Vintage Radio

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The Mullard Meteor 600 4-Valve Mantel Receiver

A great variety of valve receivers were designed and produced for the domestic market in Australia. These ranged from complex, multiband receivers to relatively simple sets designed for the bottom end of the market. This little receiver falls into the latter category and although it's a reasonable performer, it could have been much better.

THE MULLARD Meteor 600 came onto the market in 1947, at a time when Australia was still recovering from the restrictions and scarcity of raw materials due to WWII. It is housed in a relatively small brown bakelite cabinet but the components are not squeezed in, as they were in some small sets of the era.

As can be seen from the photos, the patterning on the front of the cabinet is rather unusual and this accentuates the round dial scale and its escutcheon. It is an interesting feature and helps make the set reasonably attractive in appearance.

Another feature is that the chassis is easily removed from the cabinet. This simply involves removing the two control knobs plus four screws from the bottom of the cabinet that secure the

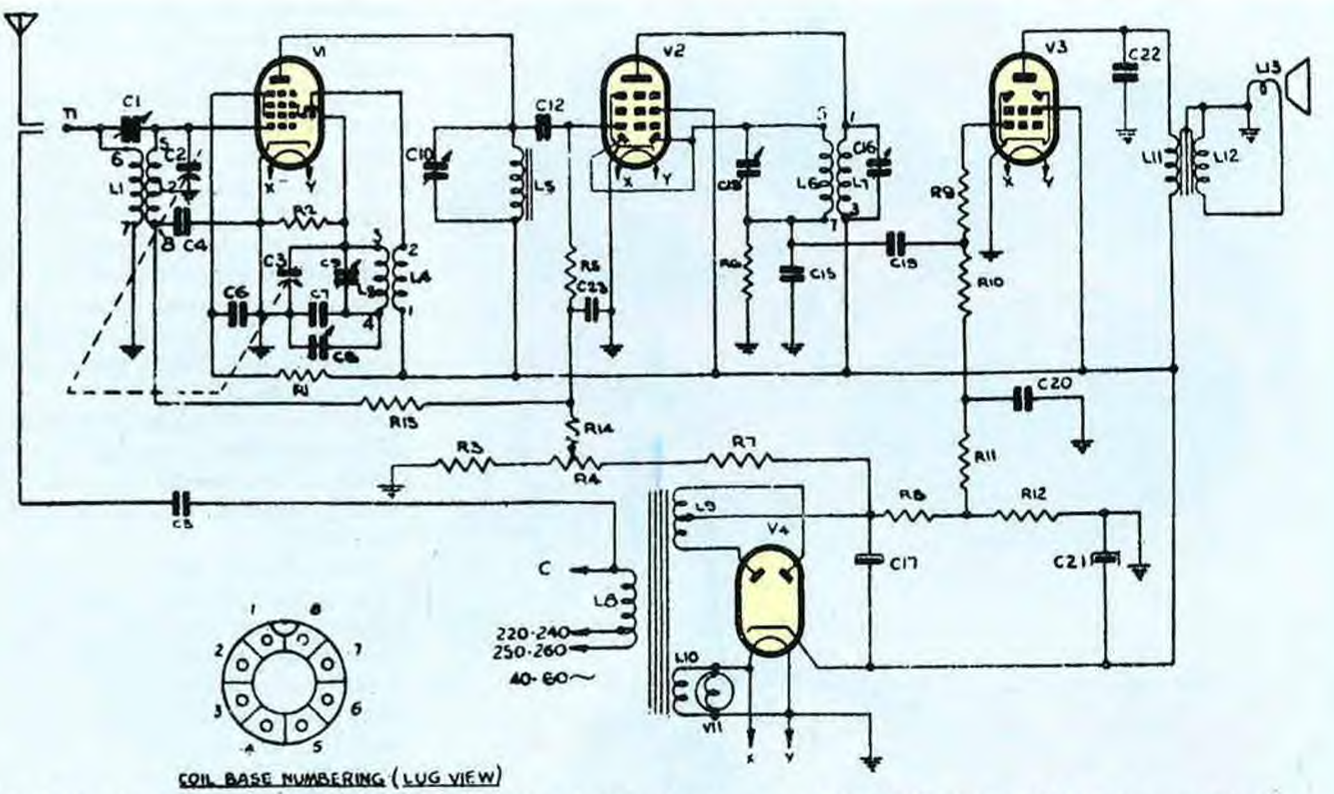


Fig.1: the circuit of the Mullard Meteor 600. It's basically a 4-valve superhet with the IF amplifier stage operating at 455kHz. The volume control is unconventional & works by varying the back bias to the first two valves in the line-up.

chassis in place. The chassis can then be slid out of the cabinet, complete with its loudspeaker and dial scale.

The dial scale is circular and has a red background with yellow station markings and a yellow dial pointer. There are a few stations from NSW, Victoria, Queensland, Tasmania and South Australia shown on the scale but none from Western Australia. This initially made me wonder if the set was even marketed in WA, although I now think it probably was. That's because the ratings shown for the power transformer indicate that it can be used at 40Hz, which was the mains frequency used in Perth at that time.

The Mullard Meteor 600 covers the broadcast band from 540-1620kHz and has a fairly simple tuning system. This uses a control shaft to drive a drum attached to the tuning gang via a dial cord. The dial cord is simply wrapped around the control shaft three times and the ends attached to the dial drum so that it can be rotated one way or the other. However, although the mechanism is simple, replacing the dial cord requires removal of the dial scale to gain access to the drum.

One interesting feature is the way in which the volume control works. It doesn't work in the conventional manner which is to vary the audio level that's fed to the audio output stage. Instead, in this set (and a number of others of the same era), it varies the back bias to control the gain of the first two valves in the receiver and hence the audio output volume.

The volume and tuning controls are symmetrically located beneath the dial, with the volume control on the left and the tuning control on the right. As with many other receivers made at that time, there is no on-off switch and the set has to be switched on and off at the wall socket.

Circuit details

Fig.1 shows the circuit details of the Mullard Meteor 600. It's basically a 4-valve superhet with an IF amplifying stage operating at 455kHz.

There are not many circuit variations that can be implemented in such a simple 4-valve broadcast mantel receiver. There is nothing that can be considered unusual and similar circuits are found in other 4-valve mains-powered radios from the late 40s and early 50s.

As shown in Fig.1, the antenna is connected to the first tuned circuit via a coupled winding and a top-coupled trimmer capacitor. The antenna could be either a separate external antenna or it could use the mains wiring as an antenna!

In greater detail, small kitchen-model receivers often had provision to use the mains as the antenna and in this case C5, a 100pF high-voltage capacitor, was used to couple one side of the mains to the antenna tuned circuit. This method did have some serious drawbacks, however. It might have been convenient way of eliminating the need for an external antenna but the RF signal from mains would have been quite noisy. **Additionally, should the capacitor short, both the antenna and the chassis could become live and dangerous** (ie, it would be at mains potential), as the latter wasn't earthed via the mains plug.

The converter stage (V1) is based on an ECH35 triode-hexode. The oscillator components consist of capacitors C3, C7, C8 & C9, coils L3 & L4, and oscillator grid resistor R2. This produces the sum and difference frequencies which are then fed to an IF tuned circuit consisting of coil L5 and capacitor C10. This tuned circuit is unshielded (see photo) and is initially adjusted

The old Mullard Meteor 600 cleaned up quite well, as is evident from these above-chassis views. The parts on the top of the chassis are easy to access.

using a Philips-type fixed-wire trimmer. Once adjusted, it was expected to retain its tuning almost indefinitely although this doesn't always work out in practice as we shall see.

Both the antenna coil and the oscillator coil are housed in the same metal can, located on the back edge of the chassis. This is convenient for access but means that both would have to be replaced if a fault developed in either section.

The signal from V1 is applied via the tuned circuit to V2, an EBF35 IF (intermediate frequency) amplifier. Bias is applied to both V2 and V1 via resistors R5 and R15. R14 and C23 act as a filter for any hum that may be on the back bias line, which consists of R7, R4 and R3. R4 varies this bias from -1.2V up to -26V.

At -26V, the EBF35 will still have some gain, as its plate current is not cut off until the bias reaches around -38V. However, the ECH35 will be cut off, as its cut-off voltage is -17V, so effectively the volume will be zero even before the volume control is at its minimum setting.

V2 amplifies the 455kHz signal and this is applied to the IF transformer which consists of L6, L7, C13 and C16. The output of this transformer is then applied to the detector diodes in V2 and the detected audio signal is developed across resistor R6. The signal is then coupled to the grid of V3 (6V6GT) and this stage then drives the speaker transformer and a 5-inch (125mm) speaker.

Bias for the 6V6GT is obtained from another back-bias voltage divider consisting of resistors R8 and R12. This divider supplies -5.5V to the grid of the 6V6GT.

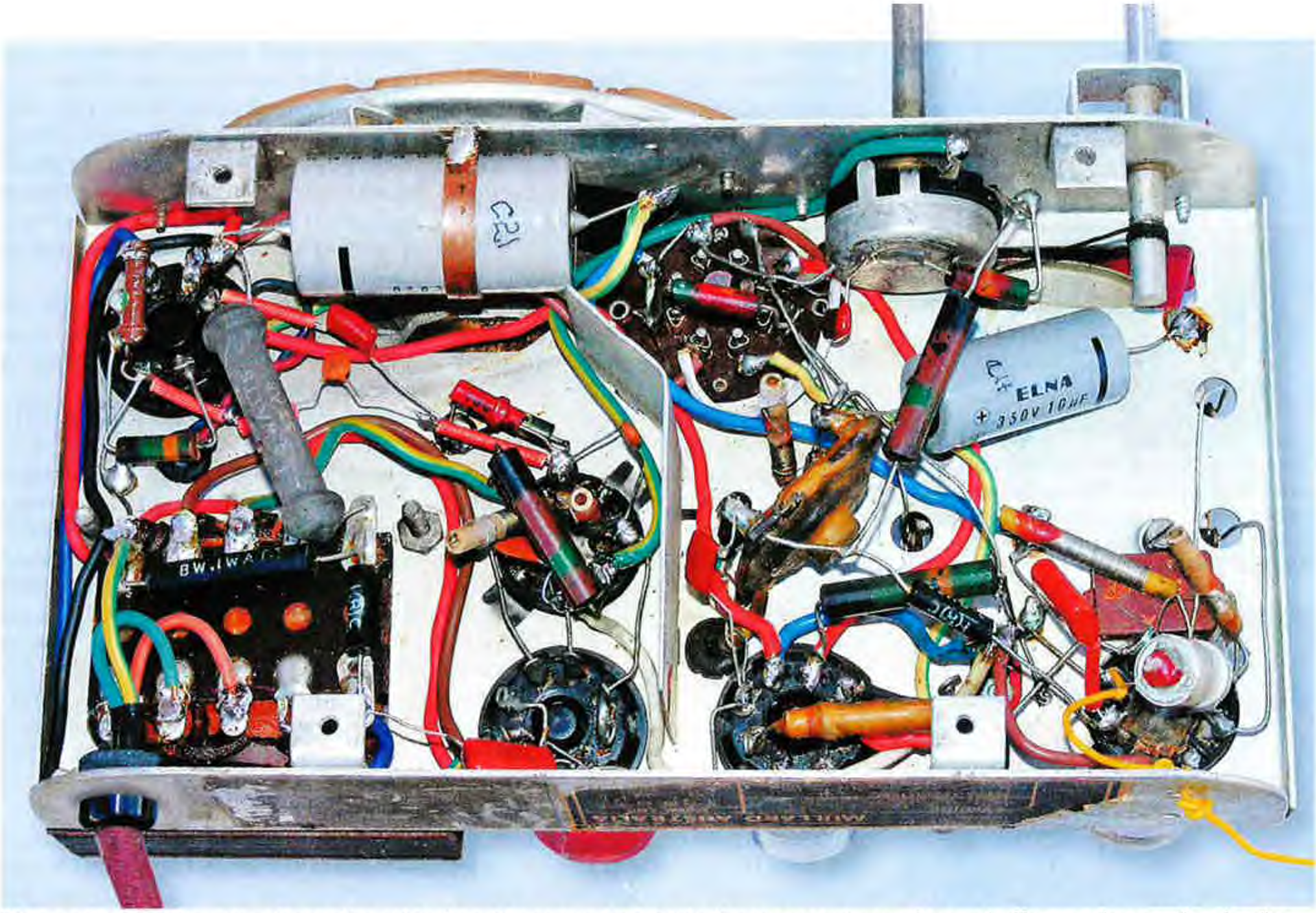
Power for the receiver is derived via a mains transformer which has a tapped primary to suit mains voltages between 220V and 260V AC (40-60Hz). In the service notes, there is a comment that the transformer lamination stack may be one inch (25.4mm) or 1.5 inches (38mm) high. I believe that for 40Hz mains, the stack would have been 1.5 inches high. The transformer in this particular set is designed for 50Hz and 60Hz mains, as it only has a one-inch high lamination stack.

The HT secondary winding of the transformer drives a 6X5GT rectifier (V4) and the filter capacitors have common positive terminals, while the filtering resistors are wired into the negative supply line and consist of R8 and R12.

Back bias

The voltage drop across the back bias line of R8 and R12 is around 75V. I question why such a high voltage is dropped across the network. It seems to me that more effective use of the available high-tension (HT) voltage could have been made. The voltage across C17 is of the order of 185V and with 75V dropped across the back bias network, only 110V is available for the valves. The total HT current drain is around 28 milliamps.

6V6GT valves really don't work all that well until they have 150V or more on their plate and screen elements. By reducing the voltage drop across the back bias network and re-jigging the power supply circuit, around 150V could have been supplied to the 6V6GT. This could have been obtained without changing the power transformer or many other small parts.



This under-chassis view shows the set before it was rewired. Note the incorrect use of green/yellow mains earth wire for some of the connections (this wiring was later replaced).

Because of the low HT voltage, the audio output is quite limited and it becomes distorted if pressed hard on strong stations.

Restoration

The owner of this set kindly loaned it to me so that I could complete the restoration and write this article. When he bought it, it had largely been restored. However, a common problem is that although sets are often advertised as having been restored, the restoration is often not complete or has not been done correctly. Such was the case with this radio.

As mentioned earlier, the set is easily removed from the cabinet and the works readily accessed. The cabinet is in good condition and required no attention from me. However, a quick look at the chassis showed that the frequency converter had been changed, along with the paper and electrolytic capacitors. The wiring had also been changed.

The chassis layout should have been better that it is. In some cases, the inputs and outputs are close together and this has made it necessary to fit a metal shield in the centre of the chassis to ensure stability. The coils connected to the converter valve are located quite some distance apart too. In addition, placing the rectifier valve next to the IF/detector valve is just asking for hum to show up in the audio output.

In fact, the audio coupling capacitor is only 1nF, which does indeed suggest there was a problem with hum in the audio. By using a low-value capacitor here, the low-frequency output is restricted, reducing the hum problem in the process.

Only one lead of the original wiring was left in the set. That was the earth lead and the insulation on it had perished. No doubt, the previous restorer had replaced the wiring because the insulation had perished.

Although the replacement wiring had been installed neatly, the type of wire used was incorrect. In particular, scraps of mains wire had been used in various places, including green/yellow mains wire. The latter should only be used for mains earth wiring.

As a result, much of the wiring was redone, not only to conform to the necessary standards but also to make the restoration look more original.

The replacement capacitors had all been wired in correctly and the two replacement electrolytic capacitors even had C17 and C21 marked on them. However, they had been transposed in the circuit, which could prove confusing. **There was no sign of the mains antenna capacitor, which I would have removed anyway for safety reasons.**

Finally, the original 2-core mains lead had been replaced with a 3-core lead and the chassis earthed. However, this lead had not been anchored correctly and so had to be secured using a cordgrip grommet.

Does it work?

Everything else appeared to be in good order so the next step was to test the mains transformer with a high-voltage insulation tester. This showed no signs of excessive leakage between its windings or to the chassis, so it was now time to try the set out.

The first step was to apply power

This photo shows the three trimmer capacitors around the oscillator & antenna coils. Two are semi-fixed tubular types while the third is a Philips "beehive" type.

The first 455kHz IF tuned circuit consists of coil L5 & its parallel semi-fixed trimmer C10.

with the chassis resting upside down and check the voltages at various points in the circuit. These were all found to be quite close to those listed in the service sheet and the power consumption was a quite reasonable 24W. I then connected an external antenna to the set but found that the performance was nothing to get excited about.

I tried replacing the EBF35 IF amplifier and the 6V6GT audio output valves but this made no difference. I didn't try changing the ECH35 converter, as it appeared to be new.

So what was causing the performance of the receiver to be so poor? The voltages were close to what they should be, the necessary capacitors had been replaced and the defective wiring had been replaced.

This set (and some Philips sets) uses custom-made semi-fixed capacitors which act as trimmers in the tuned circuits. A couple of these trimmers can be seen in the photo of the oscillator/antenna coil assembly, with one towards the top of the picture. It consists of a thick wire inside a ceramic tube, with many turns of fine wire on the outside of the tube. The number of turns of wire wound on the ceramic tube determines the capacitor's value.

To adjust these trimmers (or semi-fixed capacitors), it is necessary to initially wind on more turns than required, then gradually remove turns until the circuit is tuned to the correct frequency (it's too bad if you take too many turns off). This set has five of these trimmers and the only trimmer not of this type is C9 which is a Philips beehive-type trimmer.

As mentioned previously, the semi-fixed capacitors are meant to retain their values and supposedly never need readjustment after the set leaves the factory. However, that was wishful thinking as some certainly needed tweaking in this set and they are difficult to deal with.

The previous restorer had decided to leave these "one-time" adjustable trimmers well alone. However, I decided I just had to bite the bullet and adjust some of them to improve the set's lacklustre performance. They are hard to adjust and **extreme care is needed when doing this as two of them operate at the HT voltage!** However, it needed to be done if the set was to operate correctly.

First, I adjusted C9 so that the set tuned to the local Italian station on 1629kHz, then checked the alignment of the IF stage.

The circuit seemed to be roughly tuned to 455kHz but the response to nearby frequencies was greater than expected, indicating that the IF stage needed alignment. I assumed that the capacitors had been adjusted correctly when the set was made so to make the adjustments a bit easier, I placed small 10pF mica capacitors across each tuned winding. I then set the signal generator to 455kHz and gradually removed turns of wire from each trimmer until the peak response had just been reached and was beginning to dip again.

When I went too far, I just rewound several of the turns back onto the ceramic tube and glued them in place. It's not a very elegant method but it works.

Because both C10 and C16 are live to around 110V (with respect to the chassis), extreme care is needed to ensure that nothing shorts when pulling the wire off to adjust these trimmers. And although I thought I was being careful, I wasn't careful enough and did get a "bite" off the 110V.

In retrospect I should have worn rubber gloves when doing this task and I certainly will in future. So be warned – even experienced people can make mistakes. Unfortunately though, these adjustments cannot be made with the set turned off otherwise I would have done it that way.

After making these adjustments, the set's performance was considerably enhanced and it performs quite well local stations.

Summary

The Mullard Meteor 600, despite no having outstanding RF or audio performance, is quite a reasonable little receiver for use in the kitchen or bedroom. It is housed in a relatively small bakelite cabinet but the components are not so crowded that service is difficult.

However, the layout of the components leaves a lot to be desired and the electronic design is deficient in a number of areas as well. For example, the set could have used AGC (automatic gain control), as the two RF valves are variable mu types. It is not that it would have required extra components.

In addition, the HT could have been made as high as 150V which would have meant that all valves operated with improved performance, especially the 6V6GT audio output stage. This could have been achieved with only relatively minor changes to the values of a few low-cost components.

It all goes to show that some makers got away with some very ordinary design and layout techniques but only because the sets were budget models and were not required to be high performers. However, this set could have been a good performer without adding to the cost.

That said, it's a nice-looking set and if its limitations are accepted it is a worthwhile receiver to have in a collection.

Finally, as a reflection on design, I was involved in the testing of new 2-way radios for a government department prior to them being approved for use by industry. During this work, it soon became obvious that some designers really knew how to design and build good 2-way radios while others produced radios that were very ordinary.

I distinctly remember two transceivers I had to test from different manufacturers. One barely met the test criteria and disappeared from use within a few years, while the other was so good that it is still used by some services some 35 years later. The same thing has happened in the design and construction of domestic valve radios – the large manufacturers didn't always get it right, while many small manufacturers produced excellent equipment.

Basically, a lot depended on who the designer was at the time when it came to the quality and performance of a receiver. SC

Photo Gallery: Tasma 585 Mantel Radio

The Tasma 585 was a large-size mantel radio, with a vibrator power supply pack nearly half the size of the radio itself and powered by a 6V accumulator. The valve line-up was as follows: IM5G RF stage, IC7G mixer, IM5G IF amplifier, IK7G detector/first audio amplifier and IL5G audio output. The intermediate frequency (IF) was 458kHz. Features included dual-wave tuning, a permanent magnet speaker and a handsome wooden case. Photo by Kevin Poulter for the Historical Radio Society of Australia (HRSA). Phone (03) 9539 1117. www.hrsa.net.au