Vintage Radio

by PETER LANKSHEAR

A Quiz on vintage radio servicing

With the summer holiday season now over, vintage radio enthusiasts may be thinking about catching up on restoration projects. If your workshops are anything like mine, you'll no doubt want to reduce the size of the pile of receivers requiring attention. As your servicing skills may need to be sharpened, this month we have a 'warm up' quiz, based on actual faults that I have encountered.

Some of the following cases provide misleading clues, while others are commonly encountered. But hopefully the questions will provide a challenge, and the answers (given later — don't peek!) will prove helpful for future reference. Let's get going, then.

Q1: Stormy reception

First, a fault fortunately not so common today. The receiver came from a country district, remote from any transmitters. With it came the comment that, following a night of violent weather, reception was very weak and noisy. A brief test confirmed the that the set was very insensitive, but otherwise operation was normal. What did I expect to find?

Q2: Inversion puzzle

Again, the complaint was of poor receiver sensitivity. With the chassis out of the cabinet and up-ended, power was turned on for some voltage measurements to be made. However, performance was now normal; everything was in place, and a general check of voltages confirmed that there were no obvious malfunctions. Was this going to be an annoying intermittent fault?

There seemed to be nothing for it but to shift the receiver to one end of the bench and let it run until the fault showed up. However, immediately the chassis was again the right way up, sensitivity was again poor.

This strange behaviour was quite consistent. With the chassis inverted, sensitivity was normal; but as it was righted, the fault disappeared! Where would *you* look?

Q3: Very tidy owner...

A radio was brought in with a straightforward and common problem: completely silent from an open circuited output transformer primary winding. The owner was obviously a careful person, as the chassis was spotless. Rather than leaving the power cable dangling, he had meticulously wound it up and tucked it between the IF cans and the tuning capacitor.

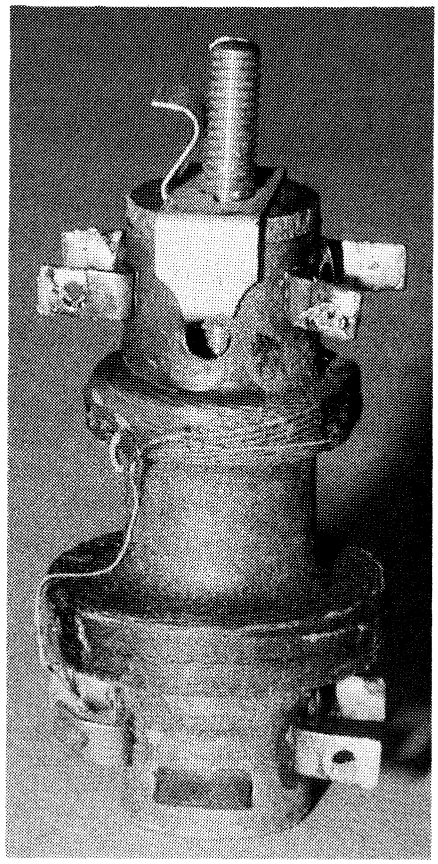


Fig.1: A typical broadcast band interstage RF coil, showing the turn of wire used as a low cost top coupling capacitor.

The transformer was repaired, but although the set was obviously now alive, reception was nil. Idly twirling the spin drive, I found that reception returned above about 1300kHz. What was the problem?

Q4: Shocking experience!

One advantage of double-ended valves is the ease with which the control grids can be accessed. A very quick check for signs of life can be made by removing grid leads one at a time and putting a finger on the vacant grid cap. Starting with the audio stage and working forward one can often quickly get an idea which stage is dead.

(CAUTION! Do not attempt this trick with early English, European or type 807 valves. As more than one enthusiast has found, the cap on these valves is the anode connection, and the lead will have HT on it.)

In this instance, there was no reception from a receiver with a front end identical to that in the diagram. The finger test on the grid of the 6B6G diode/triode confirmed that the audio system was fine, and removal of the clip from the IF grid made a lot of healthy sounding noises. However, as I removed the grid clip of the 6A8G converter valve, I got an unpleasant surprise, and a test meter indicated full HT on the clip. How did the voltage get there?

Q5: Audio distortion

In a similar receiver, the faint sound that *was* audible was very distorted. A meter check showed that there was 40 volts at the 6F6G cathode. Initially, I expected to find that either the cathode bias resistor had gone high in value, or that the 0.01uF audio coupling capacitor had broken down, causing the 6F6G to draw excessive current. In fact, the coupling capacitor was good and I was surprised to find that the cathode resistor was completely open circuited. What had kept the valve operating?

Q6: Blue light area!

Receiver operation appeared to be normal, but with the rear of the cabinet in darkness, a bright *blue* glow fluctuating with the programme volume was visible on the surfaces of the mica spacers and envelope at the top of the pentode output valve. This can be seen in Fig.2; is it an indication of impending trouble?

Q7: Good looks, sour sound

A newly completed, large, and well made valve audio amplifier, laid out with meticulous symmetry, was not going at all well. Serious distortion was evident at even quite small outputs. Although operating voltages appeared correct, with valves, resistors and coupling capacitors all new, a test meter indicated one unusual condition. With no signal, there was a negative voltage on the grids of the cathode-biased output valves. What was happening?

Q8: Unsatisfactory repair

In order to retain the original appearance of the faulty IF transformer in Q2, a replacement winding assembly was taken from another transformer and fitted into the existing can.

The repaired transformer now tuned correctly, but the receiver's overall gain was significantly lower than it should have been. What had I done wrong?

Q9: Is it oscillating?

A receiver with a standard frequency-

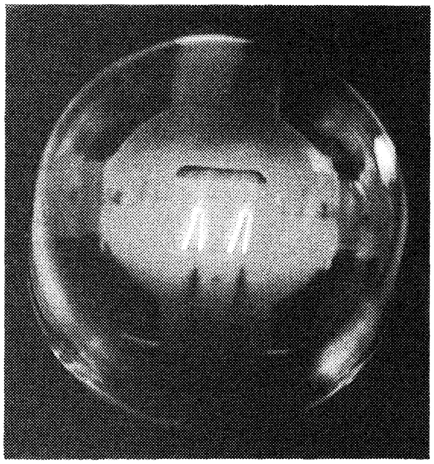


Fig.2: A 47 type directly heated pentode displaying the blue glow referred to in Q6. Although giving the impression that the elements are overheated, the red glow in the mica spacer is simply a reflection of light from the filament.

converter stage was dead. It was suspected that the local oscillator was not operating properly, and the only test instrument available was an old 1000 ohms per volt moving coil multimeter. How could this be used to check the oscillator operation accurately?

Q10: Whistles

A small, inexpensive and well used superhet had developed an oscillation on all transmissions. Regardless of the frequency, with each signal, there was a loud whistle that varied in pitch with the tuning, indicating that the IF amplifier was oscillating. The cure was to add a component often omitted in economy receivers. What was it?

Q11: Frequency jumping

A dual wave receiver had an annoying habit of broadcast band signals suddenly jumping to a different frequency. These changes in frequency were always to the same dial settings. On shortwave, the set was quite stable. What was the problem?

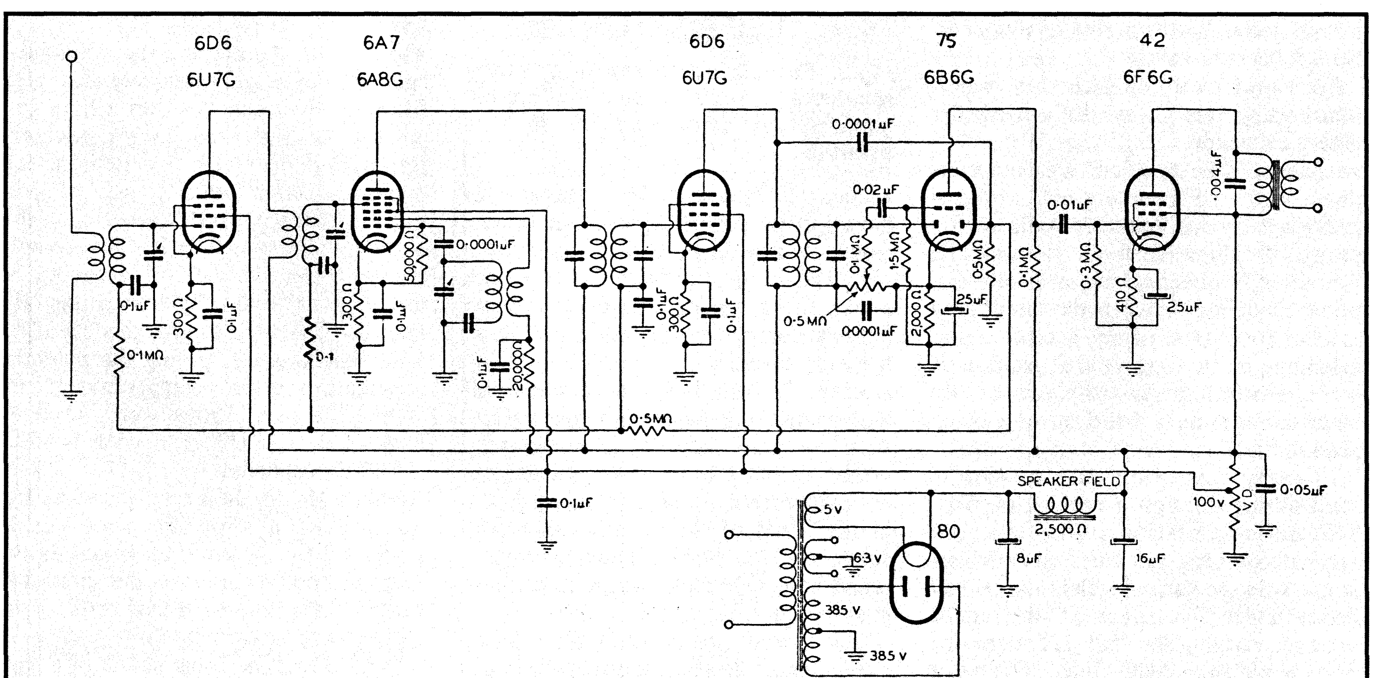
Q12: Fading sound

After a few minutes' operation, the sound from a five valve mantel set began to fade steadily, entirely disappearing after about 15 minutes. The finger-on-grid test mentioned in Q4 indicated that the fault lay in the audio system. This used type 75 and 6F6 valves in a circuit much like that shown in the diagram, except that the 75 had a small fixed bias applied to the cathode.

Both valves looked to be in practically new condition and this was confirmed by tests on an AVO model IV valve characteristic meter. However, voltage measurements provided a clue. Coincident with the fading, the voltage at the anode of the 75 steadily fell from 130 volts to 70 volts. What was happening?

The answers

Well, there you are. Twelve questions which I hope will have set you thinking, about servicing valve equipment. Now



This diagram comes from a 1938 'Technical Communication' published by Australasian Philips. It is not of any specific model, but is typical of a well designed receiver of the time, and demonstrates details referred to in the quiz.

let's look at the answers, so you can see how you went...

Answer 1: There were two related clues. As the receiver was situated a considerable distance from the nearest transmitters, there would have been an outside aerial, and there had been rough weather. A substantial voltage can be induced into a large aerial by lightning strikes in the neighbourhood, and in this instance, there had been sufficient energy to burn out the primary winding of the aerial transformer.

In the early days of radio, this was a frequent occurrence, and lightning arrestors and earthing switches were standard protective fittings. Today, fortunately, in most locations, with small lengths of wire indoors, loop aerials, or ferrite rods providing adequate reception, the incidence of this problem is much reduced.

Answer 2: The IF transformers were permeability tuned, with adjusting screws attached to ferrite slugs top and bottom. One of the upper slugs had become detached from its screw, allowing it to drop down the inside of the coil former, until it was stopped by the lower slug. With the chassis upside down, the slug slid back to its correct position.

Answer 3: Had the owner not been so tidy, the problem would not have occurred. In the stowing of the power cable, the rearmost moving vane of the tuning capacitor was pushed out of alignment and it shorted on to the adjacent stator. It was a simple matter to bend it back into shape.

To avoid troubles like this, when transporting sets always fully mesh the tuning capacitor.

Answer 4: The problem was a breakdown in the RF coupling coil, and can happen only in receivers with an RF stage. Coils with high impedance primaries frequently have a small coupling capacitor between the anode and grid connections. Many used a cheap substitute in the form of a single turn of wire, wound around the top of the smaller secondary winding as can be seen in Fig.1.

In many cases, this turn of wire is hard to see through a coating of wax. The only insulation is the silk and enamel covering the wire, and perhaps some wax or varnish. This can break down under the stress of the anode voltage, putting the full HT onto the grid lead and AGC line. The cure was simple. The wire capacitor was disconnected and a 5pF ceramic capacitor substituted.

This economy trick can also cause a puzzling loss of performance in a receiver. The insulation does not break down completely, but leakage puts a positive voltage on the grids connected to the AGC line. These grids mask the problem by acting as clamping diodes; but all the tuned circuits are heavily damped, desensitising the receiver.

Answer 5: The clue comes from the 40 volt reading. The cathode bypass capacitor was one of the traditional 25uF/40VW electrolytics. Apparently the valve acted as a high value resistor from the HT line, keeping the capacitor at its forming voltage; in the process, a small anode current flowed.

Answer 6: In fact, the glow showed that the valve was especially good. This phenomenon, known as fluorescence, occurs mainly in power output valves, and is an indication of a very hard vacuum. It should not be confused with the opposite problem, common in rectifiers, where there is an intense *lilac* coloured ionic discharge between the anode and cathode, caused by gas and often accompanied by loud raspy hum from the speaker.

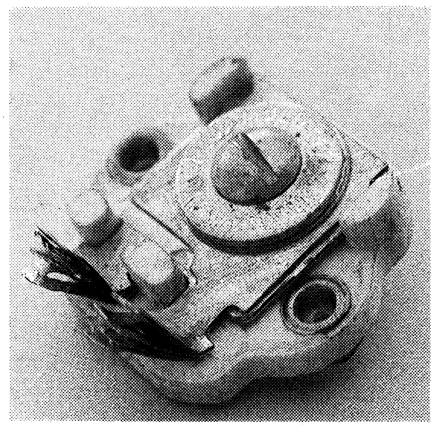


Fig.3: For oscillator tracking, many receivers used semi-adjustable 'padder' capacitors similar to this example.

Answer 7: Amplifiers using push-pull high mutual conductance output valves, such as 6L6 and 2A3, were very prone to this problem. The cause was the symmetrical layout, giving the anode leads of the output valves the same length. These leads became a tuned line VHF tank circuit, to create a push-pull oscillator.

The remedy was to insert, close to the valve sockets, 10k stopping resistors into each output valve grid lead, and 100-ohm resistors into their anode leads. It was common practice to make layouts of audio amplifiers asymmetric, to reduce the possibility of these oscillations.

Answer 8: The connections to one of the windings had been reversed. The phase relationship of IF transformer windings is critical, and if incorrect, the inductive and unavoidable capacitive couplings between windings will oppose each other.

Answer 9: For a simple 'go/no-go' check, another receiver nearby could have picked up the oscillator; but this method does not give an indication of performance. It was no good attempting to use this type of meter to measure oscillator voltage, as they do not accurately indicate RF and in any event, loading is so great that touching a probe on the grid or anode pin is likely to have stopped the oscillator completely.

A simple and accurate method is to measure the oscillator *grid current* by disconnecting the COLD end of the grid leak resistor (in this instance a 50k resistor) at its junction with the 6A8 cathode, and inserting the meter set on the 1mA scale with the positive probe to the cathode. A typical reading will be in the order of 0.25mA, varying to some extent with the tuning.

Comprehensive valve data manuals published the desirable oscillator grid currents for converter valves. Too little, and gain will fall off seriously; whereas too much grid current indicates excessive oscillator activity that will cause spurious whistles.

Answer 10: As electrolytic capacitors age, although still adequate for hum filtering, they can develop a high impedance at high frequencies, severely impairing their effectiveness as RF bypasses. Good practice was to provide an additional capacitor, the equivalent component in the example circuit being the 0.05uF capacitor at the extreme right, bypassing the HT line. In economy designs, this capacitor was often omitted, giving the potential to create problems later. In this instance the oscillations were cured by bypassing the HT line with a 47nF (0.047uF) capacitor.

Answer 11: As the exact operating frequency of a superhet receiver is governed by the oscillator, and as the fault was not apparent on the shortwave range, either the broadcast coil or its padder was suspect.

Fig.3 shows the construction of a typical compression padder. There are several leaves, and each must be in good soldered contact. It is possible for one of the leaves to miss out on soldering during assembly, and this happened in the receiver referred to in the question. Carefully resoldering the padder connections cured the problem.

Answer 12: My first suspicion was that the anode resistor of the 75 valve was going high as it warmed up. However, a rapid measurement showed that its value did not change, and in any event, even if it had doubled in value, the stage gain would not have changed significantly.

In fact, the problem was solved by replacing the type 75 valve. Substituting it in another receiver wired for a similar valve confirmed the fault.

Initially, there was a mystery in this case. Even prolonged operation in the valve tester did not indicate a significant alteration in the valve's characteristics, and there was no indication of gas. However with a 1.5 megohm resistor in series with the grid lead, a steady rise in anode current became apparent, and a meter in series with the grid lead provided an explanation. A strong and steadily increasing positive grid current was flowing, but with the standard valve checker setup where it was connected to a well regulated bias supply, the grid was firmly 'held down'.

This incident reaffirms the contention that blind faith should never be placed on valve testers. The final test of a valve is always operation in a receiver.

Well, there it is. I hope it was an interesting challenge. There are no prizes — but who knows, some of the solutions to these problems may be of help to you in the future. ❖