RESTORING A CLASSIC STC - 1

Recently, I overhauled a model 562 STC console radio, fitted with a type 56 chassis and dating from about 1933. This turned out to be a major exercise, involving many of the techniques and problems encountered in the fascinating activity of vintage radio restoration.

When it was found in a classic location, a farm shed, the old 562 was not a pretty sight. Generations of birds had roosted in the rafters above it, leaving heavy guano deposits. The knobs, one control and most of the valves had disappeared. Worse still, the inside of the cabinet was stuffed with a large quantity of straw and litter, a sure indication that rodents had nested in the chassis.

The toilet habits of mice are not very nice, and their urine is extremely corrosive – to the extent that it will even eat through nickel plating. Painted chassis such as those STC used are even more vulnerable. Areas of steel that are attacked soon become heavily pitted with rust, as can be seen in the photograph.

To restore or not?

The poor physical condition raised questions about the viability of restoration. Had the set been a common post war model, restoration would hardly have been worthwhile. However, with its angular shape and strongly patterned veneer, the STC 562 is a good example of *Art Deco* furniture, and as such, warranted a fair bit of effort and trouble to preserve.

In addition, the chassis of the 562 is historically interesting as it comes from a period when the standard 5-valve receiver was still evolving. But a final decision was deferred until the electrical condition of its major components could be ascertained.

Four large coach bolts were removed and the chassis withdrawn. I was surprised to find that the chassis ends were wooden. At least the mice hadn't affected *them*! However, a puddle of congealed wax under the power transformer looked suspicious. This was going to be a key item in the decision making.

With the aid of a vacuum cleaner and a brush, sufficient dirt and rubbish was removed to check the chassis over. The remaining valves were removed and a new power cord temporarily connected to the power transformer.

There was no sign of distress when the power was turned on. The HT voltages were checked at the anode terminals of the '80 rectifier socket and were found to be close to 400V. When loaded, these would be down to about the correct 375V. So far, so good.

Here I should inject some words of caution to those not used to working with valve equipment. This is not to frighten beginners off, but to remind them to make safety their first priority.

Fig.1: When first found, the grain of the wood was barely visible through the dirt and faded polish. But it responded well to basic treatment, as you can see.

Always be alert. Power transformers are capable of delivering lethal shocks. **Check and double check any mains connections, and if you are measuring high voltages or working on a live chassis, keep one hand in your pocket.** A mains isolating transformer is very worthwhile.

After an hour or so with the mains connected, the transformer was barely warm, indicating that it had survived the suspected overheating.

With this encouragement, the windings of the IF transformers, aerial and oscillator coils were checked for continuity. Apart from one of the oscillator coil windings, they were all intact. I wasn't too worried about the open winding, as oscillator coils of this era were usually single layer wound and easily repaired.

The remaining key item was the loudspeaker field winding. Fields were wound with fine wire, which can be open circuited by corrosion, but fortunately this one measured the correct 2500 ohms. Mounted on the speaker was the output transformer, with a primary resistance which should have been about 400 ohms. In this case it was open, but again it was not critical as I had a similar transformer salvaged from another radio. In any event, it would have been reasonably easy to rewind.

Restoration viable

All things considered, restoration seemed to be worth attempting. A close inspection of the cabinet showed that damage was largely superficial, and most of the mess was removed with a good scrubbing with detergent and water.

Although the cabinet refinishing treatment I described in the December 1988 issue of *EA* could have been used, the owner wisely wished to retain an antique appearance, and used methods employed by antique furniture restorers. These revive the original finish as much as possible by blending, reamalgamating and the judicious application of polish.

As can be seen from the photograph of Fig.1, the result was most satisfacto-

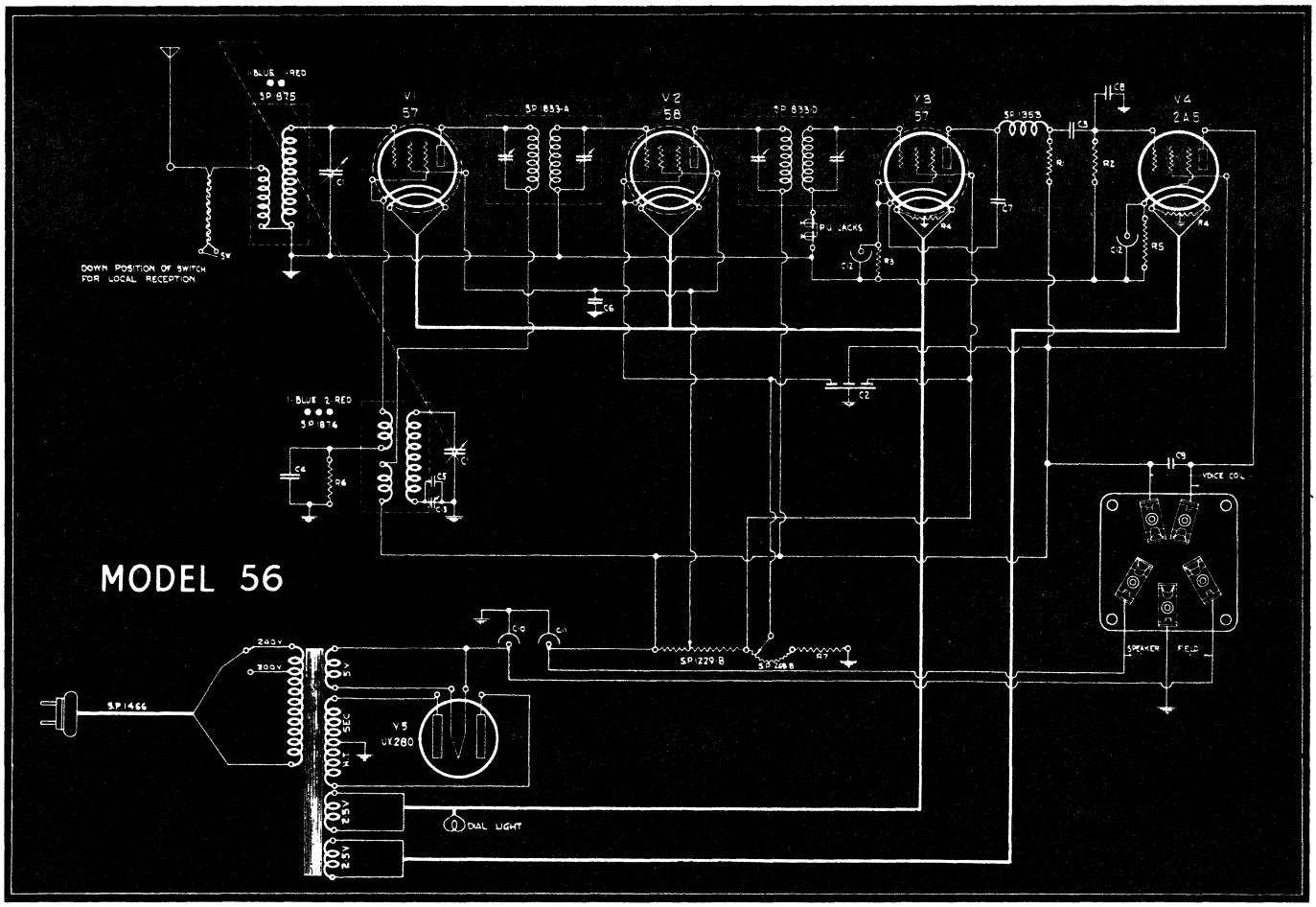


Fig.3: The circuit schematic for the model 56 chassis used in the 562 receiver. It had no AGC, and a switch was used to insert a twisted-wire 'gimmick' capacitor in series with the aerial for reception of strong local signals.

ry. The chassis however needed a lot more work.

Interesting circuit

Before describing the work on the chassis, we will take a good look at the circuit. This is quite different in many ways from those of the more familiar post-mid-1930's receivers.

A 5-valve superheterodyne, the valve lineup is typical of Australian made receivers of the period. Rather than using a pentagrid frequency converter and a combined diode-triode detector, which were only just appearing in the US, this chassis used a pair of 57 pentodes. One was used as a self oscillating mixer, and the other as a biased detector. The intermediate frequency amplifier used their variable-mu companion, the type 58. A 2A5 output pentode driving the loudspeaker and the usual '80 rectifier completed the lineup.

The missing control turned out to have been a single pole rotary on/off aerial attenuator switch, for coping with strong local signals. It simply inserted a small amount of capacitance in series

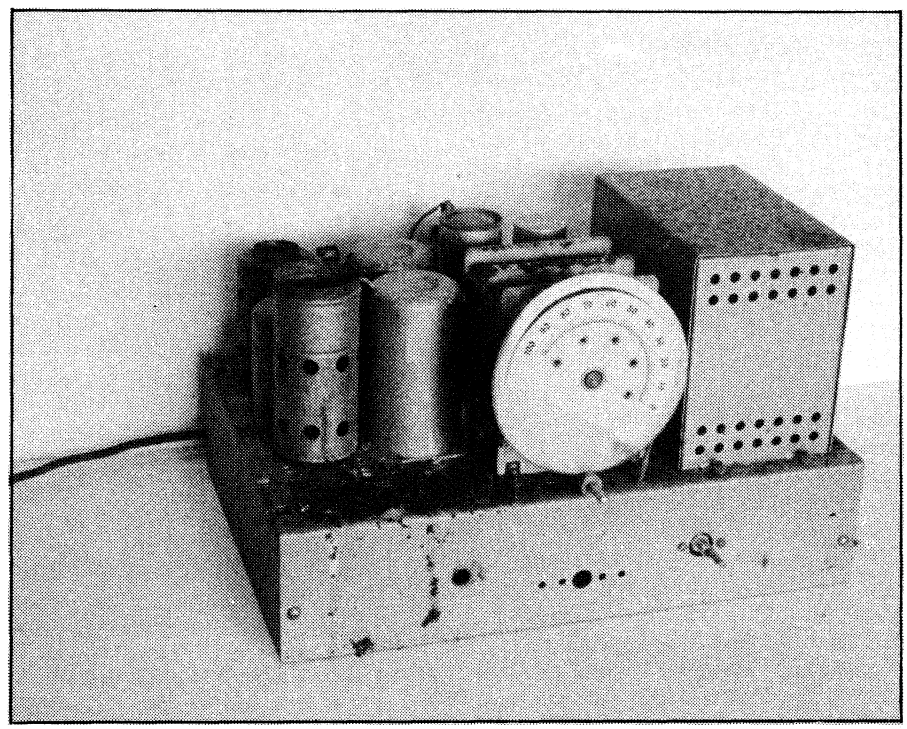


Fig.2: Bad storage and rodents had left the chassis in a very rusty state. But it too was to respond to treatment, as the author explains.

with the aerial. The twisted wires symbol on the circuit indicates that the capacitor was just three or four turns of wire around the aerial lead.

Normally, a 5-valve set of this period would have used a three section tuning capacitor, with two aerial tuning circuits to overcome the problem of images resulting from the use of the commonly used low intermediate frequency (IF) of 175kHz.

Without preselection, as it was called, a strong signal 350kHz above the desired programme could produce interference. In this case, STC anticipated the radio industry's later universal change to a higher IF, by using 460kHz.

This increased the image frequency difference to 920kHz and simplified the model 56 by requiring only a single tuned aerial circuit, and hence a two 'gang' tuning capacitor.

Capable of very good performance on the broadcast band, the 'autodyne' self oscillating mixer used in the STC was a popular frequency converter during the early 1930's. Basically, the autodyne mixer is a valve biased nearly to cutoff, with tuned oscillator and coupling windings connected between the anode and cathode.

Readers familiar with transistor receivers will recognise the similarity of the autodyne to today's mixers.

Related to the autodyne mixer, the biased pentode detector was popular until displaced by combined diode-triode and diode-pentode valves.

It is capable of fully driving a pentode output stage with only a volt or so of input signal, but one of its shortcomings is its inability to generate AGC voltages. This requires the volume control to be placed very soon after the aerial.

As the gain of an autodyne mixer cannot be readily varied, the earliest point of control in the STC 56 is the cathode voltage of the 58 IF amplifier valve.

With the prior amplification of the uncontrolled mixer stage, the IF stage gain control cannot cope with strong local signals.

This is where the aerial attenuator switch comes in. It works, but is an inelegant solution and contrasts with the progressive use of a high frequency IF.

A method used by many manufacturers at the time, and later by STC, would have made the switch unnecessary. In this the control is divorced from the voltage divider and one end is connected to the aerial. The other end is connected to the cathode of the IF amplifier and the moving arm is earthed.

As the bias on the valve is increased, the aerial is also progressively loaded down, resulting in a smooth double acting wide range control. The output stage was the traditional pentode with cathode bias. Equally conventional was the power supply using the inevitable '80 rectifier.

During the 1930's few mains powered receivers used permanent magnet speakers. Instead, electromagnetic fields were standard, with the field windings doubling as filter chokes.

Many Australasian manufacturers, including STC, favoured fields of 2500 ohms and the resulting voltage drop required power transformers to have HT voltages of about 375 volts.

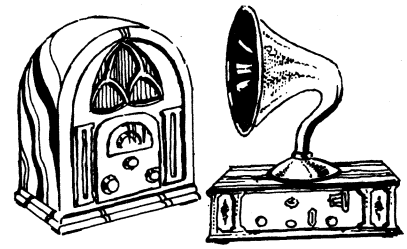
All low value resistors were wire-wound on small bobbins, whilst the high value types were Australian brand 'Chanex' with ceramic bodies and cast metal ends. The few paper capacitors were again 'Chanex' brand, with C2 (the main bypass block) of STC's own make.

The loudspeaker proved to be interesting, with an unusual frame in front of the cone. Fortunately, the mice had left the cone intact, and apart from replacing the output transformer, the speaker required no attention.

In the next chapter the actual servicing and restoration work on this receiver will be described.

Vintage Radio

by PETER LANKSHEAR



Restoring a classic STC radio – 2

Last month's article described the condition and design details of an STC model 562 receiver that had seen better days. This article will cover the work that was necessary to make it once again a fully operational and useful radio.

Before launching into a description of the actual restoration work, I would like to give a few words of advice – even a warning.

With this receiver, as with others I have restored, at no time was any attempt made to 'fire it up' before restoration to see if it would 'go'. The initial checks had shown that it could not have worked anyway, and there would have been a chance of doing serious damage.

My advice in fact is to be very cautious about applying power to receivers that have not been checked over, for the chances are that the only thing heard will be the bubbling of overheated power transformer wax! It's a good rule to ALWAYS check out and service old equipment before switching on.

First priority

A thorough cleaning was essential before any serious work was undertaken, and this started with washing the exterior of the chassis. Provided that it is completely dried afterwards, electronic equipment is not harmed by clean water, but nevertheless care was taken to avoid excessive wetting of components.

A bucket of hot water, some detergent, an old paint brush and a pot scrubber dealt with the soluble grime. Stock was then taken of the physical damage. Some work would be necessary on the speaker socket at the rear of the chassis, but the worst damage was corrosion. Readily removable items like valve shields, filter capacitors, the power transformer cover and the tuning capacitor were taken off, to improve access to both themselves and the chassis.

Carborundum cloth and steel wool were used on the rust. Pitting of the surface required some hard work in places. When the sanding was finished, a commercial 'rust killer' containing phosphoric acid was applied to the affected areas to passivate the metal and provide a good painting surface.

Replacements

Before any repainting, the little white celluloid licence notice was removed from the rear of the chassis, and the rivets drilled out of the broken speaker socket.

At the time that the 56 chassis was made, some manufacturers – including STC – used large diameter valve and speaker socket holes and sockets to match. The damaged speaker socket was one of these and as there was no suitable replacement available, a piece of thin fibre board was cut to size, and a hole punched in the middle for a standard socket. A scrap of suitably coloured 'Formica' could have been used instead of the fibre.

Fortunately the open-circuited oscillator coil winding was not covered by other windings. A close inspection with an eyeglass revealed a green spot of corrosion at about the middle of the winding. It would have been possible to reuse the wire after joining the corroded ends, but a new winding was preferable and after counting the number of turns, wire of a similar gauge was wound on in the same direction as the original winding.

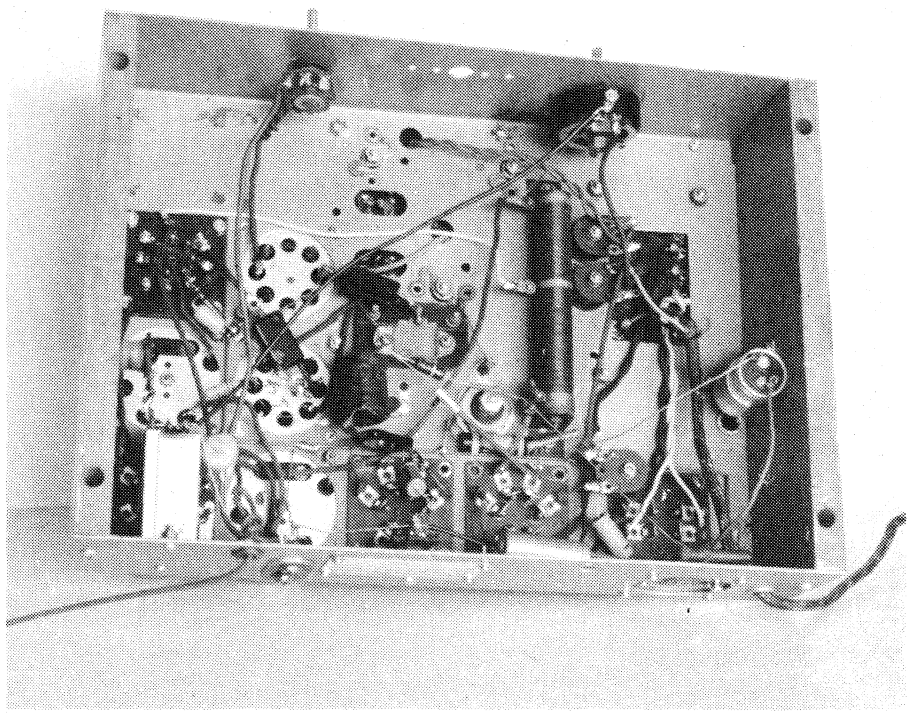


Fig.1: The underside of the chassis after servicing. Fortunately it was in better condition than the outside. Note the tubular HT voltage divider, a type popular with Australian manufacturers.

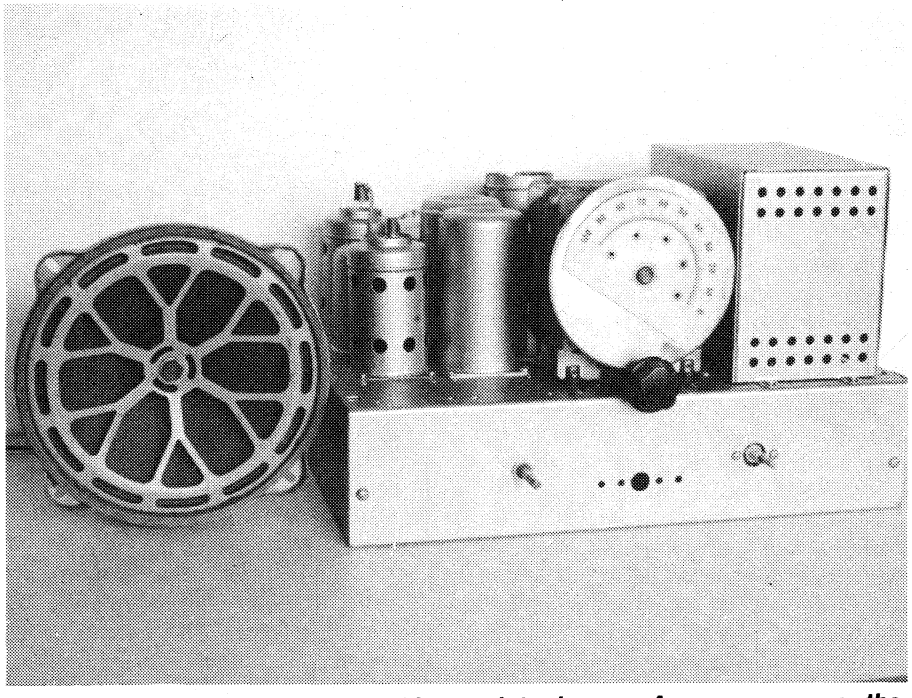


Fig.2: The finished chassis, looking a lot cleaner. As you can see the loudspeaker has an unusual framework in front of the cone.

Repainting

Prior to reassembly, the chassis was repainted. STC had used a distinctive paint finish. Best described as a metallic gold/pink, nothing even remotely like it is available commercially nowadays.

Some experimenting with aluminium paint showed that a good match came from mixing in some gold powder and red enamel! A couple of coats of this brew were brushed on and the chassis started to look respectable again.

The dial assembly, a popular type in early receivers, used a friction drive to the rim of a metal disc. Provided that there is no excessive wear or disc distortion, these drives only need some lubrication and perhaps adjustment of the collar controlling spring tension.

Tuning capacitor rust spots were removed with steel wool and the bearings were relubricated. Soft rubber mounting grommets were widely used for valve radio tuning capacitors and, as usual, these had disintegrated into a gooey mess. These mounts are now hard to find, but satisfactory replacements can generally be made from standard grommets.

With the capacitor remounted, attention was given to the grid leads of the 57 and 58 valves. Top grid leads deteriorate from exposure to heat and light, and are abraided by the edges of valve shields. Apart from the appearance of worn insulation, there is a possibility of contact to cans and shields. In this case, the detector and IF amplifier grid leads were in a bad way and were renewed.

Under the chassis

As the type 56 chassis was intended for a console cabinet, its size was generous, with plenty of room for the underside components. To be expected with the uncomplicated circuit, wiring was simple and easy to follow.

Most of the fabric covered wire was sound, but a couple of rubber insulated leads needed replacement. As a safety precaution, the power cord was replaced even though it appeared to be in reasonable condition.

Incidentally when renewing power cords in old sets, use fabric covered cable. Plastic coverings do not look right.

Earthing to a plated chassis is generally by direct soldering or solder lugs. These are not very satisfactory methods with the painted steel used for the 56 chassis, and STC had connected earthing points together with busbar wire. This should be remembered when replacing components.

Restoration of a receiver of this age requires a different approach from run of the mill post war models. Original components should be repaired wherever possible. Many carbon resistors and paper capacitors will have deteriorated sufficiently to warrant replacement, but they are, of course, practically non repairable.

In this case all paper capacitors showed considerable leakage when tested with a multimeter, and were replaced with modern mylar and polyester types of sufficient voltage rating. Block capacitors can often be emptied and the contents replaced by modern plastic types.

The main set of bypass capacitors 'C2' (see circuit last month) was a STC-made triple 0.25uF group mounted in a rectangular can. It was a simple matter to unclip the fibre tagboard and renew the contents with three 0.27uF 400 volt polyester units. This block of capacitors can be seen at the bottom left hand corner of the under chassis photograph.

Predictably, the original wet electrolytic filter capacitors had long since dried up. One with an iron case was badly corroded. This was discarded, but the other, being more presentable was retained – although disconnected – for appearance. Standard 16uF 450 working voltage tubular replacements were fitted under the chassis.

Note that high capacity replacements should not be used for input filter capacitors with valve rectifiers. To do so runs the risk of rectifier and possible power transformer damage. The dual cathode bypass capacitor C12 was replaced by a pair of miniature low voltage electrolytics.

STC model 562: VALVE OPERATING VOLTAGES

		Plate Voltage	Screen Grid Voltage	Grid Bias Voltage
Valve V1	Type 57	235	90	5.4
Valve V2	Type 58	235	90	2.2
Valve V3	Type 57	120	50	2.4
Valve V4	Type 2A5	225	235	14.0
Valve V5	Type 280	375 AC	425 DC	(Cathode)

ALIGNMENT FREQUENCIES: IF 460kHz. Padder 600kHz. Trimmers 1400kHz

Fig.3: A table of voltages for the set, as published by STC. The voltages in the restored set were found to be very close to these.

C8, visible in the underside picture, was a .0005uF (500pF) 'Chanex' paper capacitor inside a Bakelite case. To retain the case for its cosmetic effect, the contents were removed and a 250 volt tubular ceramic capacitor refitted inside.

Carbon resistors R1, 2, 3 and 6 had colourful labels on ceramic bodies and cast metal ends. These resistors always look the part in vintage equipment, but unfortunately each one was hopelessly high in value or open circuited. Standard one watt replacements were used.

The remaining resistors, all wire-wound, were intact. This was fortunate in the case of the main voltage divider, and as it was wound with very fragile resistance wire, care was taken not to damage it in any way.

Wound on a fibre tube 20cm or so long and about 15mm in diameter, this type of voltage divider was frequently used in Australian receivers. Tappings were taken off with adjustable clips. BE CAREFUL – these clips should only be adjusted with extreme care. Normally there should be no need to touch them.

Switch-on time was approaching. First though, a careful check was made to see that were no incorrect connections – including any made in the past, a possibility which can be a trap for the unwary. A set of valves known to be good was installed and the speaker plugged in.

Switch on

With a close watch for any signs of distress, power was turned on and after the usual warmup time, voltage checks were taken. These proved to be similar to those in the table, but there was no sign of any reception. Taking the grid clip off the detector valve produced the time-honoured loud 'burp', indicating that the audio system was fine.

Connecting a signal generator to the grid of the 58 confirmed what I had suspected. The IF transformer trimmers had been attacked by someone attempting to make the set go. This unfortunately is an all-too-common occurrence.

Retuning the trimmers to 460kHz produced some life, but sensitivity was poor and the range of received frequencies seemed to be wrong. The oscillator tracking was obviously out of adjustment, but the problem was how to find the right settings.

Normally, dial calibrations are a guide to the correct adjustments. In this case, the dial was only marked 0-100, so some other method had to be found.

The basic principle of tracking is to keep the RF and oscillator tuned circuits in step with each other, but separated in frequency by an amount equal to the IF. In this case, only the oscillator padder and trimmers are adjustable, and the oscillator must track the RF tuning.

With a large aerial connected, and the tuning capacitor nearly closed, it was possible to hear the background noise peak as the padder was adjusted. This put the RF and oscillator coils in step. Next the oscillator trimmer was adjusted so that 1500kHz tuned to 5 on the dial scale. The RF trimmer was then peaked at 1300kHz and the set came to life.

Finally, a friend with a lathe turned some knobs typical of the period from hardwood, and fitted them with brass cores tapped for grubscrews.

To conclude a satisfying and rewarding project, the chassis was refitted into the cabinet. The set is working well again and, with a bit of luck and kind treatment, may well reach its century – by which time it will be an even more valuable piece of history.