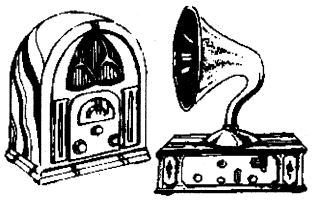
Vintage Radio

by PETER LANKSHEAR



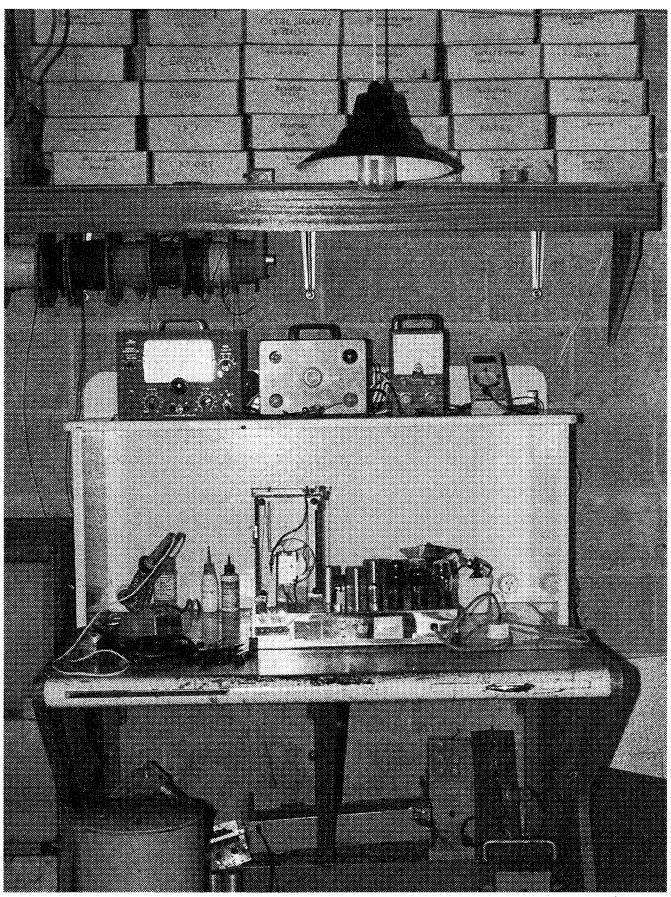
The vintage radio collector's workshop

Sooner or later, any collection of vintage radios will need some servicing and workshop facilities. Old hands and experienced collectors will have their own ideas about what is required, but this month we offer a few hints and tips — especially for the newcomer.

Everyone would like a dedicated, comfortable, and well lit workshop, with plenty of storage room and complete with extensive test facilities and a wide range of tools. The reality for most of us is something considerably less ideal. We may have to settle for working on the kitchen table, when the official activities have ceased for the day. Or possibly, set up a temporary workspace in some corner.

For probably the majority of us, a far more satisfactory arrangement is a small workshop sharing the end of the garage with the radio collection. This can be quite a practical solution, especially if the workbench layout and facilities are well planned.

Ideally, a work area should provide adequate space to work on a receiver and accommodate test equipment and tools. One arrangement that has stood the test of time is for the bench to have an 'upstand' (rather like a 'hutch'), the rear wall of which has several power sockets for tools, instruments and equipment. The top of the upstand can then be used as a shelf for test equipment, manuals etc. This enables test equipment leads to be kept short and the instruments readily accessible, without being hidden behind chassis and cabinets on the work level.



This service bench, which fits comfortably into the rear of the family garage, was adapted from a small metal desk and incorporates a shelf for test instruments — in this case, a service oscillator, a capacitance bridge, a VTVM and a digital multimeter. Small components are conveniently stored in boxes on the shelf above.

Fig.1 shows the writer's own work area, situated — yes — at the end of the family garage. The bench cost practically nothing to make, having been originally a small metal desk salvaged on its way to be dumped, and the upstand was made from recycled timber. Any small and reasonably sturdy table would also be suitable, but better still would be an old office desk, as the drawers would be available for parts storage.

Make sure that there is adequate headroom be-tween the bench top and the shelf, or there could be problems with accommodating tall cabinets. As most of the old mantel receivers will fit into a 500mm space, this is the clearance above the surface of the bench in the photograph.

Good lighting is most important, and a source immediately above the work area is essential. A 100 watt lamp and shade suspended a metre or so above the bench provides good lighting, but in warm weather the heat can be decidedly uncomfortable. In recent years high efficiency compact fluorescent lamps have become available, and fitting a 25W bulb of this type is well worthwhile.

Space seems always to be at a premium in a workshop. Cupboards or shelving are essential and, if the ceiling height allows, a small 'mezzanine' deck is a very handy place to store larger items.

The right tools

Although the established workshop is likely to accumulate a range of tools, the basic kit for valve radio servicing can be quite modest. The old saying that 'it is a poor workman who blames his tools' is quite true, but to go further, it is an unusual workman who cannot do a better job with the *right* tools.

Tools vary considerably in the steel used and there is no question that good quality costs more initially, but

provides the greatest satisfaction and service.

Essentials are a set of screwdrivers, long-nosed pliers, a pair of diagonal wire cutters, an adjustable wrench, socket wrenches and a soldering iron. For aligning receivers using ferrite cores in tuned circuits, never use steel screwdrivers. Instead purchase a set of proper plastic or ceramic alignment tools.

A range of screwdrivers will be needed, from small 'pocket' sized to quite large bladed types for undoing chassis and power transformer bolts. Fortunately, as traditional slotted screw heads were standard, cross headed 'Phillips' and 'Posidrive' screws are not found to any extent in old radios.

Having the correct tools can make the difference between success and a botched job, and no more so than with soldering. It is very interesting to read some of the old time methods of radio construction. In the very early days, electric soldering irons were not at all common, especially in amateur workshops, and many early radios were serviced with the aid of small 'soldering bolts' fitted with a miniature blow lamp or heated in a gas ring, on the kitchen stove or even in an open fire. However by 1930 electric soldering irons were in use — although they were primitive compared with the modern heat controlled models.

Soldering temperature is all important. Too hot and the solder is oxidised; too low and the joint will be pasty and unreliable. The range of soldered joints encountered in valve radios is quite large, with the old pre-octal valve sockets having a significant thermal capacity and really requiring a 60 watt iron or larger. On the other hand the more modern miniature bases require a fine tipped iron.

Previously two different sized irons were really necessary to cope with the range of chassis likely to be encountered, but a single modern heat-controlled iron soldering station of adequate size will serve for most jobs.

A word about quick-heating irons. A soldering gun or carbon element iron with 'on demand' heat is very convenient for the occasional brief job. But unless the operator is very experienced with this type of iron, it is very easy to spoil the soldering, especially by overheating, and the time taken to heat the iron for each individual joint can add significantly to the time taken for a job.

Long nosed pliers

Some method of cutting wire is obviously required, and the traditional pair of side cutting pliers or nippers takes a lot of beating. A pair about 120mm in length is a good size, but be sure that they are made of high grade steel with sharp cutting edges.

Long nosed pliers are absolutely essential for shaping and holding leads during soldering and for crimping joints. About 150mm in length is a good size, and although most pairs do have cutting jaws, this feature is not really essential if side cutters are also available.

To deal properly with nuts and bolts, a set of small socket wrenches is necessary. Although a full set of wrenches complete with handles can be very convenient, they are really only essential for a busy workshop. A boxed set of removable sockets with a common handle is much less expensive and is more likely to have the exact size needed.

A set of high speed drill bits up to at least 5mm diameter can be very useful, and although straight electric or the more modern battery powered drills are very convenient, an old 'egg beater' hand drill is fine for many jobs.

A very useful adjunct to the drills is a hand reamer for enlarging and deburring holes. Although they are not cheap, reamers will last a lifetime if given careful treatment.

Finally in the metal working department, a couple of files and a hacksaw for cutting pot shafts to length and similar jobs, will be handy.

The tools I've listed are the basic essentials, and the range available today is limited only by the pocketbook. There is a massive array of additional 'nice to haves' to make life easier.

At the top of any wish list would be a lathe, although frankly it would be hard to justify given the amount of turning work encountered in straight servicing work. For construction of early replica equipment — and some enthusiasts do take on this class of work — a lathe can be very useful, and is especially useful too for rewinding speaker field coils.

The simplest valve checker is the emission tester, which provides an indication of cathode condition and internal shorts. Many old time servicemen relied on simple instruments such as this pre-ware Triplet — but were aided by a lot of commonsense!

Handy probes

One extremely useful set of quite inexpensive tools is known as a soldering aid set, somewhat like a dentist's probe.

In the days of hand wired radios, most manufacturers took great care to crimp leads tightly before soldering, making them very difficult to unsolder and separate from their tags. Many servicemen, pressed for time, would cut off a faulty component's lead, leaving the end still firmly attached to its solder tag.

The restorer's aim is to retain as much originality as possible, but the result of brute force clearing of old wire can be a broken tag. A far better way is first to mop up excess solder with a solder wick (in practice a length of copper braid saturated with flux), and then use the pointed tools to unwrap the old pieces of wire.

Test equipment

It has been said, with some degree of justification, that the greater the experience of the repairer, the less is the need for test equipment. But for all that, a few instruments really are essential for valve radio work.

Although not of laboratory standard, hobbyist kitset instruments such as those which were produced by Heathkit are quite suitable for receiver servicing, and can sometimes be found in garage sales and the like.

In practice, the majority of receivers can be serviced solely with the aid of a multimeter. Indeed, many successful veteran radio servicing businesses had access to only a simple multimeter and a basic signal generator. Some had a valve checker as well, but not much else.

Modern test meters have a wider range and are more accurate than the instruments commonly available 50 years ago. Typically, the well equipped pre-1940 servicing kit had a moving coil volt-ohm meter which gave a full scale deflection with 1mA current. With switched ranges, this typical multimeter could measure voltages with full scale deflections of 5, 10, 100 and 1000 volts. The current ranges might be 1, 10 and 100 milliamperes DC and 1.0A AC or DC, and it could measure resistances with reasonable accuracy between about 100 ohms and 1MΩ.

Such a meter was known as having a sensitivity of 1000 ohms per volt. This figure is derived of course from its ability to provide a full scale deflection from a current of 1mA. As 1V will generate 1mA through 1000 ohms, each range required a total series resistance (including the meter coil itself) equal to the voltage multiplied by 1000 ohms. Thus the 100V range would have a resistance of 100kΩ and the 1000V range a resistance of 1MΩ.

This was fine for measuring voltages in low resistance circuits, but there was a very different situation when used on high resistance circuits. A classic example would be a resistance coupled pentode voltage amplifier. The typical operating screen grid voltage, supplied from the HT line through a 1MΩ resistor, is about 30V.

To get a sensible reading with our meter, it would seem that the 100V range should be used. But this would connect 100kΩ from the screen to ground, creating a serious error. Even when measuring the anode voltage of this same amplifier, shunting the typical 0.25MΩ load resistor with the meter will produce significant errors.

English firm AVO produced top quality instruments, and their Mark IV valve characteristic meter is one of the best. Basically a mutual conductance meter, it is very flexible, with facilities for making a wide range of tests.

The situation becomes quite impossible when trying to measure AGC voltages, where the total resistance of the circuit will be of the order of megohms. To use a 1000 ohms per volt meter set to the 10V range would shunt the line with 10kΩ — a sufficiently low value to effectively short circuit the AGC system completely. Many modern moving coil meters are admittedly more sensitive (and delicate) than our example, but 20,000 ohms per volt is about the practical limit, and can still introduce significant errors.

It was common practice during the 1930s for receiver manufacturers to make allowances for the errors caused by meter shunting and to state, when listing voltages on circuits, the resistance and range of the test meter. This point should be borne in mind when using modern measuring instruments which do not provide the same loading, and therefore may give significantly higher readings.

Vacuum tube voltmeters

Later, the Vacuum Tube Voltmeter or VTVM became available, and was in its time a considerable advance in measuring technology. This is a wide range voltage and ohm meter which, by using the amplifying and isolating properties of a valve, enables measurements to be taken with virtually no loading. The VTVM can also be used with a diode probe to actually measure signal levels. It is still a very useful instrument, and well worth acquiring if the opportunity arises.

Nowadays the VTVM has its solid state counterpart in the digital readout multimeter, an instrument that old timers could only have dreamed about. Not only does it have the advantages of the high input resistance of the VTVM, combined with the portability and convenience of the multimeter, but as well, it can make a wide range of measurements and many have the facility to measure capacitance. Some users might prefer an analog readout, but this is a small price to pay for the versatility and accuracy now possible.

Although much servicing work can be done with the aid of a multimeter alone, there are times when other facilities are necessary. One is an oscillator for re-alignment. Most receivers, if left alone, will not drift very far out of adjustment; but any service work involving a tuned circuit will require a re-alignment.

Unfortunately too, there is a universal problem in that people who know little about the subject will 'tighten up' trimmer screws in an attempt to get a faulty receiver operating.

An accurately calibrated oscillator is

really necessary to correct misalignment, especially of the IF amplifier.

Surprisingly perhaps, it was largely elaborate shielding and the complexity of the output attenuator which created the considerable price difference between simple hobbyist type 'modulated oscillators' and fully professional signal generators.

Fortunately, for normal service work, an oscillator does not need to be complicated but it does need to be reasonably accurate.

Basic valve testers

The remaining piece of recommended test equipment is not essential, but can be very useful, and should be used with discretion. This is some sort of valve tester.

There are various ways of testing valves, and one of the best is still to substitute a known good specimen for a suspect valve. After all, if a new valve provides little improvement in receiver performance on a weak signal, there is not much point in replacing the original. However, a comprehensive tester can detect faults that may not be immediately apparent, and can be useful if the receiver is completely dead anyway.

There are two primary types of tester. The first is a simple *emission* tester, which is based on the principle that as a valve ages, its cathode gradually loses its electron emitting ability. This type of checker simply connects the electrodes as a diode and tests the emitting condition of the cathode or filament.

As well, there is usually some provision for testing for internally short circuited elements. This is a somewhat basic form of tester, but is certainly better than nothing.

Much more comprehensive is the *mutual conductance* or *transconductance* tester, which tests the amplifying ability of valves. Used in conjunction with an emission test, these checkers will pick up most valve faults.

Models like the Mark IV AVO illustrated in Fig.3 are virtually laboratory instruments and are sufficiently flexible that they can be used to ascertain most parameters of just about any valve, even those not listed in the comprehensive manual. These testers were popular in the 1960s and are well worth watching out for.

Another instrument that can be very useful is the capacitance bridge. Although modern digital meters frequently have very useful capacitance measuring ability, they do not normally cope with very large or small values, and do not have a power factor balancing control — very useful for getting an idea of deterioration of electrolytic capacitors.

Two more test instruments used for vintage radio repair were the signal tracer and the oscilloscope. Neither, in my opinion, is essential, especially if other instruments are available.

A signal tracer is essentially an audio amplifier with a probe and optional detector diode connected to the input.

To follow a signal from the aerial through a receiver to the faulty section would seem to be a useful method of fault location, but in practice, it is just as easy to make the receiver its own signal tracer and proceed back from the output stage, injecting signals into each stage until the inoperative stage is located.

In many cases, simply proceeding through the receiver, touching each control grid in turn with a screwdriver will generate enough 'signal' to reveal the problem area.

When they first came into general use, oscilloscopes were regarded as a very desirable and versatile instrument for servicing.

This is certainly the case with TV receivers, where it is essential to be able to check the amplitude and waveform of voltages; but in my own experience, an oscilloscope is rarely essential for sound receiver servicing.

About the only time one is indispensable is the rare occasion when, in conjunction with a frequency swept oscillator, it is used for the alignment of variable-selectivity IF amplifiers.

A handy aid

Finally, I'd like to suggest a simple and readily made labour (and cabinet) saving servicing aid.

Loudspeaker leads are often not long enough to remain plugged in while a chassis is on the work bench. As a result the speaker has to be unscrewed from the cabinet, a time consuming exercise and one which leaves the speaker without a baffle. A set of extender cables, a couple of metres long and fitted with suitable plugs and sockets is well worth making up.

Many manufacturers used standard four and five-pin valve sockets for speakers, and if suitable plugs are not available, discarded valve bases can be used instead.

A set of cables will soon repay the effort in making them up, in convenience and time saved. ❖