VINTAGE RADIO

By JOHN HILL

An interesting grid bias problem

One of the more interesting aspects of vintage radio is repairing non-functioning receivers. As far as I'm concerned, getting them working again is the most satisfying part of this hobby.

As a person having neither an electrical or electronics trade background, I have never been properly trained to do radio repairs. I have developed my own repair techniques from reading books, asking others and doing my own investigations. As a result, there is a lot I have yet to learn and learning new things helps to maintain my interest in vintage radio.

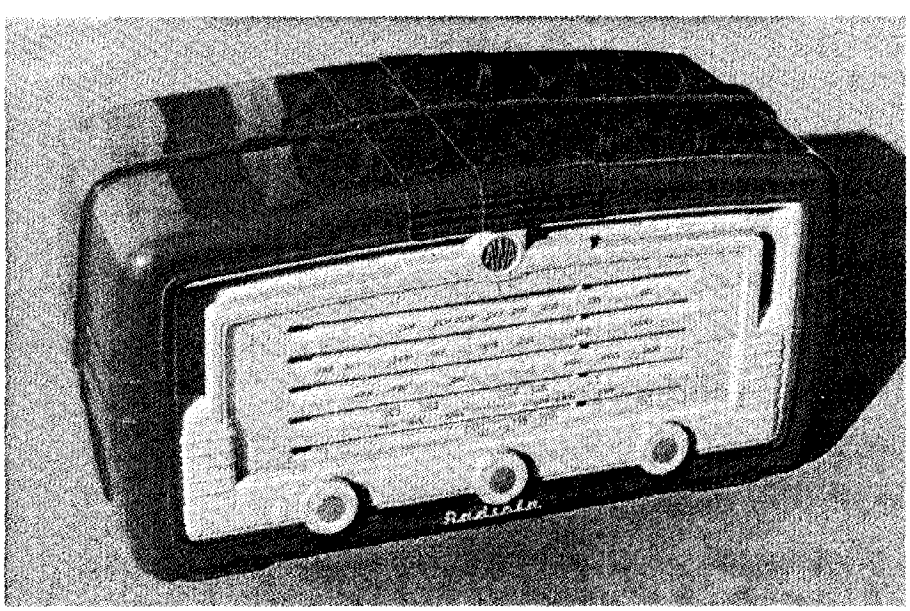
Having a limited background makes one easy prey to any new fault that comes along and these tricky problems always remind me of how inexperienced I really am. But perseverance usually wins and the fault is eventually found and rectified. Solving such faults is very satisfying.

A recent repair to a mid-1950s 4-valve Radiola produced one of these mystery faults and it proved to be quite elusive. Allow me to explain.

A real wreck

This particular receiver was one of the worst wrecks I have seen for a long time. It had obviously been stored for many years in a workshed, judging by the number of multicoloured paint splats that were on it. Why people have to flick their paint brushes at old radios I will never know!

The little Radiola was filthy and mouse infested. When the set was removed from its plastic bag there remained about a tablespoon full of mouse droppings and other miscellaneous items such as partly eaten pumpkin seeds, small bones and other debris. I hate working on sets like these!



The Radiola was a common mid-1950s 4-valve receiver. Considering its filthy condition when found, it scrubbed up fairly well.

After a thorough clean up, the usual checkout routine revealed that one of the oscillator coil windings was open circuit and the rectifier valve had almost no emission. As there were plenty of 6X4s in the valve box, the weak rectifier wasn't a problem but it did arouse a suspicion that there was something else wrong with the receiver to reduce the valve's emission to such a low level.

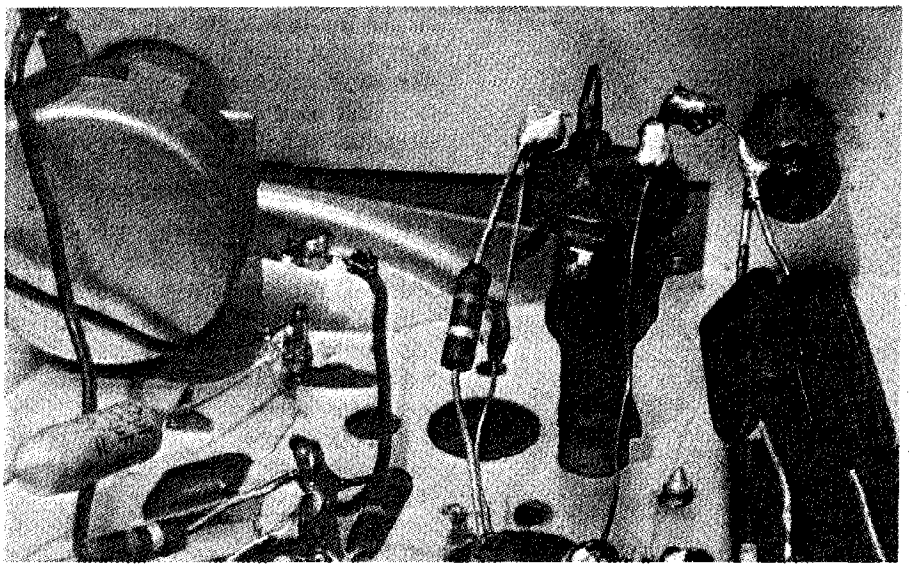
Other problems with the old Radiola were: (1) all the original paper capacitors were still in place; (2) the speaker grille cloth was a filthy, tattered mess; and (3) the dial cord was made up of four different sections of string. As the knots in the dial cord would not go around the pulleys, dial movement was restricted to about one quarter of its total length of travel. The things that some people put up with!

An examination of the oscillator coil revealed that one of its leads had broken off. If the truth be known, the wire had most likely been chewed through by a furry little rodent.

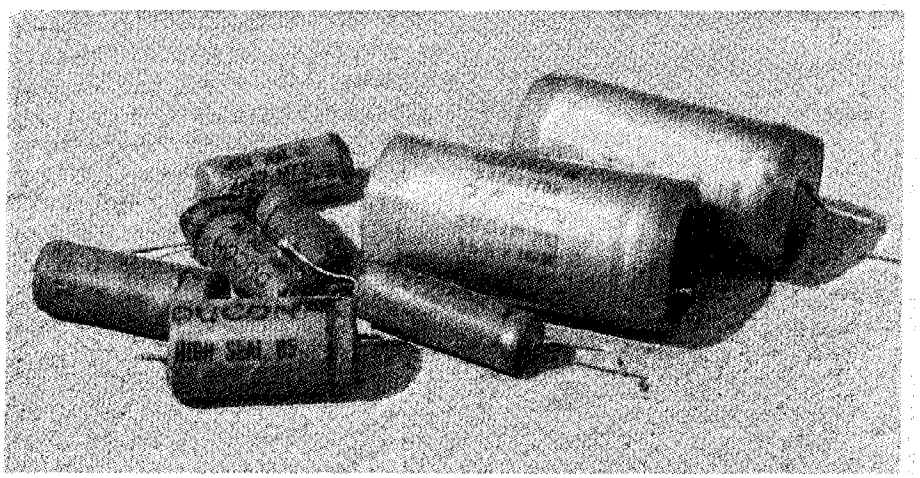
Repairing the oscillator coil was relatively simple as the broken lead protruded from the sealing compound by about two millimetres which allowed a new lead-out wire to be attached. After reinstalling the repaired oscillator coil, the set was ready for a test run, even though the paper capacitors had not been replaced at this stage.

The little Radiola fired up straight away and seemed to be in good tune, pulling in a number of stations while using only its built-in aerial.

Regardless of the fact that the set was performing well, the paper ca-



The oscillator coil (centre right) needed repairing because of a broken lead-out wire. The volume control (left) also required attention as it was noisy.



Replacing the electrolytic and paper capacitors had little effect on performance. However, leaving them in service is only asking for trouble later on.

pacitors were replaced with modern polyester types, which seemed to make little difference. Then the rot set in!

Distorted sound

After the receiver had been working for a few minutes, the sound gradually became more and more distorted. What's more, as the sound distorted, the high tension dropped from around 200V to 175V.

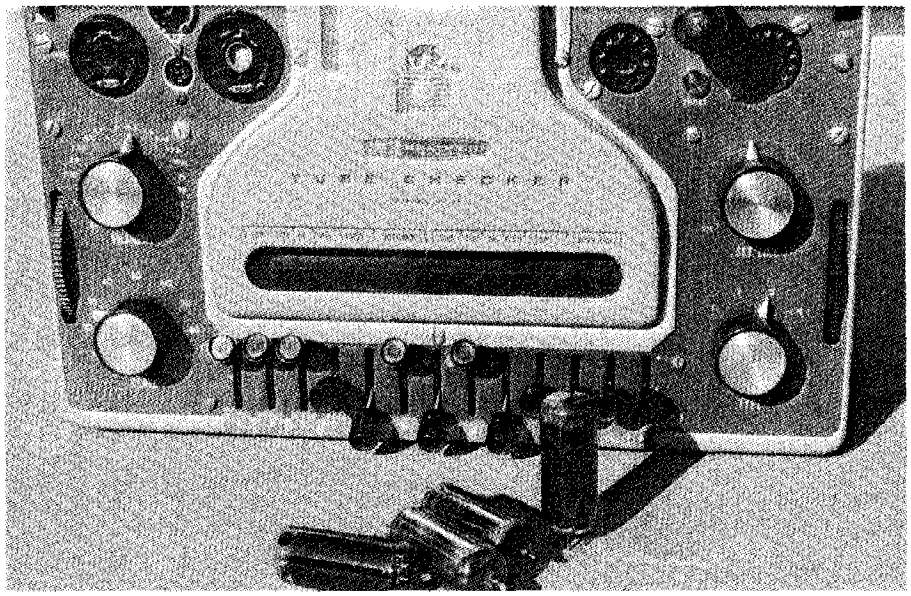
Leaving the set to cool off for a while produced a similar result. It worked perfectly for a few minutes, then the distortion slowly crept back. So what appeared at first to be a simple and straightforward repair had now developed into one of those mystery faults.

I suspected a faulty output valve and so a good secondhand 6BV7 was substituted for the valve that came with the receiver. I might add, at this stage, that both of these valves tested "GOOD" when checked in a valve tester.

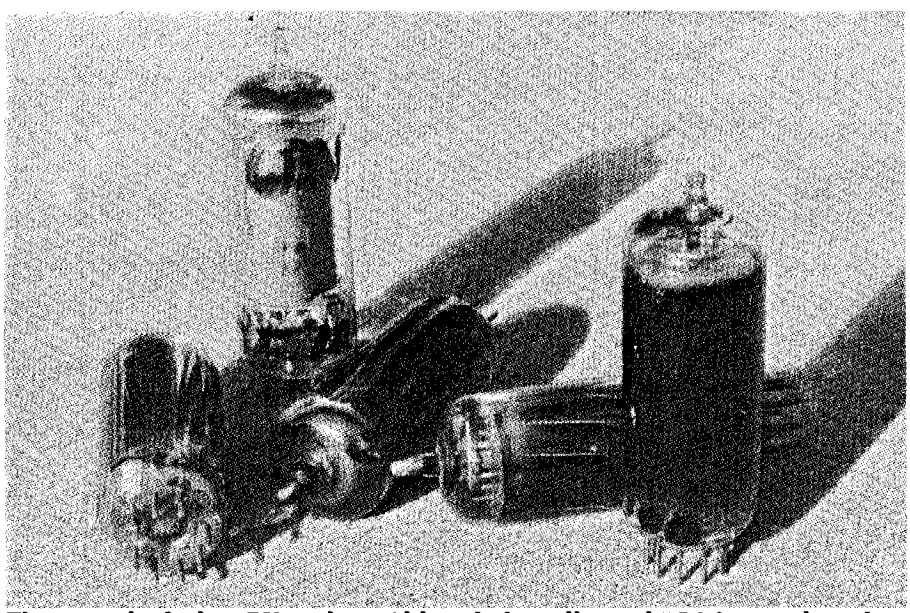
The result was the same – the set was OK for a few minutes, then went into a slow downhill slide until the sound became quite distorted. It was time to start thinking!

Distortion is usually associated with the audio end of a receiver (but not always) and is often caused by a lack of grid bias. With this thought in mind, the back bias circuit that provides the bias voltage to the output valve was checked. The 100Ω bias resistor seemed OK and nothing could be seen that looked remotely suspect.

The grid bias on the 6BV7 output valve should be somewhere around -4V, taking into account the plate volt-



When testing the faulty valves, only one produced a flicker in the shorts indicator neon. Testing a valve in a valve tester is only half a test. The other half is to give it a thorough work-out in a working receiver.



These are the faulty 6BV7 valves. Although they all tested "GOOD" in the valve tester, they had a problem that deprived the control grid of its negative bias. They worked OK when cold but not when they became hot.

age at which the valve was operating. It seemed an appropriate time to check out the actual bias voltage.

Grid bias voltages are best checked with a digital voltmeter as these instruments have a very high input impedance, which has little or no affect on the function of the receiver. A cheap analog 2,000Ω/V meter can seriously affect both the voltage reading and the operation of the receiver under test.

The receiver was set up with two voltmeters, one to measure the high tension voltage and the other the bias voltage. The bias reading was -3V and after this reading had peaked, it went into reverse and dropped slowly until it almost reached zero. And as the bias voltage dropped, so too did the high tension voltage, due to the output valve passing increasingly more current. Distortion did not become apparent until the bias voltage decreased to about -1V.

Perhaps the bias resistor was faulty? Maybe its value decreased as it warmed up?

Not having a 100Ω resistor on hand I used a 130Ω resistor as a replacement instead. Hopefully it would increase the bias voltage to -4V and it did! But the problem remained – the reception was perfect for a few minutes and then went into a slow decline just as before.

An interesting discovery

It was at this stage that I made an interesting discovery. I replaced the original output valve in its socket while the set was still operating. The bias voltage immediately went back to -4V, stayed there for a short period, and then started dropping again. I repeated the operation with the other valve after it had cooled and the same thing happened.

The fault was in the valve – both valves, in fact! They worked OK when cold but not after they had become hot!

Out came all of the 6BV7s I had in stock. I selected a new valve and fitted it to the output socket with vastly different results. The bias voltage settled on -4V and stayed there!

It was too good an opportunity to miss out on and all the 6BV7s were checked in the receiver. Out of the 13 valves tested, six of them had the diminishing grid bias characteristic. So, in one hit, my 13 "good" 6BV7 valves were reduced to almost half that number.

The valve tester

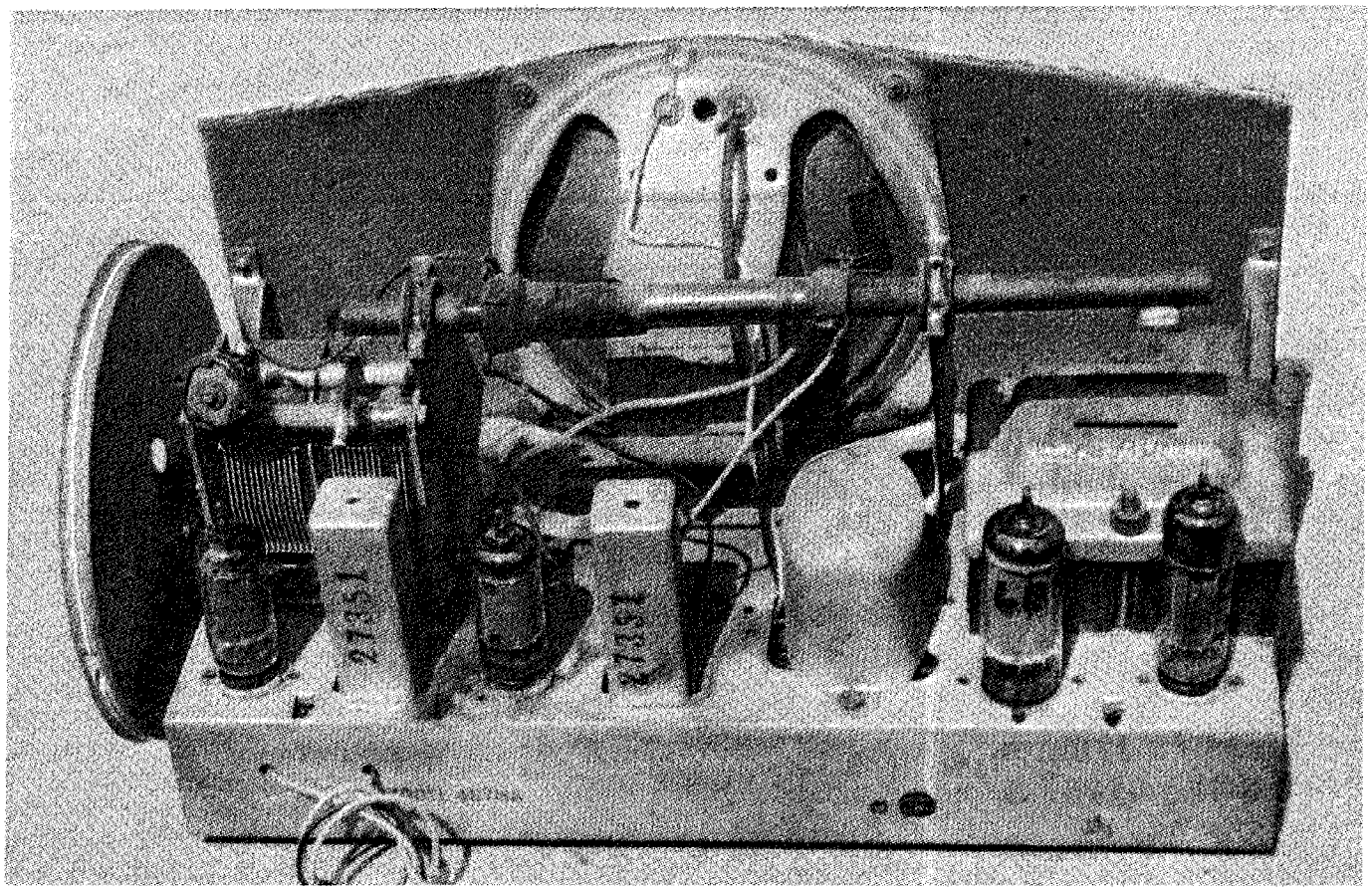
It's time for the valve tester to enter our story. I set it up to recheck all the valves that had failed in the receiver, even though they had previously checked out OK in the valve tester.

Of the six faulty valves, only one could manage to produce a flicker in the tester's shorts indicator neon. This short was on pin number eight which is the control grid. It would appear that these valves have a problem when they reach full operating temperature.

It is worth noting that the four new valves were all OK. Only the second-hand units produced the diminishing grid bias characteristic, even though most of them had emission levels comparable to new valves.

So there's something new to ponder over! Is the 6BV7 a more troublesome valve compared to other output valves? And what is the mechanism of the fault anyway?

Initially, the most likely possibility seemed to be that the valves were gassy. And a fellow enthusiast suggested that this could be aggravated



There's nothing very exciting about a 4-valve Radiola, as it was a very basic radio receiver. Note the built-in aerial mounted above the chassis. The valve line up is as follows: 6BE6, 6AU6, 6BV7 (output) and 6X4 (rectifier).

by a grid resistor that had "gone high", as they frequently did in those days.

However, these ideas had to be discounted. All resistors are routinely checked during restoration and any found to be out of tolerance are replaced. Also, I took the opportunity to try these valves in another set and they behaved identically.

That seemed to further confirm that the fault was in the valves rather than in any associated circuits. And the gas theory seemed to be ruled out by the fact that there was no violet glow in the valves, which is characteristic of this condition.

Another idea which was considered was a fault known as "silver migration". It occurred in valves with silver plated pins, the silver "migrating" across the glass, particularly between pins with a high voltage between them.

This idea was also thrown out. For one thing, the warm-up delay didn't seem to fit but, more importantly, the pins were not silver plated.

Finally, the most likely explanation would seem to be a condition known as grid emission. Apparently, this can occur when the grid becomes coated with cathode material, generally due to the heater being overrun for long periods.

So, perhaps that is the answer. But the question remains as to whether this type of valve is prone to this problem.

An unusual valve

Incidentally, for those unfamiliar with the 6BV7, it is a little unusual in that it is a duo-diode output pentode. As far as I'm concerned, it is the only one of its kind and I also suspect that it is a locally designed and manufactured valve, as it doesn't seem to be mentioned in overseas valve lists.

Actually, a duo-diode output valve is a logical type to use in a 4-valve radio. If a receiver is to have automatic gain control and diode detection, then there have to be diodes somewhere, so why not have them in the output valve?

Another mid-1950s 4-valve setup was to use valves of the duo-diode RF pentode type (6N8, 6AR7) as an IF amplifier detector and pass the resulting audio signal to a standard output valve such as a 6M5 or 6AQ5.

Looking back on the Radiola repair, perhaps the most annoying aspect was the fact that the fault was accurately diagnosed quite early as being a suspect output valve. It was ironic (read rotten luck) that the substitute valve used to check out this theory happened to have exactly the same fault!

Anyway, learning new things helps to maintain my interest in vintage radio. It is unusual faults like the one just described and their remedies that make vintage radio repairs both interesting and challenging.

When I finally learn all there is to know about valve radio servicing, then all the fun will have gone out of it for me. However, as that time seems a long way off, I'm sure that vintage radio will continue to hold my interest for many years to come. **SC**