VINTAGE RADIO

By JOHN HILL

Troubleshooting vintage radio receivers – the basic techniques

There are few tasks more daunting to a new and inexperienced radio collector than the repair of a receiver that does not work. If one is unfamiliar with valve radio repairs, finding a fault can be quite difficult. Here are a few tips to get you started on vintage radio repairs.

Many vintage radio collectors are totally divorced from the electronics trade and often have little or no knowledge of the workings of a radio, whether it be valve or otherwise. Many such enthusiasts simply collect their treasures, clean them up so that they look nice and display them.

If a set happens to be in working order, it is a special prize. However, even if it does go, there is a good chance that it will not work for very long before something breaks down and the set no longer functions.

This month's Vintage Radio column presents a simple troubleshooting chart (Table 1) and discusses some of the problems associated with fault finding. The chart contains a list of problems (or symptoms) and the possible reasons for them. The chart does not contain every conceivable fault or remedy but most of the common ones are covered fairly well.

Multiple faults

A neglected 50-year old radio can be a mess of problems and there is often more than a single fault to find and repair. For example, a partial short circuit in a high voltage capacitor may not stop a receiver from working but the leakage problem can overload other components. Items such as valves, resistors, loudspeaker field coils and high tension chokes are vulnerable to overloading of this nature. It is, therefore, pointless to replace the overloaded component without also replacing the component that caused the problem in the first place.

One of the most potentially destructive faults for the vintage radio enthusiast is an open circuit speaker transformer (see Table 1). It should be carefully checked before the set is turned on. Failure to apply HT to the plate of the output valve will cause the screen to carry excess current and to run red hot – a valuable warning sign but one which may come too late.

The red hot screen can release (occluded) gas, making the valve gassy and useless. Most valves can withstand this abuse for brief periods but a few suffer instant destruction. The type 59 valve was notorious for this weakness and there may be others. This was tragic enough in the days when these valves were popular but at least they could easily be replaced.

Another very common fault listed in Table 1 is weak and (often) distorted audio. This was almost always due to the first audio stage screen resistor – usually 1.5MΩ – going high in value, typically to several megohms. The high value resistors of those days (ie, anything above 1MΩ) were notoriously unreliable.

Paper capacitors

At the risk of repeating myself, I will say again what I have said quite a few times in the past. Faulty paper capacitors are the cause of a great deal of trouble in old valve radios. These ancient capacitors are unreliable and are the direct cause of many problems. In fact, they can be so troublesome that I feel justified in discarding all of them.

That's right! Total replacement of the paper capacitors is part of my routine restoration procedure. By do-

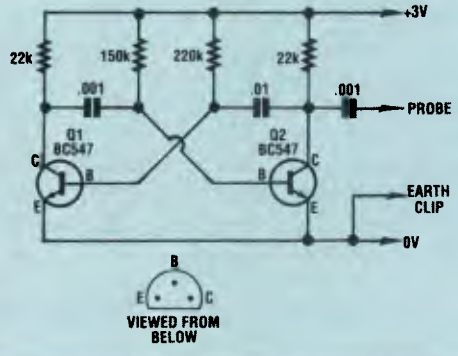
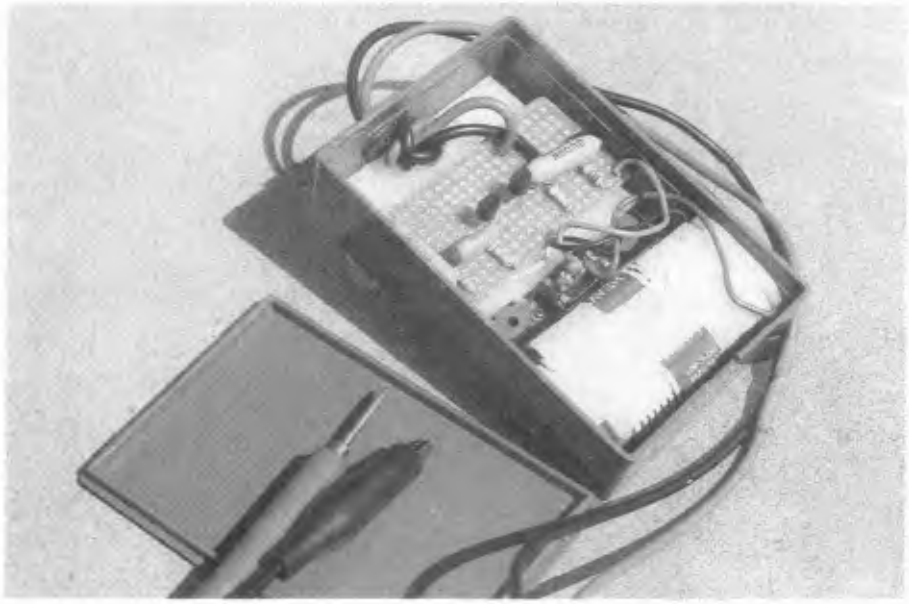


Fig. 1: the signal injector circuit uses two transistors wired as an astable multivibrator. It produces a 2kHz tone that is rich in harmonics up to 20MHz.



A simple signal injector can be built around two common NPN transistors. This unit operates from a 3V supply which is provided by two penlight batteries.

When using the signal injector, the earth clip is connected to the chassis and the probe is connected to the control grid of the valve being tested. A signal injector can quickly locate a faulty stage in a radio receiver.

ing this, one can eliminate about half of the common problems that would otherwise be encountered when restoring a valve receiver.

Total capacitor replacement (using modern polyester types) also minimises the likelihood of future capacitor breakdowns and makes the set more reliable than it may have been when new.

If your wallet dictates that you restore with restraint, then at least replace those paper capacitors that have some measurable voltage potential across them – particularly where high voltage potentials are involved.

However, vintage radio repairs often involve more than just replacing a few suspect capacitors. There are many other things that can go wrong and stop a receiver from working. To trace these faults requires more than a troubleshooting chart. Some basic tools and instruments are also needed. Two very useful instruments are a multimeter and a signal injector.

Little needs to be said about multimeters other than that you only get what you pay for. A meter that has a good ohms range and can measure capacitance is better than one of the more basic types.

The signal injector

A signal injector is another very useful piece of test equipment and can be made up quite cheaply for only a few dollars. Fig.1 shows the circuit details of such a device, while one of the photos shows the constructed item.

An injector is used as follows: first, attach the earth clip to the receiver chassis, then switch on the injector and place the probe on the grid pin of the output valve. If the output section is OK, the injector signal will be heard through the loudspeaker.

If the signal is not heard, then there is a fault somewhere in the output stage. In such a case, the problem could be a defective valve, a faulty coupling capacitor, a corroded valve socket connection, an open output transformer, no high tension at the valve socket, a dry solder joint, a speaker plug not making contact or faulty wiring inside the speaker plug.

On the other hand, if the output stage tests OK, then one must go back

The author's signal injector was built into a convenient cabinet that once housed a low-cost burglar alarm.

to the preceding valve and again place the probe (ie, inject the signal) on the control grid. If that stage is working, sound will again be heard through the loudspeaker (it should be louder than before) and you then move back another valve until the faulty stage is isolated.

A signal injector will not indicate the exact cause or location of a fault but it will indicate where you should look. If a signal injector is designed properly, it will deliver a signal that produces an audible sound in the loudspeaker no matter what part of the set the signal is fed into. This signal should be heard regardless as to whether it is injected into an audio or a radio frequency (RF) stage of the receiver. It should even be heard from the aerial terminal, if the set is functioning normally.

Precautions

Care should be taken when using the injector probe. It is unwise to indiscriminately place the probe anywhere, unless the injector output is adequately protected. Touching any high tension connection could damage the transistors.

Protection is normally provided by means of a small capacitor in the probe lead. The original injector circuit shown used a .01µF capacitor in this role, which was too large for high voltage (valve radio) use. Consequently, any high tension contact promptly wrecked the transistors. Replacing this capacitor with a value of .001µF solved the problem and made the signal injector more suitable for valve work.

The smaller capacitor restricts the output a little but is a small price to pay for protecting the transistors.

The advantage of a signal injector is that it will quickly locate the defective section of a malfunctioning receiver. Once a particular stage becomes suspect, it then narrows down the search by a considerable margin.

If you don't have a signal injector, removing a valve while the set is operating usually produces a loud "click" in the speaker as the high tension is disconnected from the valve. A click accompanying the removal of an output valve would be a reasonable indication that the valve and the loudspeaker are operating and that the fault lies elsewhere. Shorting out the grid with a clip lead may also produce similar results.

Compiling a troubleshooting chart is a difficult exercise, as it is impossible to cover every conceivable situation. Valves can have internal faults, transformers can have open windings, and dry solder joints can be difficult to find. Dry contacts such as those in

WARNING!

Dangerous voltages are present in valve radio sets so always exercise due caution when troubleshooting. In particular, take care with the power supply and high tension (HT) circuitry in the set. Note also that some vintage receivers were AC/DC models with no power transformer and these should be left strictly alone unless you know precisely what you are doing.

TABLE 1	
Symptom	**Possible Cause**
No power; nothing lights up	Faulty mains plug connection; faulty on/off switch; open circuit power transformer primary; disconnected mains wiring inside set.
Receiver lights up but does not work	Faulty HT winding on power transformer; faulty valve; open circuit winding in aerial coil, oscillator coil and/or IF transformer; open circuit winding in field coil or HT choke; burnt out resistor; shorted high-voltage capacitor; faulty valve socket or speaker plug connection; missing parts; disconnected wiring; short circuit caused by perished insulation.
Receiver works but is noisy	Troublesome dry solder joint; dirty socket or switch connections; faulty valve (tapping may pinpoint); faulty components (resistors, capacitors, etc).
Severe oscillation (receiver squeals)	Faulty decoupling or bypass capacitor; ineffective valve shield; faulty valve (usually in RF stages); wrong valve.
Motorboating	Open grid or cathode circuit (usually in audio section); faulty valve; faulty second filter capacitor.
Distortion	Faulty coupling capacitor to output valve; incorrect grid bias; gassy output valve.
Hum	Inadequate filtering of high tension; stray coupling from AC source to grid lead; short between valve cathode & heater; unshielded audio leads; gassy or faulty rectifier valve; filament resistor in early output valves; faulty electrolytic capacitor.
Pronounced hum	Shorting electrolytic capacitor; internal fault in rectifier valve; shorted field coil or HT choke.
Intermittent loud/soft volume	Faulty coupling capacitor on output valve; valve with loose internal elements; faulty connection (eg, valve socket or solder joint); faulty screen grid bypass capacitor
Static like noises when tuning	Tuner plates scraping; faulty earth connection on moveable plates.
Set crackles or makes frying sounds	Faulty connection or component on HT line; faulty valve (tapping may pinpoint); badly worn volume control.
Very soft volume	Worn out valves; low HT voltage; incorrect valve types; leaky high-voltage capacitors; alignment problems; open circuit audio-coupling capacitor; high value screen resistor on first audio valve.
Low high tension	Weak rectifier valve; damaged or faulty power transformer; wrong primary tapping selected on power transformer; incorrect loudspeaker (ie, wrong field coil impedance); faulty valve.
Double spotting	Incorrect alignment.
Overheated choke or field coil	Excessive HT current caused by faulty HT component, probably an electrolytic capacitor.
Rectifier anodes glow red hot	Direct short on HT line (eg, electrolytics in HT filter short circuit).
Output valve screen grid glows red hot	Open circuit anode on output valve (probably open circuit output transformer). Note: this can damage the output valve.
No shortwave reception	Dirty wave-change switch contacts; leaky paper capacitors; resistors gone high in RF stages; low HT voltage; weak frequency changer valve.

valve sockets, wave change switches and some tone controls are just waiting to give trouble and often do. The list could go on and on.

Hence the accompanying chart lists mainly common problems and has been compiled for the benefit of the novice.

Remember, a good vintage radio restoration should result in the set looking and working as it did when it was new. Restoring a vintage receiver so that it looks as new can be a difficult and time-consuming task in some instances, but there's no reason why it cannot function as new. Hopefully, my troubleshooting chart will help you in this regard. **SC**