VINTAGE RADIO

By JOHN HILL

A simple junkbox receiver

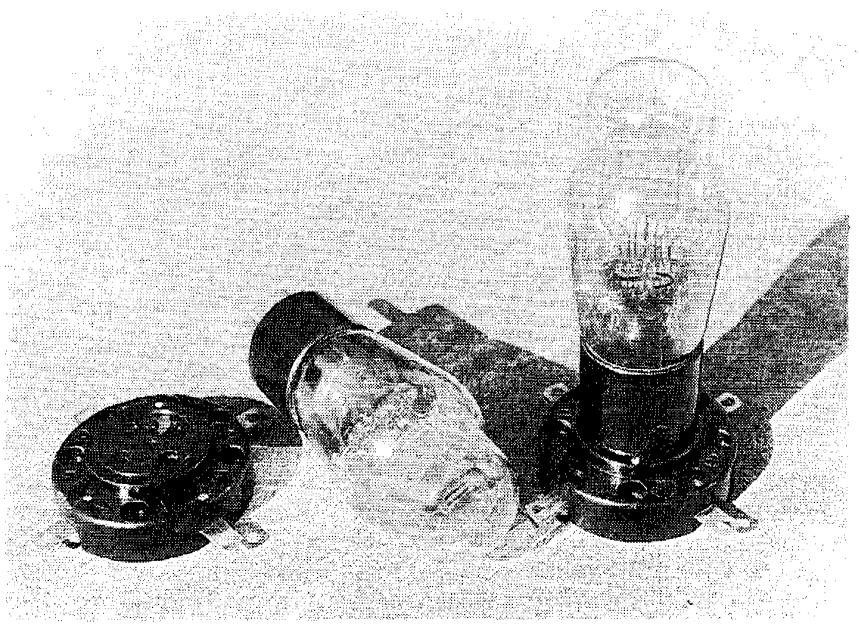
During the early days of radio, a simple home-built 1 or 2-valve receiver was a popular choice. This concept remained current for many years and supplied hours of entertainment for radio enthusiasts in the period before television.

Those early "home-brew" radios followed a fairly standard format and consisted of a regenerative circuit mounted on a baseboard with a front control panel. The circuit components could either be mounted directly onto the baseboard or on a separate circuit board. Mounted on the front panel were the receiver's controls, such as the tuning dial, reaction, on/off switch and headphone jack or terminals.

Regenerative receivers were easily built and consisted of relatively few parts. But despite their lack of refinement, these little radios performed surprisingly well, although they did have certain limitations.

One and 2-valve regenerative receivers could be bought in kit form or built from miscellaneous bits and pieces from one's radio parts junkbox. This latter method was almost a necessity if one wished to build a small radio receiver during the war years, when new radio components were difficult to obtain. In the early 1940s, radio magazines often featured "junkbox specials" which could use a wide range of substitute components if the recommended types were unavailable.

The war years were challenging times for the radio hobbyist.



A pair of old 30 valves were used in the receiver, together with baseboard mounting valve sockets. These valves can be replaced with earlier 4V or 6V triodes which give similar performance.

A 2-valve receiver

The basic circuit for my 2-valve junkbox radio comes from a 1941 radio magazine but I have made a couple of modifications. Who blindly follows a proven circuit without making a few alterations?

The additions to my version consist of: a back bias circuit to eliminate the "C" battery (I hate "C" batteries; as if "A" and "B" batteries aren't enough to contend with)! Also added was a 20Ω filament rheostat and a 75kΩ rheostat in the plate circuit of the detector, to vary the plate voltage.

The filament rheostat was necessary because a 3V filament supply was used, while the valves specified have 2V filaments. This was not an uncommon situation in the old days; the choice of filament supply being either a 2V accumulator or two 1.5V dry cells in series.

There were two reasons for adding the plate rheostat. The main one was because the original circuit specified 22.5V as the detector plate supply, and this meant using a tapped "B" battery, which I wished to avoid. I hate tapped "B" batteries too!

The other reason was to assist regeneration control. Although the circuit calls for a 100pF regeneration capacitor, the one actually used is less than 80pF. This restricts the range of regeneration control and this can be compensated for by using the plate rheostat.

The use of a rheostat to control regeneration in this way is rather unconventional and a departure from normal procedure. However, this ad-

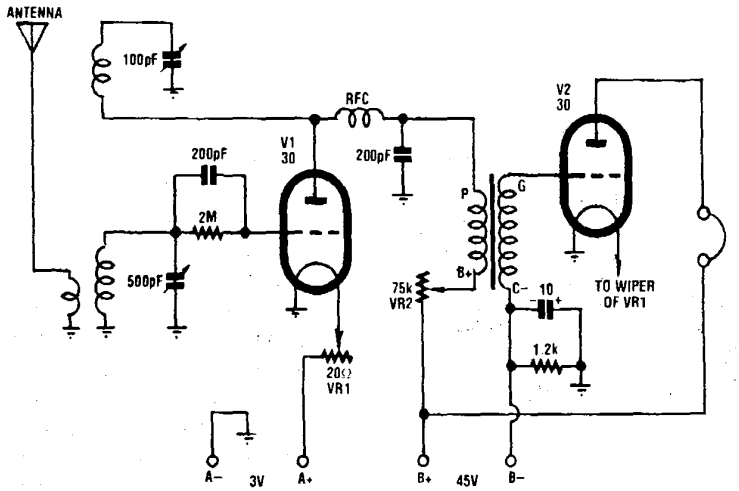
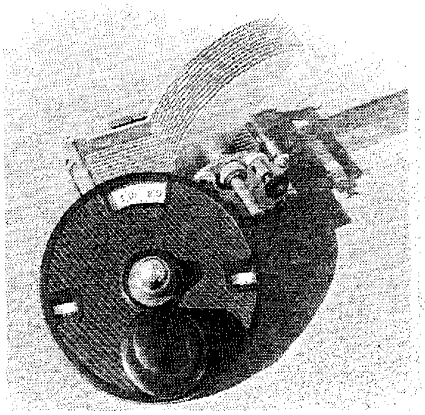


Fig.1: the circuit of the "Junkbox 2" receiver was taken from a 1941 publication but has been modified by the addition of a filament rheostat and a detector plate voltage rheostat.

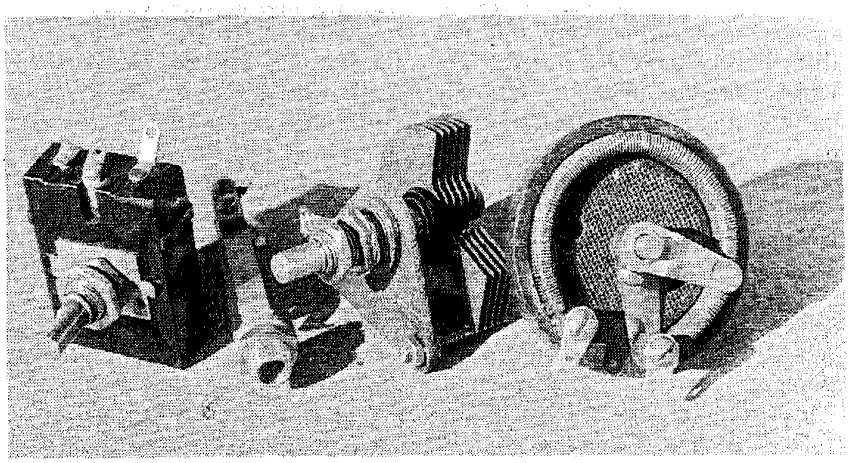
dition allows the reaction to operate smoothly over a wide range of voltages and without the need for a tapped "B" battery. It was found to work very well and is a useful control.

The final modification involved the addition of a switch and a small capacitor. The switch connects (or disconnects) this capacitor in series with the tuning capacitor, thus effectively halving its capacity. This could be of benefit if the plug-in broadcast band coil is ever replaced with a set of shortwave coils, the advantage being easier tuning. However, until some more 5-pin coil formers are located, this will remain a future project. (Note: this modification is not shown on the circuit).

Fortunately, my junkbox contained all the odd bits and pieces one would expect a vintage radio enthusiast's junkbox to contain and I was able to select fairly appropriate components for my "war years" receiver. Items such as an old Emmco dial, black Bakelite "vintage" control knobs, metal screw top terminals, baseboard valve sockets and a Philips audio transformer were there for the taking. The valves chosen were a pair of 2V 30s, the ones used in the original circuit.



An old Emmco dial and an ancient 500pF tuning capacitor are used in the Junkbox 2. Quite a few hours were spent cleaning and restoring these components to working order.



These four front panel components were all scrounged from the author's junkbox. They are, from left: 75-ohm pot, phone jack, reaction capacitor and filament rheostat.

Other interesting old bits and pieces were an ancient radio frequency choke, a reaction capacitor, and some square bus bar that was salvaged from a 1920s wreck. Many early sets used square wire (bus bar) and this offers a wide contact surface when connected to the thumbscrew terminals which were used on so many early radio components.

Valve specifications

The valve specification manual revealed that the old 30 was no startling performer. As the valve has an amplification factor of only 9.7, it was a good thing that the proposed receiver had two of them.

The 30 is a 4-pin battery triode from about the mid 1930s and was considered fairly old and obsolete way back in the 1940s. As my junkbox had half a dozen good 30s in it, it seemed appropriate to use them rather than some more modern type.

Incidentally, there is an octal equivalent of the 30 in the form of the 1H4. Although both valves are electrically the same, the 30 is 4-pin based and can be used with the old style baseboard valve sockets.

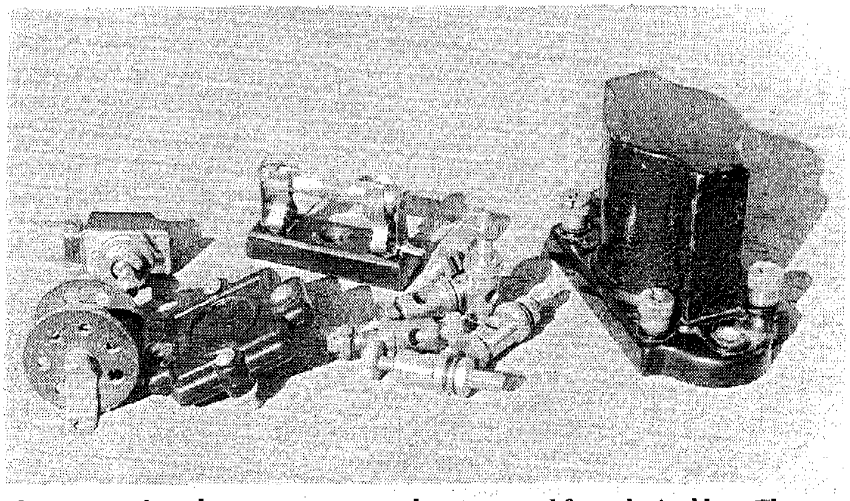
Scrounging around in my garage also produced suitable material for the baseboard, circuit board and front panel. Although black Bakelite would have looked nice, the circuit board and front panel were made of Masonite. Although Masonite may not be very traditional, many a home-made receiver has been constructed with this material.

Layout

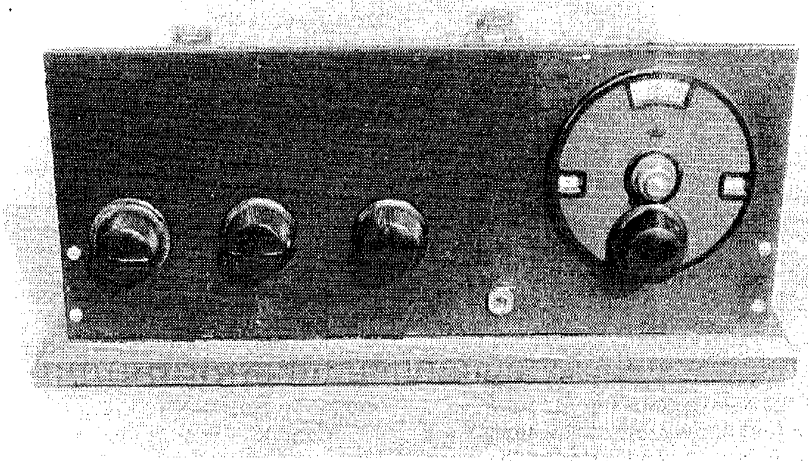
When assembling a radio from a kit, one has instructions and a suggested layout of components to follow. When working from a circuit only, one must think ahead and mount the parts in the appropriate places.

The coil should be mounted close to the tuning capacitor and reaction control, and the wiring to these components kept as short as possible. Thought must also be given as to where the dial and other control panel items should be mounted.

Both the front panel and the circuit board need to be set up with their



These circuit board components were also scrounged from the junkbox. They include the radio frequency choke, gridleak holder, screw top terminals, a capacitor and an old Philips audio transformer.



Front view of finished receiver. Having the phone jack between the dial and the reaction control helps keep the headphone cord out of the way.

respective components and their positions marked out in pencil. It is only when you are absolutely sure that everything is in the best possible place that the holes are drilled and various components mounted.

There are plenty of options as to the layout of the parts and some thought should also be given to aesthetics as well. In other words, having the components neatly spaced and appealing to the eye is important too. Nothing looks worse than a circuit board with most of the parts all cramped up at one end.

All the receiver components were mounted and wired according to the circuit diagram. Most of the connections and the back bias components (1.2kΩ and 10μF) were on the underside of the circuit board, with leads coming out through holes near the front edge of the board. These leads connected to the various control panel components.

The square bus bar was not easy to work with as it was very stiff and difficult to shape. As most of this wiring ended up underneath the circuit board and out of sight, it was a bit of a lost cause anyway.

At this stage, everything was complete with the exception of the coil. Winding this was quite time-consuming and very tedious due to the fact that the coil former was barely long enough for the job. A little extra former length would have made all the difference.

When winding such a coil (three separate windings on the one former), one must take into account the number of turns on the aerial coil, the number of turns on the grid or tuning coil, and the number of turns on the reaction coil.

The coil specification can only be found by trial and error and my coil ended up with the following number of turns on a 1.5-inch diameter coil former: aerial coil 15 turns; tuning coil 74 turns; reaction coil 70 turns.

Failure to experiment with the right number of turns for each winding can have many undesirable side effects. Too many or not enough turns on the aerial coil can make tuning either too broad or too sharp. Too many or not enough turns on the tuning coil can displace the tuning range, resulting in the set not covering the full broadcast band. And too many or not enough turns on the reaction coil can lead to uncontrollable or not enough reaction.

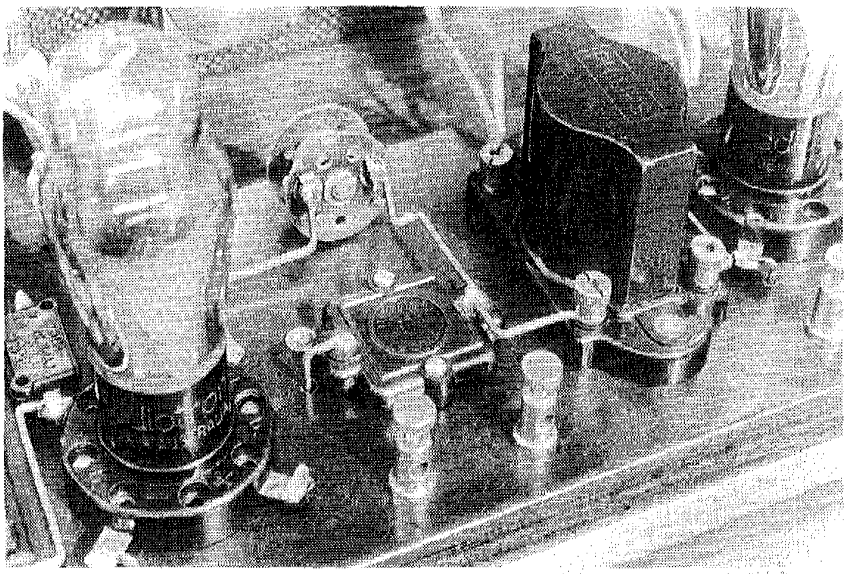
There are many variables involved and the ultimate arrangement will differ for each set, depending on the components used. The number of turns on the reaction coil alone varies with the distance it is from the tuning coil, the diameter of the former, the gauge of wire, the capacity of the reaction capacitor, the inductance of the radio frequency choke, and the amplification factor of the valve and the plate voltage it operates at, to name just some of the factors involved.

Performance

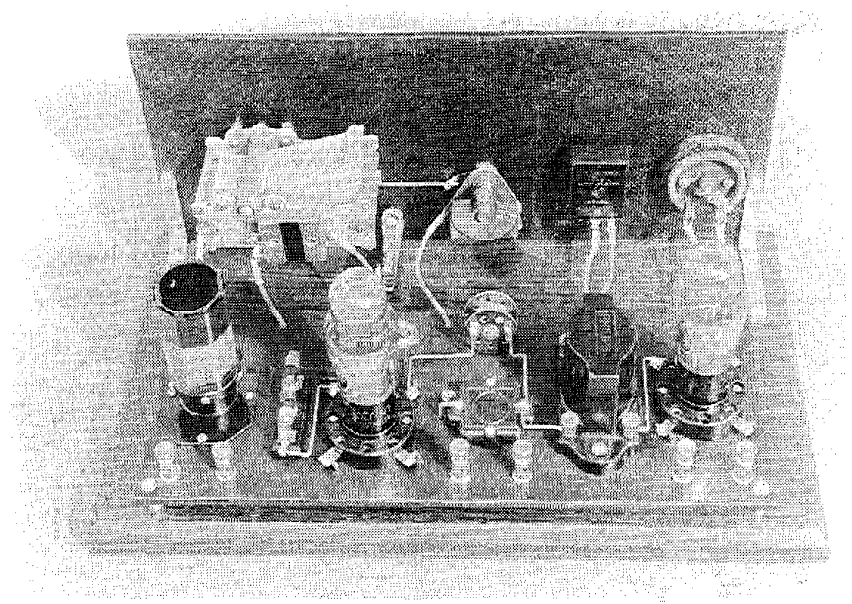
It was found that the set performed quite well on 45V, even though the original circuit called for a 90V B battery. When operating on 45V, B battery consumption is approximately 1mA.

By using a wave trap to suppress a very close local station (3CV Central Victoria) and no earth connection to maximise selectivity, it was found that the little two-valver worked extremely well, although the reaction really needed to be kept on the boil. It pulled in several low-powered interstate stations on a 25-metre aerial in daylight hours, which seemed rather good for such a simple receiver. These stations were 2QN Deniliquin, 5RM Renmark and 7BU Burnie in Tasmania.

Reception at night was even better, with a number of Queensland stations coming in loud and clear. In addition, Adelaide's 5AN and Sydney's 2BL sounded like local stations. Even 2YA New Zealand came through for a short period before surging off into a prolonged fadeout.



This close-up view on the construction detail clearly shows the square bus bar that was used to make the wiring connections. All the unsightly bits and pieces are underneath the circuit board.



Rear view of the Junkbox 2. The coil, tuning capacitor, detector valve and reaction control are at one end of the circuit board and the audio section at the other. A neat practical layout is essential for such a project.

Of course, reception conditions in central Victoria are quite different to those in metropolitan areas, where the chances of picking up distant signals between the powerful local stations are remote.

One thing that did not impress was the discomfort of the old STC headphones that were being used with the receiver. It brought back childhood memories of crystal sets and the caloused ears that went with headphone listening. Those hard Bakelite earpieces become quite painful after a while!

Using a pair of 8-ohm stereo headphones and an output transformer changed this situation for the better. Not only were the stereo headphones much more comfortable to wear but they also gave better sound reproduction. These improvements were made only by sacrificing a little volume, however.

But despite the restrictions, there is a lot of pleasure and satisfaction to be gained from building such a basic radio. There is nothing quite like listening to the receiver that you built yourself. **SC**