WIRELESS of Yesteryear

by Mike Holmes

MIKE HOLMES REBUILDS A VINTAGE AM RADIO SET AND DISCOVERS THAT 1930'S TECHNOLOGY WAS RATHER MORE SOPHISTICATED THAN WE GIVE CREDIT FOR TODAY

PART 1

Photo 1. The 'Ekco' AC-85 LW/MW receiver.

At the beginning of the year, I was given the opportunity to borrow a 1934 Ekco AC85 AM receiver with the aim of attempting to 'get it working again'.
It belonged to a neighbour who in turn had recently been given it by another family member. Before this it had for several decades been banished to the attic after the original owner had acquired a radiogram.

In its favour this meant it hadn't been 'worn out', but unfortunately, since this attic was located in a marshy area noted for encouraging dampness, corrosion was the basis of the set's main problems (apart from one failed valve).

Background

The two decades leading up to the Second World War were the heyday of 'wireless' world-wide, with many manufacturers cashing in on the boom. Among the British was E. K. Cole, giving rise to his series of 'Ekco' receivers, of which the AC85 (Photo 1) is so much a classic example of that ilk that today a number of radio museums possess at least one. Similarly it is also quite collectable; the current owner has at least been offered £300 for it even in a non-working condition.

Photo 2. Back panel legend.

As regards its worth at time of manufacture (1934), a contemporary book entitled The Handy Man And Home Mechanic (no date) has this to say in the chapter 'Wireless': '— A fair price for a mains-driven set of the superheterodyne type varies from £12 upwards, according to the number of valves, while reliable battery sets can be obtained for about £10 including batteries —'

To put this into a modern context you need to multiply those values by 50, so think of some sort of modern home entertainment system costing in the region of £600 — £1000 and you get an idea of the outlay that was involved.

It is easy to understand, therefore, that homes in possession of a wireless set rarely had more than one. Furthermore a receiving licence had to be purchased, costing 10 shillings.

As an aside it should be pointed out that battery sets had nothing to do with portability. Many homes were still without a supply of electricity in those days, or if they had one, it might be DC instead of AC, depending on regional differences. Consequently the back panel legend of the AC85 explicitly states 'For AC mains' (Photo 2). Moreover this came in three basic flavours: 200 — 210 Volts, 220 — 230 Volts or 240 — 250 Volts.

Features

So, what did the proud owner of a new AC85 get for his money? Firstly, a proper superheterodyne type of AM radio receiver, which was still a fairly novel innovation at this time and truthfully a 'state of the art', since not many years earlier the trend had been for valve assisted crystal sets and simple TRF type receivers. Only Long Wave and Medium Wave bands are catered for, these being all that were normally available for commercial traffic. (There was no VHF or FM or anything like that, and although Short Wave bands probably existed, they were most likely populated with CW Morse Code.)

For added value, however, the designers included a couple of 'extra features': the ability to add external loudspeakers, and also to play records through the audio amplifier. With these the AC85 could then form the hub of a broader sound system.

First Impressions

In view of the large initial purchase cost it was, therefore, a bit of a shock to discover evidence of cost-cutting, 'bodging' and plain ordinary mistakes in the construction. Apart from one dry joint (one end of C5 in Figure 1), most of the latter applied to the loudspeaker unit (more about which later).

As far as cost-cutting is concerned, the most obvious item is the case, a single Bakelite moulding streaked with black dye to emulate a polished, dark wood effect. Doubtless there were contemporary critics who bemoaned the sacrilege of using 'plastic wood' in place of real wood, but obviously much quicker and easier to create. The case bottom is reinforced with two steel rails to carry the weight of the chassis, which is fixed in place by four 4BA screws.

The main chassis itself was pressed from a single sheet of steel and includes front and rear panels only, being fully open on all other sides. There are two thick, flat bars welded transversely across the bottom for it to stand on. This was lightly covered in an extremely bland, battleship-grey paint (but typical). Valve holders are secured with rivets, implying that the chassis with sockets already attached arrived at the assembly line as a complete unit.

Speed obviously took precedence over neatness for installation of the components, hence the interior is a right old spider's nest of loose wiring, and connections were rarely wrapped around tags before soldering. While printed circuit boards per se were unknown at this time, it is nevertheless interesting to note the use of a number of square plastic boards, perforated rather like prototyping boards, used to carry groups of components.

The chassis itself is used as a universal earth bus, hence several fixing nuts include solder tags as earth points. Cost obviously prohibited electrical insulation beyond the absolute minimum, so that for example the two valve top connector clips are totally exposed, of which one carries the full HT, and there is a perturbing amount of bare metal connected to the mains.

Restoration

Photo 3a shows the state of the chassis on initial removal. Most steel items had at least some rust, quite bad in places, including the speaker (but fortunately confined to the upper surfaces, so the chassis interior was still in good condition). Aluminium was coated in white oxide and all bare brass and copper parts were black (if not actually green). In addition the inevitable carpet of fluff that high voltages unerringly attract had been reduced by the damp to a disgusting black layer of filth that covered most horizontal surfaces.

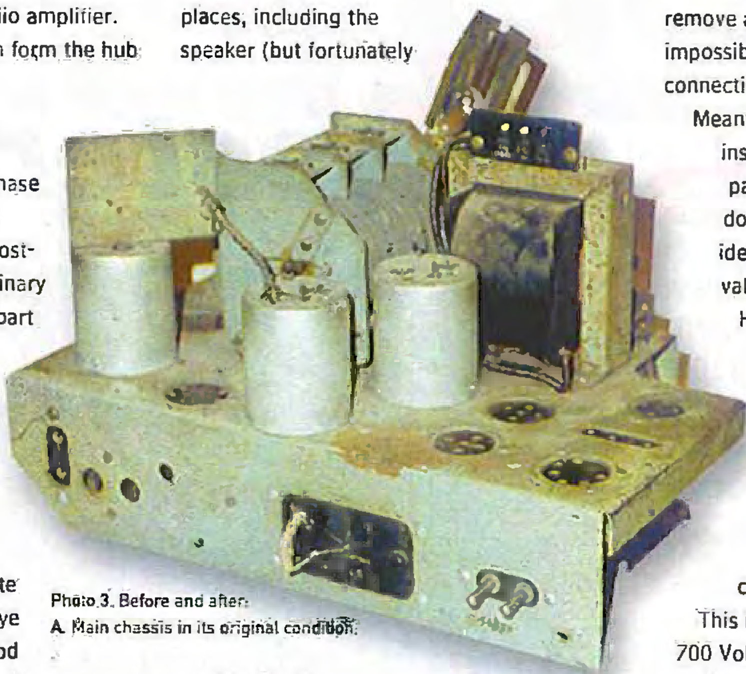


Photo 3. Before and after:
A. Main chassis in its original condition.

Before going any further, however, the first hurdle was to establish whether replacement valves could be sourced. The AC85 has six valves (see Photo 4), all early types with 4 Volt heaters and which have already been obsolete for several decades. The base sockets are archaic, preceding even International Octal, being either B5 (5-pin) or B7 (7-pin). In each case correct orientation is achieved by offsetting two of the pins.

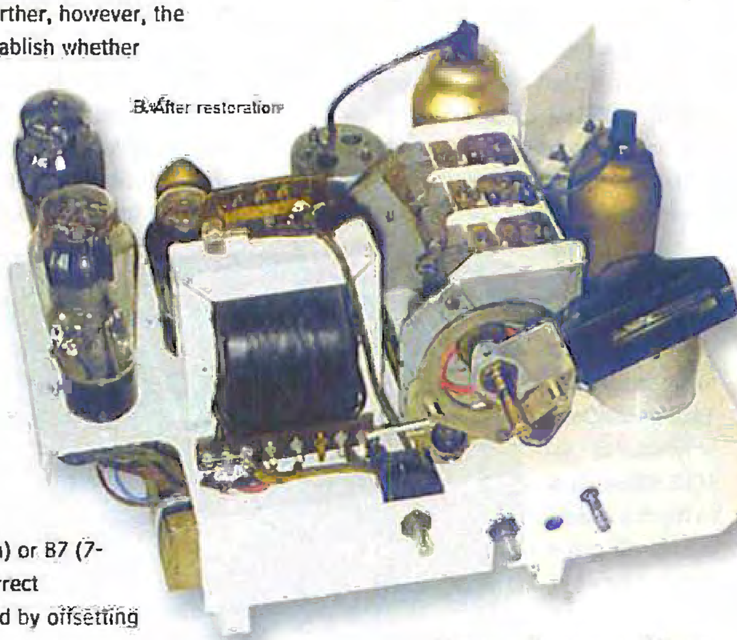
As an aside, in each case for V1 to V3, what looks like gold or silver paint actually covers a layer of aluminium deposited onto the outside of the glass as a metal screen. Prior to this much less convenient, separate screening cans had to be added.

One valve was already known not to work (V5), but it transpired that two others were also non-operational. The top connector of V2 was broken off, possibly due to an attempt to remove a clip stuck with corrosion. It proved impossible to repair the internal wire connection since it is embedded in the glass.

Meanwhile V3 had been mistakenly inserted into the rectifier socket. It was particularly unfortunate that it is a double diode with pin-outs virtually identical to those of the actual rectifier valve V6, because this had enabled the HT to reach the cathode and thence punch through the heater insulation in an attempt to complete its circuit (V6 has no separate cathode pin, it is combined with one of the heater pins). This left the heater of V3 permanently connected to cathode, rendering the valve useless.

This is, by the way, quite apart from the 700 Volts AC that were applied across the anodes, producing an audible arcing that the owner described as 'spluttering'.

Three new valves were therefore needed, and the next problem was correct identification. V1, V3 and V6 were still clearly marked, but the legends for V2 and V4 were completely missing, while that for V5 was partially obliterated. At this point I ought to mention that I am indebted to John Mosely for unloading his valve data books onto me,



B. After restoration

because it was one of these that contained all the answers! By matching the most likely valve type, pin-out diagram and heater voltage, V5 (the failed valve) eventually answered to the name of the PenA4 power output pentode.

V2 was either the VP4A or VP4B. Tracing the circuit established that the top connector

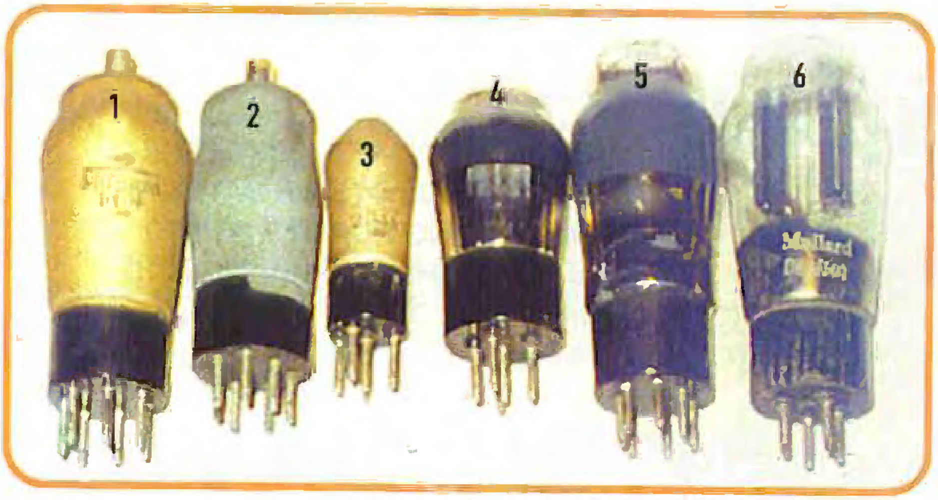


Photo 4. Valves line-up: originally 1. FC4 octode frequency changer. 2. VP4A variable-mu pentode (damaged). 3. 2D4A double diode (damaged). 4. TT4 triode. 5. PenA4 power output pentode (failed). 6. DW4/500 full-wave rectifier.

is anode, meaning it is the VP4A version (in the B version top connector is signal grid). Finally, V4 resolved itself to be the TT4 as the closest match.

It so happened that direct replacements for V2 and V5 were readily available from old stock in the possession of The Chelmer Valve Company www.chelmervalve.co.uk, and at some length V3 was finally located at Crowthorne Tubes of Berkshire (found on the Internet as www.crowthornetubes.co.uk. Restoration could then proceed, commencing with a lengthy process of dismantling, cleaning and repainting of major components.

Photo 6. The restored loudspeaker sub-assembly on its plywood baffle.

Problem Areas

With the aim of re-energising old equipment of this sort, the greatest danger is that of wire insulation. Typically this is rubber, as there were no flexible plastics at that time, but being organic in origin rubber perishes with age and becomes brittle, so it merely cracks and falls off as soon as the wire is flexed. All such wires should be replaced with modern, plastic coated equivalents.

Fortunately very few wires in this receiver were rubber sleeved. Most point-to-point wiring is single-core copper, insulated — quite elaborately by modern standards — by a woven cloth sleeving. Underneath this there is an additional layer of whitish material of uncertain composition, but still sound. Colour coding of a sort exists, but is limited to green, yellow, red and, occasionally, white.

Another possible source of trouble is the poor quality, by modern standards, of passive components. Again due to an acute lack of suitable plastics, many capacitors use waxed paper dielectrics with attendant current leakage problems. Small values appear to be mica or ceramic dielectric types encapsulated in Bakelite.

There are only two electrolytics acting as HT reservoir and smoothing filter for the power supply, both sharing the same negative plate and combined in a rectangular block of a white, waxy substance. Strangely, the whole is then enclosed in a cardboard carton.

This 'condenser pack' appears not to be original, more likely replaced as a repair. One clue is that its three rubber leads are still perfectly sound, another that it was very loosely tied in position with a piece of string looped around two other components. At least I hope it did not leave the factory like that! Lastly, the two positive leads were connected the wrong way round; the smaller value (8µF) being used as the reservoir (should be 16µF). These were duly swapped around and the pack better secured to a mounting rail with plastic tiewraps (see Photo 5).

Resistors are enormous and appear to consist of carbon film deposited onto ceramic rods or tubes measuring approximately 1 x 0.25 inches. Leads are wrapped around the ends and connected by a metal plating technique, and the whole insulated in paint. Despite their large size, power dissipation is modest; one component (R1 in Figure 1) having charred badly due to overheating and was replaced. Colour coding is very strange.

It is interesting to note that it was obviously very difficult to obtain values much less than 1 kilohm with carbon film in 1934, since all resistors less than a few kilohms are of a completely different construction, comprising flat, rectangular paper envelopes most likely containing resistive wire.

Next Month Mike will start by looking at the circuit of the Ecko AC35

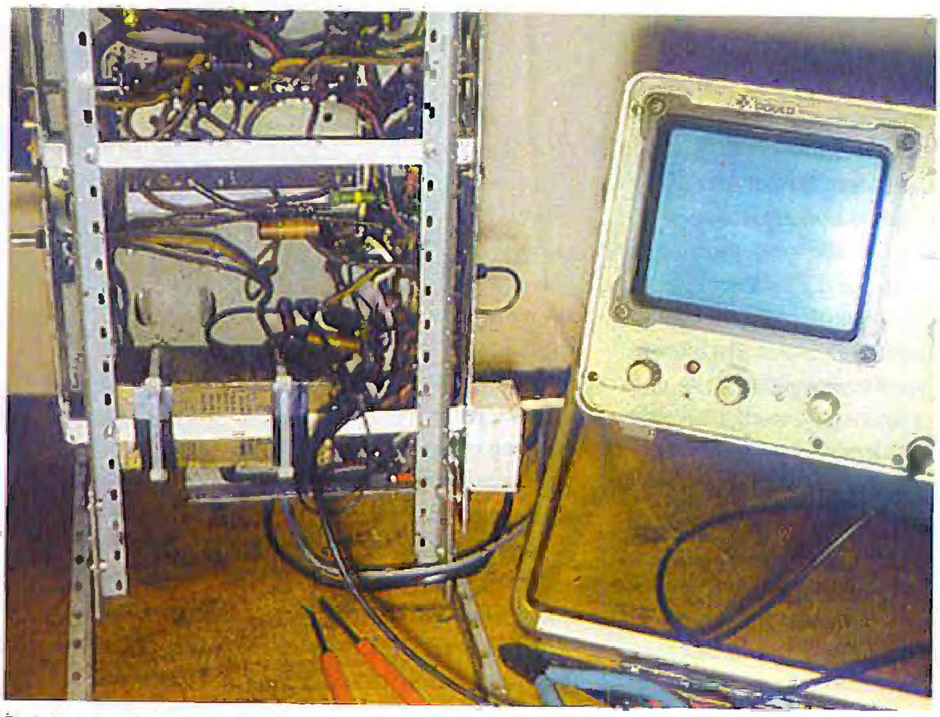


Photo 5. Underside of chassis showing components. Note fabricated support stand for all round access while powered up.