

Vintage Radio

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The HMV B11A 5-valve battery-operated mantel receiver

Manufactured around 1950, the HMV B11A is a battery-operated mantel receiver that was designed for use in rural areas. It was one of the first domestic receivers to use miniature 7-pin valves.

BATTERY-OPERATED RECEIVERS made between the mid-1930s and the late 1940s used valves that required 2V on their filaments and a high-tension (HT) supply of about 135V. This involved using a 2V lead-acid cell and three 45V dry batteries.

These batteries were all quite expensive in one way or another. The 2V cell

required regular recharging and this was usually done by the local radio serviceman or at a local motor vehicle repair garage. This was not only inconvenient but also meant that the household was sometimes deprived of the use of the radio for a day or two. The 45V batteries could not be recharged and were expensive to buy.

As a result, battery-operated sets were usually only turned on when a specific program was being broadcast, then turned off. They were certainly not left on all day as background entertainment, because the cost of running them was too great. Of course, these sets were mostly located in rural areas that lacked mains power, so the batteries had to be conserved as much as possible.

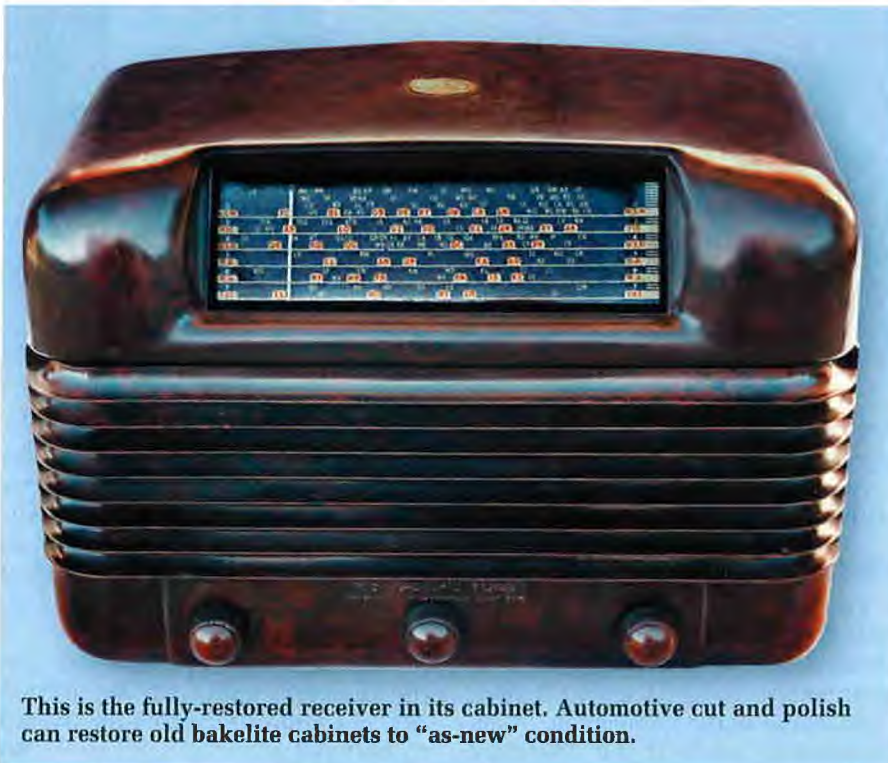
To lessen the cost of recharging and replacing batteries, valves were developed that only required 1.4V on the filaments and around 90V of HT. These became available around the beginning of WWII and used the octal valve base. Later on, around 1945, 7-pin miniature valves using the same voltages became available – to the military at least – and these had somewhat similar characteristics to their octal predecessors.

Seven-pin miniature valves were subsequently used in consumer equipment in the late 1940s and continued in use up until the early 1960s when valves gave way to transistors.

The HMV B11A

HMV's B11A comes in a "chunky" bakelite case and features a slide-rule dial scale which was quite typical of the era. There are only three controls: off-on-tone, volume and tuning.

The set itself would have been aimed at the middle of the market. It is a broadcast band only receiver and instead of including a radio frequency (RF) stage as was usual in most 5-valve battery radios, this set has two stages of intermediate frequency (IF) amplification instead. This simplified the front end, as a 2-gang tuning capacitor could be used instead of a 3-gang unit. This



This is the fully-restored receiver in its cabinet. Automotive cut and polish can restore old bakelite cabinets to "as-new" condition.

also meant that the associated extra tuning coil and adjustments were not needed.

One drawback is that the dial scale has no provision for dial lighting, so tuning at night requires adequate external lighting. This no doubt was an economy measure.

The chassis itself was originally designed to take octal battery valves, as evidenced by the small plates used to cover the holes where these valves were located. The 7-pin miniature valves use the same locations and so their sockets are mounted in the middle of these plates.

Circuit details

Fig.1 shows the circuit details of the set. It's a fairly conventional superhet design with no surprises.

The converter is based on a 1R5 which is neutralised via capacitor C5, with resistor R3 used to smooth out variations in the oscillator's output across the band. The 457.5kHz converter output is then coupled to the first IF stage which uses a 1T4. Its output in turn goes to the second IF stage which also uses a 1T4.

From there, the signal goes to the detector and an automatic gain control (AGC) diode in the 1S5. The resulting audio output from the detector/AGC diode is then applied to the grid of the pentode section of the 1S5 via the volume control. This in turn feeds the 3V4 output stage which drives the speaker via output transformer T1.

The AGC signal is taken from the top of the volume control and is fed via R7 to R1, C3 & C11. The receiver uses simple AGC, as delayed AGC (DAGC) could not easily be achieved with the miniature battery valves that were available. However, this appears to have little effect on the receiver's performance.

The audio amplifier has two negative feedback loops. First, C25 gives some negative feedback to the screen of the 1S5 from the voice coil. The other loop is via C23 when it is connected to the plate of the 3V4. This capacitor can be switched to one of three positions and acts as a tone control.

The 3V4 is the only valve which has bias applied to it and this is achieved using back bias resistor R14. The 1S5 obtains contact potential bias due to the high value of its grid resistor. By contrast, the RF stages have no standing bias.



Despite its rather grubby condition, this set was relatively easy to restore as all the original parts were still in place. The chassis was cleaned by first dusting it with a paintbrush and then using a kerosene-soaked rag and a kitchen scourer.



This view shows the front of the chassis after restoration. The dial-drum is driven by a rubber tyre assembly.

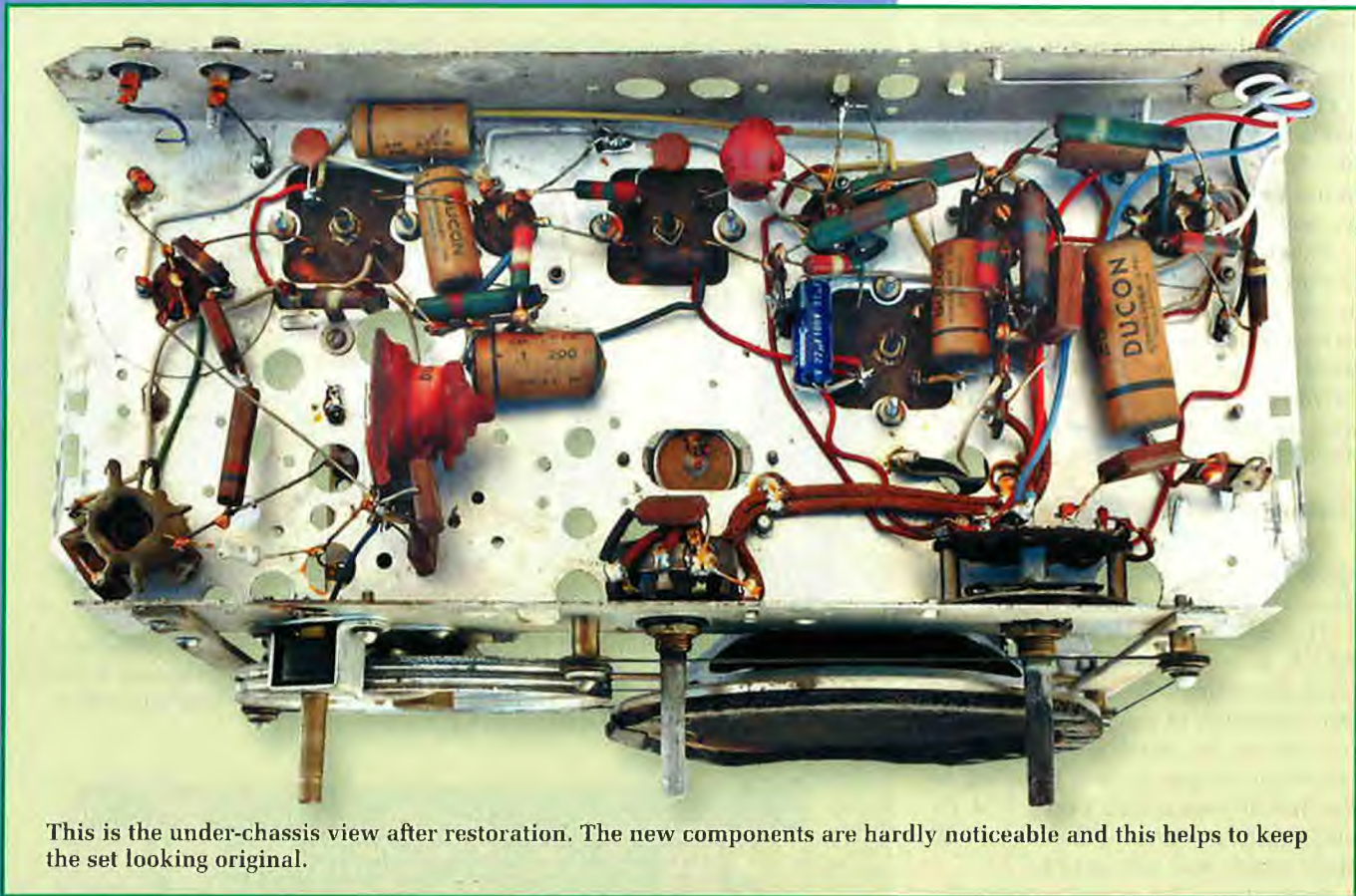
Note that V1 and V2 have AGC applied to them even with no signal being received. That's due to the noise picked up on the antenna generating some AGC voltage. V3 has no AGC applied to it but will develop grid leak bias if the incoming signal is sufficiently great.

One interesting little circuit quirk is the fitting of the radio frequency choke (RFC) CK1 in the filament supply line. This isolates the second IF amplifier

from the converter and the first IF amplifier and makes the receiver more stable. As an experiment, I shorted out this RFC but found no evidence of any feedback anywhere across the broadcast band. Apparently, HMV wanted to make sure that there was no likelihood of instability in the IF amplifier stages.

Dismantling & cleaning

The radio was quite grubby when



This is the under-chassis view after restoration. The new components are hardly noticeable and this helps to keep the set looking original.



The chassis is fitted with a roll-over frame and can be tipped into any position for servicing without damaging other parts.

it came into my possession, having been stored for quite a few years after a nasty accident (more on that later). The back panel was held on by only one screw and this was removed, as were the three knobs at the front. That done, the two chassis retaining screws were removed and the chassis separated from the cabinet.

The first thing I noticed was that the roll-over frame had four screws missing along the rear of the chassis. This problem was immediately fixed using some small self-tapping screws, after which the chassis was dusted using a paintbrush to remove any loose dirt. It was then rubbed down using kerosene and a kitchen scourer and a most of the muck came straight off.

Admittedly, there was some corrosion where mice had been.

Fortunately, their stay must have been brief, as little damage was caused.

Having removed the grime, I oiled all the pulleys and bearings on the dial drive system, along with the various control shafts. That done, the dial-drive pointer guide was cleaned with a kerosene dipped rag and then oiled sparingly.

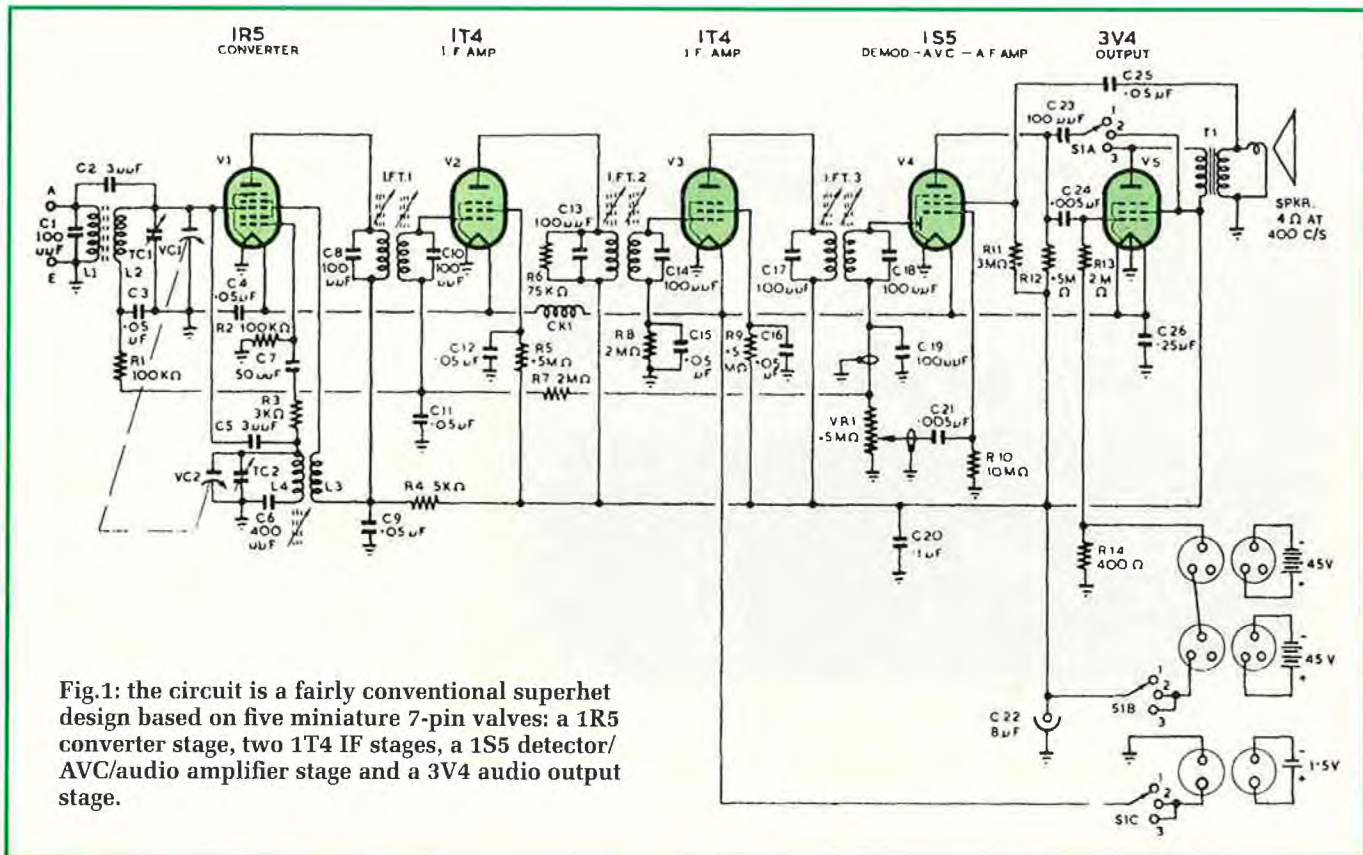


Fig.1: the circuit is a fairly conventional superhet design based on five miniature 7-pin valves: a 1R5 converter stage, two 1T4 IF stages, a 1S5 detector/AVC/audio amplifier stage and a 3V4 audio output stage.

The mechanics of the receiver were now working as they should, with one exception: the dial drive was a little “lumpy” in its action due to a flat spot on the drive rubber. It wasn’t bad enough to worry about, however.

Next, the speaker grill was removed (it’s attached to the main part of the cabinet by four speed nuts), after which the cabinet (which splits into two halves) and knobs were given a good scrub in soapy water. Once dry, these parts were then polished using automotive cut and polish and this brought the cabinet up to as-new appearance.

Overhauling the electronics

With the cleaning done, it was then time to look at getting the receiver up and running. Inspection under the chassis showed an uncluttered layout, so overhauling the electronics was relatively easy. In fact, it would be nice if all receivers were as easy to service as this one.

The four battery leads had seen better days, so I decided to replace them with new hook-up wire. There were no plugs on the battery leads so the circuit had to be carefully checked to determine where each wire went

– connecting the filaments to the HT lines would not have been nice!

Having done that, I checked for a circuit between the filament positive rail and chassis. It should have measured just a few ohms but it was open circuit. It didn’t take long for the penny to drop – the previous owner had obviously connected the 90V HT line to the filaments and in a few milliseconds had blown the filaments in all five valves. As a result, I labelled the LT and HT leads appropriately to avoid making the same mistake in the future.

Because of the previous owner’s carelessness, I had to replace all five valves. Of course, this was also the likely reason that the radio had been set aside in the first place.

Fortunately, I have a good stock of new and secondhand valves, otherwise replacing them would have been an expensive exercise. In fact, two of mine were faulty as well, so I replaced seven valves in all to get the set operating. These battery valves have filaments that are rated at 50mA and are quite delicate. Even when all operating conditions are optimum, they have a shorter lives than their beefier mains-operated cousins.

Before replacing the valves, I

cleaned the sockets with Inox contact cleaner. I then connected my dry battery eliminator which supplies a variety of voltages to suit receivers like this one. The various connections were then triple-checked before applying power, to avoid wrecking the valve filaments again.

With the fresh valves fitted and an outside antenna and earth attached, the receiver was up and running but its performance was poor. Most mains



This close-up view shows the rubber tyre dial-drive system used on the B11A receiver.



This is the old B11A receiver before restoration. It was covered in dust and grime, having been stored in a garage for many years.

receivers don't require a separate earth to achieve good performance as they are "earthed" capacitively via the mains. By contrast, a dry-battery set does not have this "capacitive" earth and therefore requires an earth for best performance.

A few quick checks revealed that the set was drawing normal current and the voltage readings on all valves were within specification with one exception – the voltage on the screen of the second IF valve was noticeably higher than it should have been. This valve didn't appear to be drawing any current, so another 1T4 was fitted and then the set didn't work at all! The reason wasn't hard to find – its filament was open circuit.

Fortunately, I had another 1T4 and fitting that made all the difference to the performance. The set was now performing quite well, although the front-end alignment was out, with stations not quite where they should appear on the dial.

Alignment

The alignment procedure for this set is quite straightforward. My first step was to set the receiver to the 621kHz mark on the dial, which is marked as station 3AR (now 3RN). That done, the oscillator coil slug was adjusted until 3RN came in.

Next, I tuned to the position for 3AK (1500kHz) at the other end of the dial and set my signal generator to run at 1500kHz with tone modulation. The generator's output was loosely coupled to the aerial lead (ie, placed near it) and I then adjusted the oscillator trimmer on the tuning gang until I heard the tone from the speaker.

That done, I rechecked the oscillator coil adjustment at the low-frequency end and then at the high-frequency end again, as these two adjustments interact with each other. I then tuned to a nearby relatively weak station at the high-frequency end of the dial and peaked the antenna trimmer.

Having completed the front-end alignment, it was time to align the IF stages. This should also be done with the set tuned to a weak station. However, I found that the IF transformers were all correctly aligned, so no work was required here. This didn't surprise me, as the set appears to have had very little work done on it under the chassis.

Finally, the various adjustments were all sealed using a dab of nail polish on the trimmers and re-melted wax (using a soldering iron) on the adjustment slugs.

Capacitor checks

Some readers may be wondering

why my standard practice of checking all critical capacitors before switching on was skipped on this occasion. The reason is that because the voltages are relatively low in this battery-operated set, a few liberties were taken.

However, once the set was working, I decided to take a closer look. Normally, I would replace audio coupler C24 and the two AGC bypass capacitors (C3 & C11). In this set, however, the audio coupler is a mica capacitor and had minimal leakage, so it wasn't worth replacing. And if the two AGC bypasses have high leakage, it won't harm the set – it just won't work as well and will probably overload on strong signals.

I checked the voltage on the grid of the 3V4 with a digital multimeter and it was normal. I then tuned the set to a strong station and measured -5V at the detector and only -2.5V on the AGC line. As a result, I replaced the two AGC bypasses and the voltage on the detector dropped to -3.5V (the voltage across the two AGC bypasses was also -3.5V). The AGC system was now working as it should and the audio output level was nearly the same on both strong and weak stations.

Next, I checked the paper capacitors on the HT line and replaced any that had excessive leakage (as measured on my high-voltage insulation tester). I also checked the HT filter electrolytic capacitor (C22) and found that it had dropped to just 1µF. This was replaced with a 22µF 160V electrolytic, as I didn't have the correct value (8µF).

The receiver was now performing quite well and proved to be remarkably quiet with no signal coming in. It will operate quite successfully with the HT voltage as low as 45V. We often look at such simple sets and think that they cannot be good performers. However, as shown by this set, that assumption is often wrong.

Summary

The HMV B11A really is a surprise packet. It's a rather unassuming little set but gives a very good account of itself. It is quite sensitive, has adequate volume and will work satisfactorily with nearly exhausted dry batteries. The design is straightforward and access for servicing is good.

HMV receivers of this era have always impressed me and this one is no exception. It is a worthwhile addition to any radio buff's collection. **SC**