

Vintage Radio

By Rodney Champness, VK3UG



The HMV A13B 4-Valve Twin-Chassis Mantel

Produced by HMV during the early 1950s, the A13B 4-valve mantel receiver was small in size but big in performance. It's also an easy set to work on and a simple modification to the oscillator circuit makes it work even better.

IFIRST SAW one of these receivers at my grandparents' home in the early 1950s. I'm not sure why I was so intrigued with the set; maybe it was because it was so small compared to other radios I was familiar with at the time (mainly large vibrator-powered receivers that ran off batteries). Or perhaps I was impressed by the performance delivered by such a small set.

Of course, by modern standards, it isn't all that small. However, at the

time, it was the smallest I had seen and my grandparents' set was even housed in a brown Bakelite cabinet, just like the A13B receiver featured here.

A little history

HMV has always built interesting receivers, both from a technical viewpoint and in terms of appearance. The cabinet of this receiver is much smaller than other 4-valve superhet receivers. It features rounded edges and a central

dial scale which looks quite attractive, although it is relatively small. The loudspeaker is located to the left and is partly behind the dial scale.

The cabinet has four large holes towards the top of the rear panel, designed to accept four fingers so that the set can be easily lifted and moved from one location to another (after first disconnecting the antenna and unplugging the set from the mains). The antenna supplied with the set was around 6-7m long and this was typically draped along a picture rail or run along the skirting board in the room.

As an aside, radio receivers of this era were often supplied with a short-wire antenna. This could be used in good signal areas instead of the set being connected to a large, outside antenna. Of course, that was before ferrite-rod antennas came into common use.

In practice, most people soon abandoned the idea of shifting such sets from room to room, since relocating the antenna each time was a nuisance. The advent of the ferrite-rod antenna made shifting valve sets easier but it wasn't until transistor receivers arrived that sets became truly portable.

The advent of transistor receivers also eventually made it possible for households to afford multiple sets. By contrast, at the time the HMV A13B was produced, receivers were expensive and the average household could only afford one receiver.

Circuit details

Fig.1 shows the circuit details of the HMV A13B. It's a 4-valve superhet design (broadcast band only) but its performance matches that of many 5-valve receivers due to the fact that its IF (intermediate frequency) amplifier valve also acts as the first audio stage. This particular circuit technique is called "reflexing" and was common in Australia from the 1930s to the mid 1950s. However, it was not used as much in other countries.

The antenna input circuit (top, left)

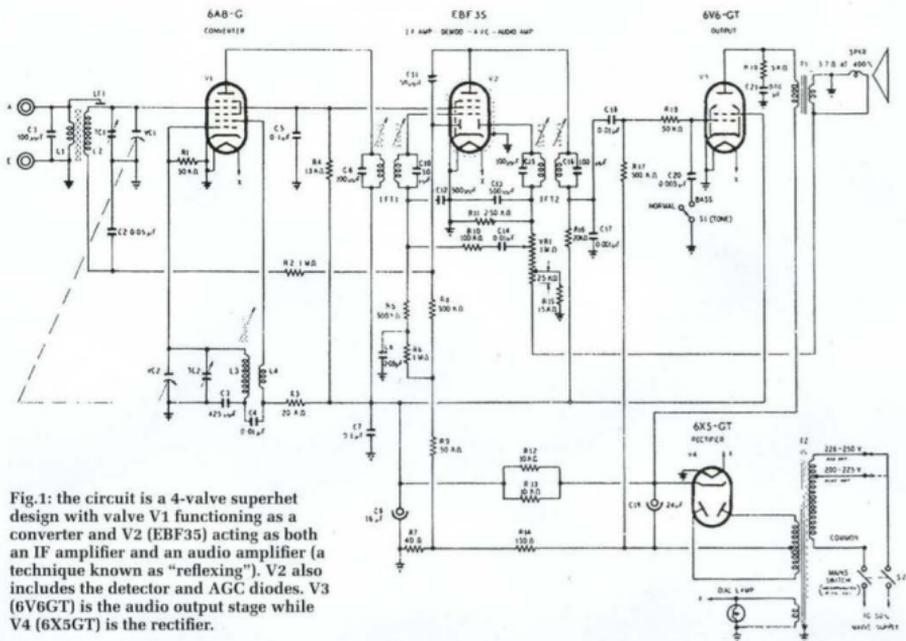


Fig.1: the circuit is a 4-valve superhet design with valve V1 functioning as a converter and V2 (EBF35) acting as both an IF amplifier and an audio amplifier (a technique known as "reflexing"). V2 also includes the detector and AGC diodes. V3 (6V6GT) is the audio output stage while V4 (6X5GT) is the rectifier.

was designed to extract the maximum possible signal from a relatively short antenna. As shown, the antenna input coil L1 is tuned using parallel capacitor C1, the resonant frequency of this combination being just below the bottom end of the broadcast band. By doing this, the maximum possible signal is extracted from the antenna at the low-frequency end of the band and this signal is inductively coupled to coil L2.

At the high-frequency end of the band, capacitor LC1 couples the antenna signal direct to L2. Either way, the signal is fed into a secondary tuned circuit comprising L2, TC1, VC1 & C2. C2 is the AGC bypass capacitor and although it's included in the tuned circuit, it has little effect on its tuning.

The signal from the antenna tuned circuit is fed to the signal grid of V1, a 6ABG converter valve. The local oscillator is a little different from normal in that it uses "padder feedback", achieved by connecting bypass capacitor C4 to the tuned oscillator winding instead of to chassis (earth).

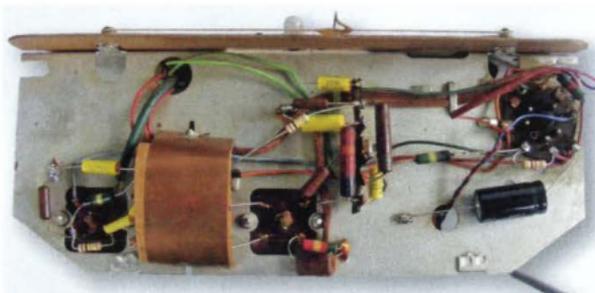


This view inside the receiver shows the unusual "twin-chassis" arrangement, with the parts mounted mainly on the two horizontal sections.

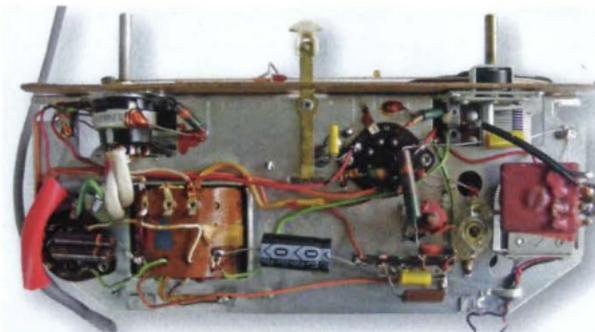
This ensures that the oscillator operates reliably at the low-frequency end of the tuning range.

However, I don't particularly like the design of this circuit. The circuit

used in the A13B was slavishly followed by many manufacturers but other manufacturers used the circuit shown in Fig.2. This is a more dependable circuit that will oscillate



The top section of the chassis supports valves V2 & V3 (EBF35 & 6V6-GT) plus the two IF transformers. Note the shield over the IF/first-audio amplifier valve, which minimises IF signal radiation and hum pick-up.



This view shows the parts layout under the bottom section of the chassis. This section mainly supports valves V2 & V4 (ie, the 6A8G converter & the 6X5-GT rectifier) and the mains transformer.

reliably across the entire tuning range without resorting to tricks like padder feedback. It maintains a more constant degree of feedback between the pri-

mary and the secondary windings than the circuit used by HMV in the A13B.

To prove the effectiveness of this slight circuit modification, try modifying a set using the HMV-style circuit to that in Fig.2. Receivers with 6A7 converters appear to benefit a great deal from this modification and the sensitivity of the set often improves noticeably.

The output from the converter (at the plate of the 6A8G) is fed to the first IF transformer (IFT1) and then to the grid of IF amplifier stage V2, an EBF35. From there, the IF signal is fed to a second IF transformer (IFT2) which then feeds the detector diode in V2.

As an aside, note that C6 and C10 in the first IF transformer have different values, ie, 100pF and 50pF respectively. This means that, unlike IFT2 where the values are equal (100pF), the inductance of IFT1's secondary is double the value of its primary. As

a result, it's not a good idea to swap these two IF transformers (or use an incorrect substitute for IFT1), as the IF gain and hence the sensitivity of the set would be degraded.

The detected audio signal from V2 is fed to the top of volume control VR1. It then passes via C14, R10 and the secondary of IFT1 to the grid of V2, where it is amplified (along with the IF signal). The resulting amplified audio signal is then fed through the primary winding of IFT2 to resistor R16 (20k Ω) and from there to the grid of V3, a 6V6-GT audio output stage, via C18 and R18.

V3 in turn drives the loudspeaker via a speaker transformer.

Note that because V2 acts as both an IF amplifier and audio amplifier, some compromises have been made in regards to some of the component values around this stage. This means that it may not provide the maximum gain that would otherwise be possible, either as an IF amplifier or as an audio amplifier. The usual compromise is to restrict the audio gain to around 15, whereas if the valve had been used purely as an audio amplifier, its gain could be well over 100.

Getting back to the output stage, the 6V6-GT's grid has -10V bias applied to it from the power supply's back-bias network. In addition, negative feedback is applied from the secondary of the audio output transformer to the bottom end of volume control VR1.

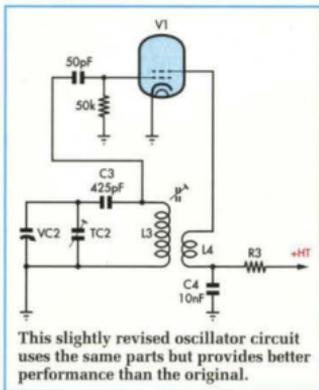
Tone control

The tone control is extremely simple and consists of switch S1 which switches capacitor C20 in or out of circuit. In addition, resistor R19 and capacitor C21 between the 6V6GT's plate and chassis form an elementary fixed tone control. The capacitor has a reactance of about 5k Ω at 3.5kHz, giving a combined impedance for the series resistor-capacitor combination of 10k Ω at this frequency. This impedance drops to just 7.5k Ω at 7kHz.

Power supply

The power supply is quite conventional and is based on a power transformer and a 6X5-GT full-wave rectifier (V4).

As shown in Fig.1, the power transformer primary is tapped for 200-225V mains supplies and for 226-250V supplies (40-50Hz). There are two secondary windings: a heater winding



This slightly revised oscillator circuit uses the same parts but provides better performance than the original.

of 6.3V and a 520V centre-tapped HT (high-tension) winding (ie, 260V either side of the centre tap). Note that the centre tap is connected to chassis via two series resistors (R14 and R7) and these are used to generate the back-bias for the various valves.

The 6X5-GT rectifier produces nearly 270V DC at its cathode and this is applied to the plate circuit of the 6V6-GT via the speaker transformer's primary. By contrast, the HT voltages for the plate circuits of V1 & V2 and the 6V6-GT's screen are obtained via parallel resistors R12 and R13, which limit it to around 185V. The screen circuits for V1 & V2 also have additional filter components connected to their supply lines.

A back-bias voltage of about -2.2V is applied to V1 and V2 and this is obtained across resistor R7 (40Ω). This back-bias is applied via R9 and R8 to the AGC diode in V2, so this receiver has delayed AGC (automatic gain control). The back-bias voltage is also applied via R2 to V1, which receives the full AGC bias developed at the AGC diode.

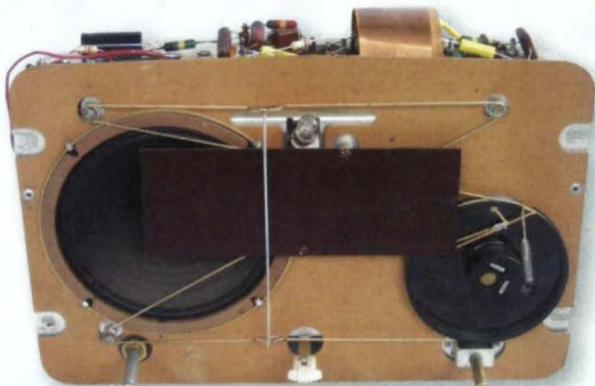
V2 also has -2.2V of back-bias applied to its grid. However, it only receives around 9% of the AGC control voltage compared to V1.

The reason that only a small percentage of AGC voltage is applied to V2 (the IF amplifier-cum-audio amplifier) is simple. Its operating conditions are a compromise and any major variation in these conditions could result in distortion and overload. In addition, because AGC reduces the gain of the IF amplifier stage, it's obvious that it also reduces the gain at audio frequencies as well. So if too much AGC voltage is applied, the audio output could become quite weak in the presence of strong station signals.

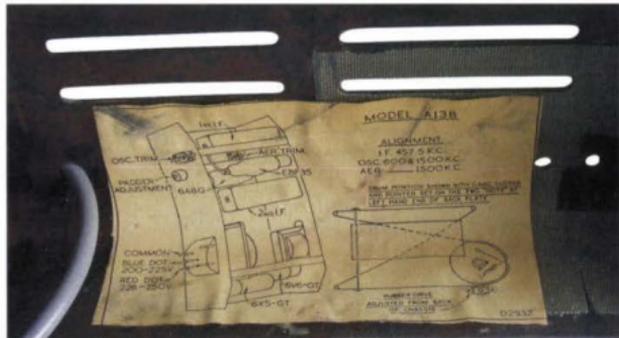
However, with careful circuit design, it's possible to come up with a good compromise to maintain a constant audio level regardless of the incoming signal strength.

Servicing access

Access to the chassis is gained by removing two screws from the rear section of the cabinet and then slipping the back off. Once this is done, the unusual layout of the receiver is immediately obvious. It has a C-shaped "twin-chassis" arrangement, with the parts mounted mainly on two



The loudspeaker is attached to the front vertical section of the chassis and sits partly behind the dark backing material for the dial scale.



A label inside the cabinet indicates the alignment points and the valve types (and their locations). It also shows the dial-cord arrangement.

horizontal sections, one at the top and the other at the bottom. The vertical section carries the loudspeaker and the dial-drive components.

To remove the chassis, it is first necessary to remove both knobs and centre the tone control switch between the two rotary controls. It's then just a matter of removing four mounting screws, after which the chassis and cabinet front can be separated.

Once the chassis has been removed, it's easy to access all the parts, including the dial-drive mechanism. Most of the larger parts, including the coils and transformers, would rarely (if ever) require replacement. Only the occasional valve replacement would be necessary.

Two large holes in the bottom section of the chassis provide access to the bottom tuning slugs of the IF transformers. Note that the circuitry around the IF/first audio valve is shielded to minimise IF signal radiation. This shielding also helps prevent the audio stage from picking up mains radiation, which would cause audible hum in the output.

The chassis layout and wiring of this set are quite logical and access for normal service is a dream compared to many other sets. A label on a curved section inside the cabinet shows the valve types, the dial-drive layout and the locations of the alignment adjustments. It also shows the mains winding taps for the transformer primary.



The rear section of the cabinet has four large "finger holes" so that the set can be easily picked up and carried. Undoing the two screws allows the rear section to be removed and provides good access to most parts with the chassis in-situ.

So even without a circuit diagram, it's not particularly difficult to find your way around this chassis. However, because it is a reflex set, a circuit diagram is handy when working around that IF/audio amplifier stage (V2), as this stage is more complex than in many other receivers.

Restoration

This old HMV A13B was overhauled and restored to full working order by

its owner (Mark) and one of his friends. First, the figure-8 power lead was replaced with a 3-core cable (securely anchored using a cable clamp) so that the chassis could be safely earthed. That done, the capacitors were all checked and quite a few were found to be electrically leaky, with resistances of just a few megohms when they should have been greater than 200M Ω (and preferably in excess of 1000M Ω).

Several of the electrolytic capacitors

had also gone low in value and so all the electrolytics were replaced as a matter of course. A number of out-of-tolerance resistors were also replaced but all the valves checked out OK.

This work solved an annoying intermittent crackling in the audio that had previously been evident. In fact, the set then performed so well that the IF stage alignment was left alone. It may have been possible to wring just a little more performance out of the receiver if an alignment had been done but it was thought that this was already was close to optimum.

Keep the leads clean

As an aside, my own supply of resistors and capacitors is quite extensive. Most of these parts are new-old-stock (NOS) and often 20-30 years old, which means that their leads have tarnished in many cases.

As a result, when using these parts, I have to carefully clean the tarnish off using sandpaper and sometimes even a scraper to get down to bright metal which can be soldered. Neglecting to do this would result in bad solder joints and could easily introduce numerous new faults into equipment that was being serviced.

Mark didn't have this problem because his replacement parts were purchased new. However, it's still something to keep in mind if using parts that you've had stashed away for some time.

Summary

HMV has always produced well-designed receivers and this set is no exception. However, as stated earlier, the oscillator circuit has some minor shortcomings and I much prefer the circuit shown in Fig.2. The components used in this revised circuit are the same as those used in the original but from my experience, it offers better performance.

The oscillator circuit used by HMV in the A13B wasn't unusual though. The same configuration was used by other manufacturers, including AWA, and "Radio & Hobbies" magazine also used it in many of their AM receiver designs.

Apart from my beef about the oscillator circuit, the rest of the circuit is to HMV's customary high standard. The performance of the set is also very good and I would be happy to have one in my collection.

SC



Another view inside the old HMV A13B with the rear section of the cabinet removed. Two holes in the bottom section of the chassis provide easy access to the adjustment screws of the IF transformers.