, plastics, Ferdinand Braun, pioneer of wireless telegraphy, that was the weekend that was, the first bakelite radios, BVWS - the first five years, the world of cathedrals, Pam 710.
Vol 22 Numbers 1, 2, 3, 4 Inc. Another AD65 story, the Marconiphone P20B & P17B, listening in, communication with wires, the story of Sudbury radio supply, French collection, Zenith Trans-oceanics, Farnham show, Alba's baby, the first Murphy television receiver, AJS receivers, Fellows magneto Company, Ekco RS3, Black Propaganda.
Vol 23 Numbers 1, 2, 3, 4 Inc. Sonora Sonorette, Bush SUG3, RNAS Transmitter type 52b, North American 'Woodies', Why collect catalin, Pilot Little Maestro, Theremin or Electronde, The Radio Communication Company, Early FM receivers, an odd Melody Maker, Black propaganda.
Vol 24 Numbers 1, 2, 3, 4 Inc. The Superhet for beginners, Triode valves in radio receivers, History of GEC and the Marconi - Osram valve, KB FB10, Great Scotts!, Riders manuals.
Vol 25 Numbers 1, 2, 3, 4 Inc. Repair of an Aerodyne 302, Henry Jackson, pioneer of Wireless communication at sea, Zenith 500 series, Confessions of a wireless fiend, RGD B2351, John Bailey 1938 Alexandra palace and the BBC, Ekco during the phony war, Repairing a BTH loudspeaker, The portable radio in British life.
Vol 26 Numbers 1, 2 Inc. How green was your Ekco?, The Amplion Dragon, Crystal gazing, The BVWS at the NEC, Installing aerials and earths, novelty radios, Machine-age Ekco stands of the 1930s, Volksempfänger; myth and reality.



Supplements:

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

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

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Cheques to be made payable to 'The Vintage Wireless Museum'.

News and Meetings

GPO registration Numbers

Martyn Bennett has the role of custodian of the BVWS list of GPO Registration Numbers. As many members will know the project of assembling this list was started in the early days of the BVWS and, more recently, has been enthusiastically carried on by 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.

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telephone: 01252-613660 e-mail: martyB@globalnet.co.uk

2004 meetings

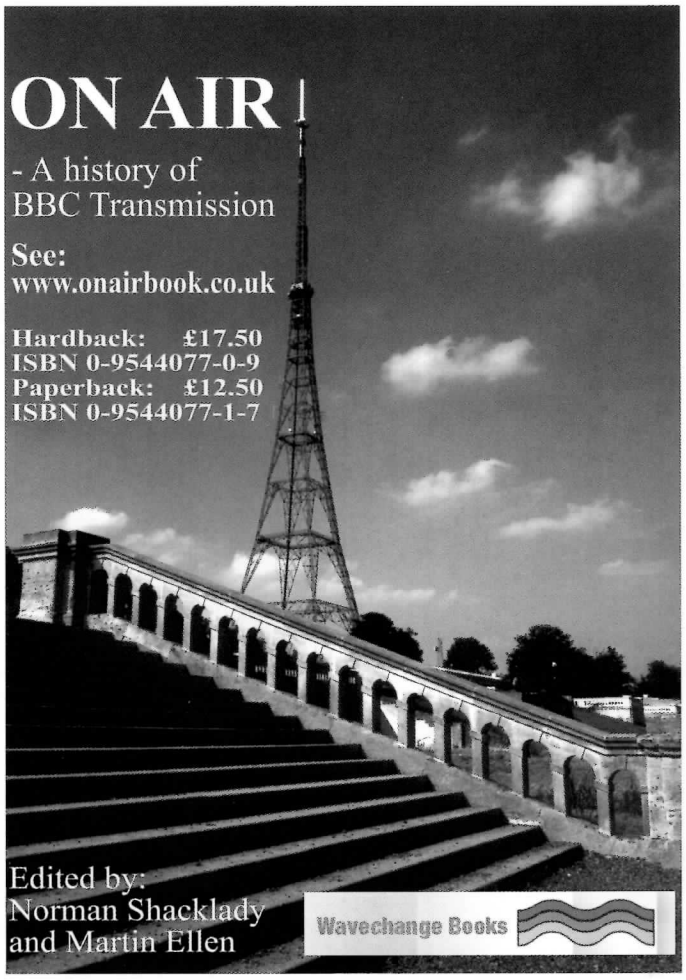
12th September Vintage Valve Technology Fair at Haydock Park
5th September Harpenden swapmeet
3rd October Radiophile swapmeet at Shifnal
10th October NVCF: Stall bookings/Details: NVCF: 122B Cannon Street Road, London E1 2LH. Tel: 07947 460161 http://www.nvcf.org.uk
17th October Workshop at Vintage Wireless Museum
17th October Southborough (BVWS Members)
24th October Workshop at Vintage Wireless Museum
24th October Radiophile swapmeet at Cowbit
7th November Vintage Audio Show at Ramada Jarvis Hotel, Seacroft Roundabout A64, Leeds. Tel 0113 273 2323. 10-5 £2 after 10, £5 before.
21st November Harpenden Swapmeet
5th December Wootton Bassett, Swindon

2005 meetings

Feb 13th Audiojumble, Tonbridge (Open to all)
Mar 6th Harpenden (BVWS Members)
Apr 3rd Leeds (Andy Wilcox) (Open to all)
Apr 17th West of England Vintage Wireless Fair at Willand Village Hall (Open to all)
June 5th Harpenden (BVWS Members)
July 3rd Wootton Bassett (BVWS Members)
Sept 18th Harpenden (BVWS Members)
Oct 23rd Southborough (BVWS Members)
Nov 6th Leeds (Andy Wilcox) (Open to all)
Nov 20th Harpenden (BVWS Members)
Dec 4th Wootton Bassett (BVWS Members)

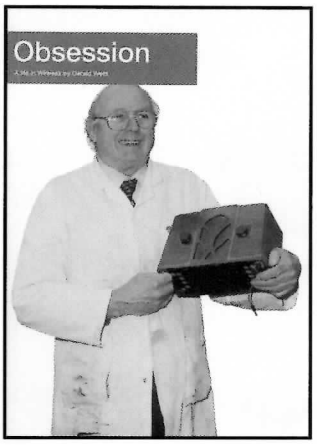
New Articles

If you have anything interesting to say concerning Wireless, Television, Broadcasting, Collecting etc. please send it to the Editor for future publication in the BVWS Bulletin. Your article can be just a few paragraphs long if you think it conveys its message to your fellow members. Also if you have any photographic material that would look good in the Bulletin, don't hesitate to post it to the Editor. The chances are that I will definitely use it!
Please send to: Carl Glover, 33 Rangers Square, London SE10 8HR.
Tel: 020 8469 2904 email: choris.b@virgin.net



Obsession

by Gerald Wells



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