VINTAGE RADIO

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Elegance from the 1920s : the 1929 AWA C58 Radiogram

In the early days of radio, receivers varied from simple crystal sets built into packing case timber cabinets to very elaborate multi-valve receivers installed in ornate (and expensive) cabinets. This month, we look at a set from the upper end of the price range – the AWA C58 radiogram circa 1929.

In the main, crystal sets were built or purchased by families with little spare cash. Conversely, receivers at the other end of the spectrum were purchased by the wealthy to grace the lounge or smoking room in their mansions. In many cases, it was very much an ego trip to have an expensive radio, proving that "I've got more money than you".

Anyone with a very healthy bank balance back in 1929 could have bought an AWA C58 radiogram. To say that it was impressive is an understatement – the cabinet measures an ample 1270mm high x 813mm wide and is 458mm deep. And commensurate with its imposing look, it requires two muscular people to lift it!

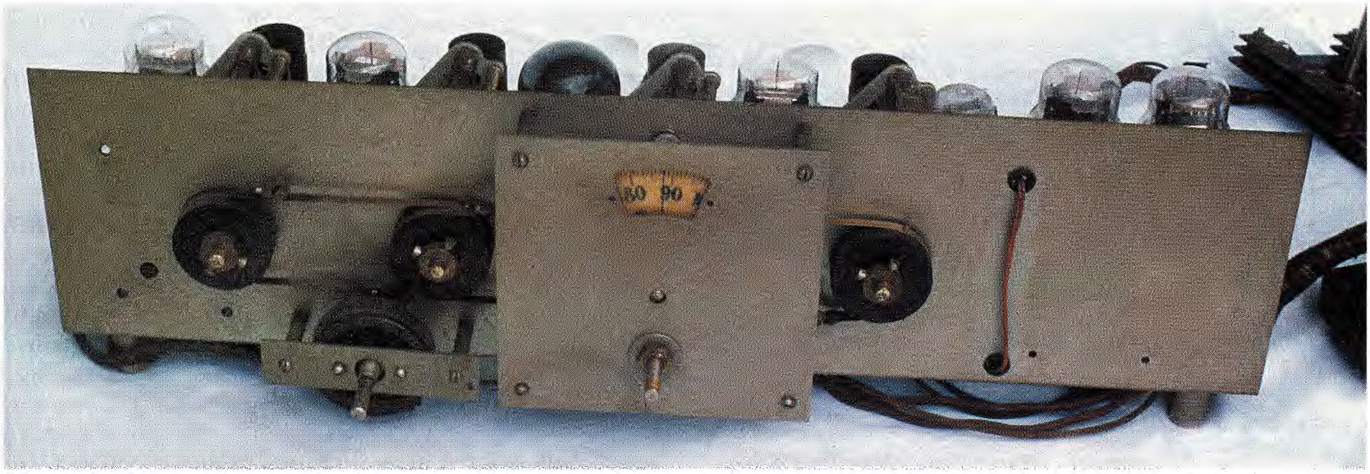
Housed beneath the lift-up lid at the top of the cabinet is a single-speed 78rpm record player. It uses a "one play" steel needle (stylus) and the usual enormously heavy pick-up head, with a stylus weight of 125 grams. The owner of the unit featured here is restoring both the turntable and the pickup head.

Below the turntable is a shelf which carries the radio frequency (RF) stages, along with the detector and first audio stage of the receiver. The front part of the chassis is metal and carries the tuning capacitors and an audio transformer. A phenolic sheet at the rear of the metal chassis carries seven valve sockets, the RF coils and a few RF bypass capacitors.

The wiring is all point-to-point and the terminals/sockets for each valve are riveted directly to the phenolic sheet, so there are no separate valve sockets. Instead, they are all part of an "integrated circuit board".

The bottom shelf of the unit carries a large power supply and the push-pull 245 audio output valves which drive the loudspeaker. This section is

This view shows the rear of the top chassis which carries the RF stages and the push-pull audio driver stage.



This is the RF chassis from the front. The tuning capacitors are all single gang and are coupled together using brass bands and pulleys.

built on a very substantial metal chassis of the type that became almost universal from the early 30s onwards.

An unusual feature here is that the metal chassis is shielded underneath by a metal plate attached to the wooden shelf. It becomes operational when the chassis is screwed into the cabinet. In fact, shielding is common in this section of the receiver.

One shielded enclosure uses no less than eight paper block capacitors as filter and bypass elements. The leads come out of the block and radiate around the chassis to do their respective jobs. Another enclosure contains a 4-section filter choke which feeds various sections of the set. The field coil is, of course, separate.

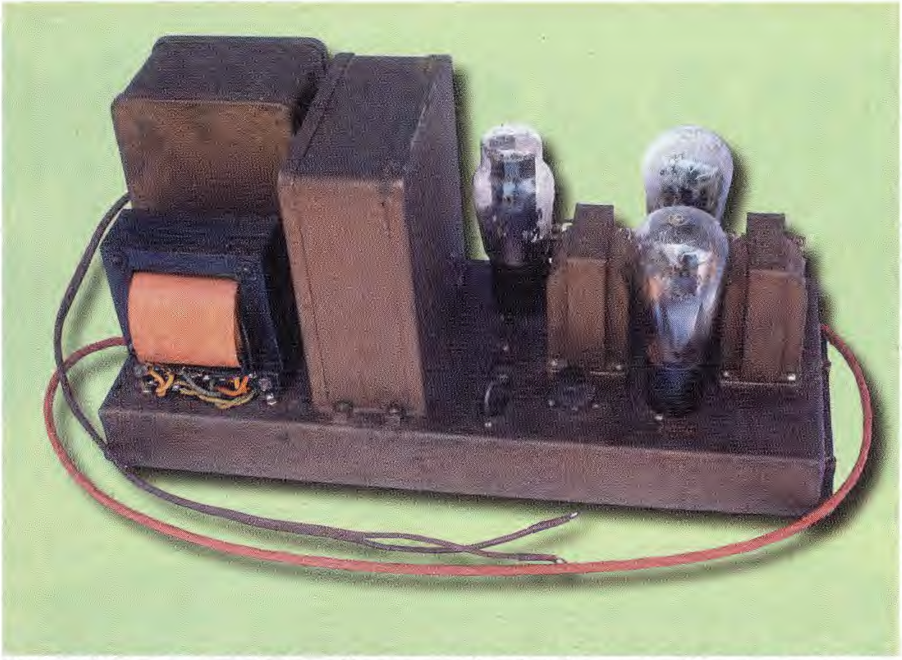
The power transformer that's now in the set is not shielded but the original one apparently was, as mounting holes are evident. It is necessary to be careful here, as there are exposed terminals on this transformer. Unfortunately, it is just too wide to slip a shield over it.

Dismantling the C58

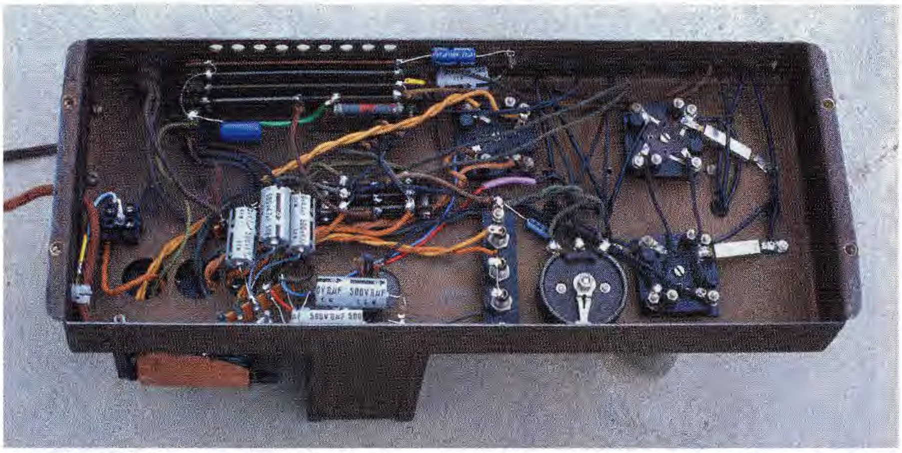
Before applying power to any elderly set that is to be restored, I first dismantle it and check it thoroughly. I never apply power to such old sets until they are checked, as the damage can be devastating if a serious fault is lurking in the works.

Dismantling the receiver is an involved task. First, all 15 leads have to be removed from the terminal block at the back of the power supply and audio output chassis (with power off and disconnected from mains). The power supply lead and the field coil

The cabinet is big, ornate and impressive. It features two "bat-wing" doors which swing open at the front to reveal the controls and loudspeaker grille.



This is the power supply & audio output chassis. The two audio output valves (2 x UX245) operate in push-pull configuration.



The electrolytic capacitors in the power supply and audio output chassis were all replaced with modern equivalents.

leads are then removed, after which the mounting screws can be removed and the chassis lifted out.

Next, the record player shield must be removed, as it prevents access to the top chassis. The front panel knobs are then removed, followed by several screws from under the shelf to free the chassis.

It was necessary to move the chassis around so that the large cable from the main chassis could be drawn back through a hole in the shelf. Additionally, there is a 6-terminal block on this chassis and the leads from this block were released. By then manoeuvring the chassis around and sliding my hand in front of the chassis, it was possible to determine which front panel toggle switch was attached to a group of three leads. The toggle switch was subsequently removed from the front panel and this at last allowed the chassis to be removed.

The cable that was removed from the 6-terminal block was connected to several other bits and pieces, namely a capacitor, a choke, a "strange" tapped switch fitted with resistors as a volume control, and a switch to select between radio or gramophone operation. This latter switch is similar to those used in early telephone exchanges.

Finally, the leads to the pick-up head were also removed so that this assembly could be removed, albeit with some difficulty.

At last it was all spread out on the work bench. I do not rush restoration jobs where such old and obviously valuable equipment is involved. Where would I get a replacement UX245 or UX226 from? This set has such valves and some of the slightly later versions (245 and 226).

Tracing the circuit

Receivers of this era did not come complete with circuit diagrams and this set is no exception. As a result, I methodically traced out all the bits and pieces on the metal chassis and noted where each component went. In particular, I noted what went to each of the lugs on the 15-terminal strip.

Despite the set's age (70+ years), very little had been replaced. I counted two high-voltage filter capacitors, the power transformer, a few valves, some wiring changes around the big metal boxes and a few alterations around the loudspeaker.

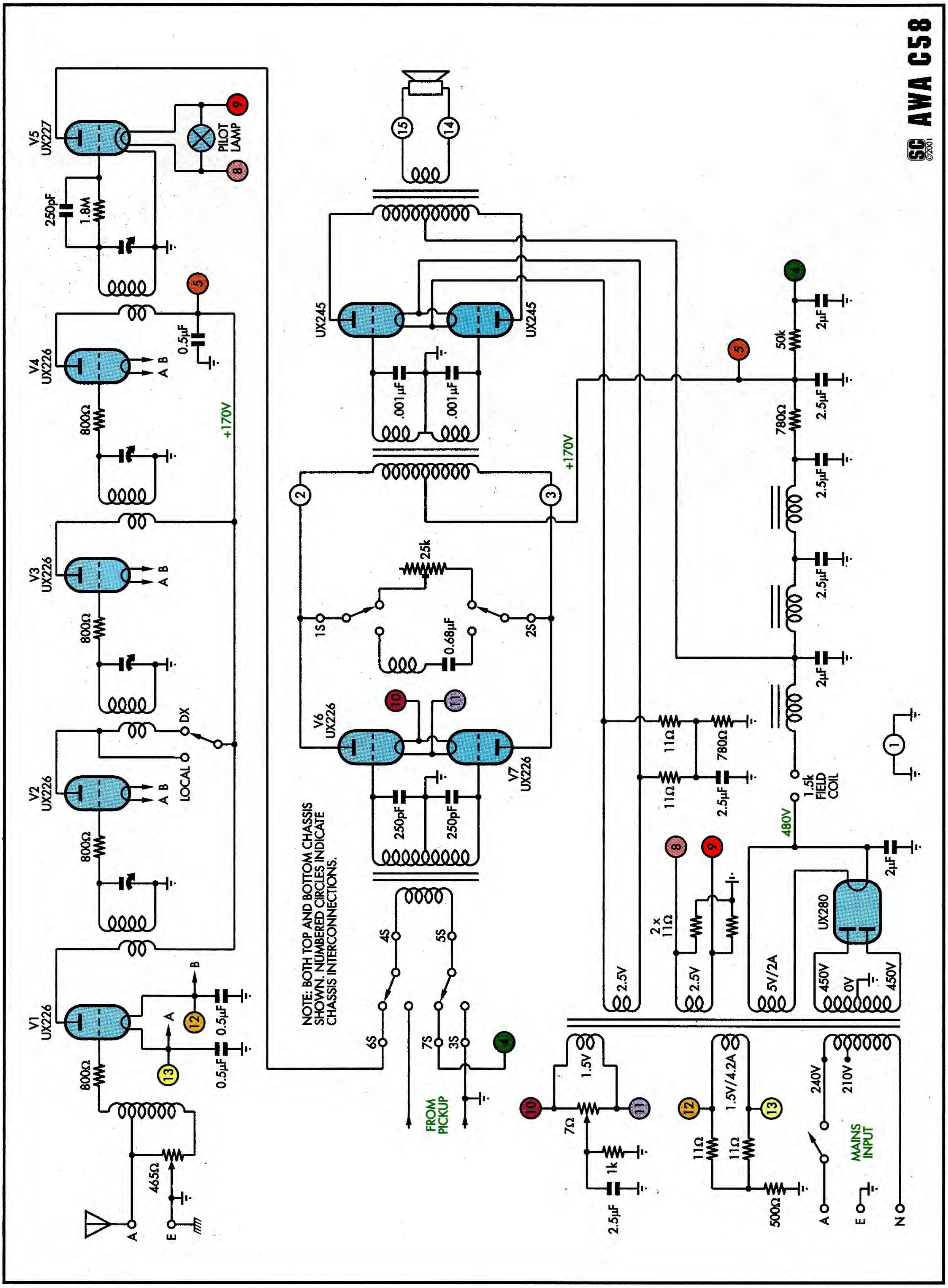
There was no evidence of any work having been done on the RF, detector and audio chassis, except for some early valve replacement. The little subgroup of parts, including the radio/gram switch, were a bit the worse for wear and were either reterminated or replaced. Only a couple of perished wires needed replacement on the two major chassis.

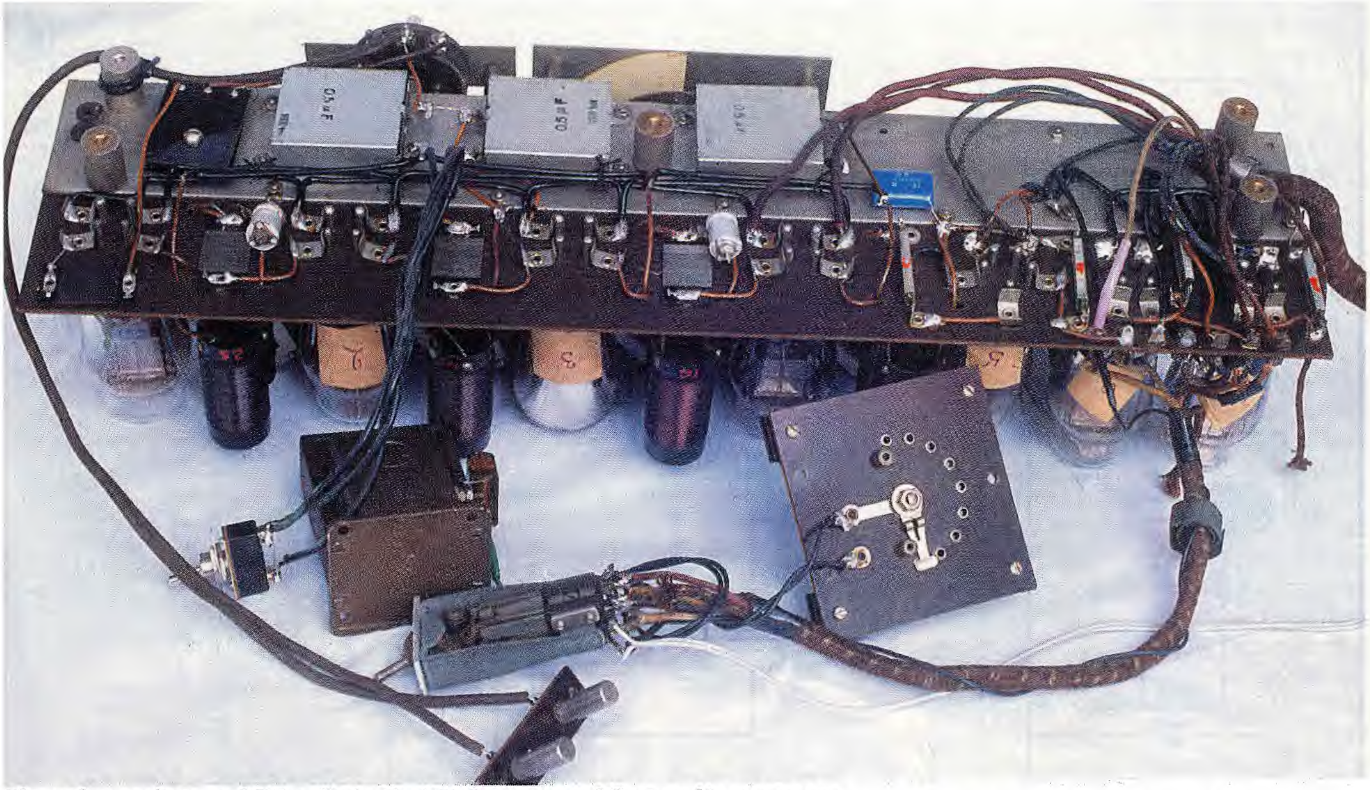
I traced out the circuit as best I could. The large metal boxes had many unidentified leads coming out of them. The condition of the internal components was an unknown quantity and only an educated guess could initially be made as to what was inside some of them. However, I was able to correct the inaccuracies when power was applied to the set later on.

It was interesting to note that all the filament to earth bias resistors for the RF chassis were actually on the power supply chassis and that some of the leads were nearly a metre long. Fortunately, the most critical bypass capacitors were on the RF chassis itself.

Power supply checks

I tested the power transformer and the filter chokes for any breakdown in the insulation which could cause short circuits or short the mains to the chassis. This was to make sure that there would be no problems for the set or electrical shocks for me or the owner. I did this using a high-voltage tester


AWA C58
SC ©2001
V1 UX226
V2 UX226
V3 UX226
V4 UX226
V5 UX227
V6 UX226
V7 UX226
UX245
UX245
UX280
PILOT LAMP
LOCAL
DX
+170V
480V
FROM PICKUP
MAINS INPUT
1.5k FIELD COIL
NOTE: BOTH TOP AND BOTTOM CHASSIS SHOWN. NUMBERED CIRCLES INDICATE CHASSIS INTERCONNECTIONS.



The valve sockets and RF coils in the RF, detector and first audio stages are mounted on a phenolic sheet attached to the rear of the metal chassis. The metal (front) part of the chassis carries the tuning capacitors and an audio transformer.

that can apply 500V or 1000V to a component under test. SILICON CHIP described a more versatile model than mine in May 1996.

Note that conventional ohmmeters can give a false sense of security here since they test at low voltage only, whereas faults such as insulation breakdown sometimes only show up when high-tension (HT) voltages are applied to the set. Ohmmeters often use a 1.5V battery to do these tests but the actual item being tested may have insulation designed to withstand 1000V (or more) across it. However, if the insulation has deteriorated, it could easily break down with perhaps 100V applied across it and a conventional multimeter won't find this.

Two modern 8μF 500V electrolytics had been installed in the set previously. I also found that a number of other capacitors in one of the shielded boxes needed replacement. An ohmmeter gave the "all-clear" but the high voltage tester said otherwise. These were all replaced with the nearest equivalent values I could find. No HT to earth shorts were found in the set, so it was all clear in this respect.

The 2-core mains power lead was replaced with a 3-core lead to ensure safety. Actually, the mains lead had been replaced at some time in the past and the earth lead had been cut off! That all-important earth connection is now back in place.

The big test

With the valves removed, power was applied to make sure that the voltages around the chassis were roughly correct and that the power transformer was in good order. Nothing heated up, so this was a good sign.

Next, the rectifier valve was installed and the receiver switched on with a 1.5kΩ resistor in place of the field coil. A few quick checks with a multimeter revealed that all was well – the various heater voltages were there and each section of the high-voltage transformer winding gave the same voltage. I then ran the set for a short period but found that some of the voltages were dropping off and that one of the metal boxes was getting warm.

With the power off, I disconnected some of the wiring between the two metal boxes and discovered that one box was full of paper block capacitors, all of which were faulty (the second box was full of filter chokes). As a result, these capacitors were all replaced with polyester or electrolytic capacitors as appropriate.

Finding exact replacements is not easy these days, so the new capacitors all have greater capacitance than the originals (the voltage ratings are the same). The set's owner wanted the set to look as original as possible, without going to extremes to make everything absolutely authentic under the chassis. Once the faulty capacitors were bypassed (they are still there in the can), the HT voltage remained constant at nearly 500V with no load.

At this point, the UX245 audio output valves were installed and a test loudspeaker attached. All went well, with the valves drawing the expected current. I then connected an audio oscillator to the primary of the audio driver transformer and swept the output frequency across the audio spectrum. The response was quite reasonable for such an old set and I was able to hear signals from around 100Hz up to about 8kHz – not bad for 1929.

Front-end overhaul

The next step was to overhaul the RF, detector and first audio stages. As before, I traced the circuit out and this

There's ample room inside the cabinet for the two large chassis sections and the big electrodynamic loudspeaker.

revealed a conventional TRF front end.

The volume control consists of a potentiometer which is across part of the antenna coil, between the antenna and earth. It is quite effective. The output from the coil is then fed to the receiver which uses four UX226 triodes as RF stages.

As shown in the circuit, the first RF stage is untuned but all the others are tuned. A switch between the second and third stages bypasses the primary of one RF coil to lower the gain in high signal strength areas. This switch is mounted beneath the tuning knob and has no escutcheon which makes me suspect that this was an addition sometime during the life of the set.

An 800Ω resistor is included in series with the grid of each RF valve to limit its amplification and maintain stability, as no neutralisation has been included. The signal from the RF stages is then fed to a UX227 [illegible] wired as a grid leak [illegible]. The 227 plate wiring goes to the six terminal strip and from there to the switch which does the change over from gram to radio.

The tuning capacitors in this set are all single gang and are coupled together via brass bands and pulleys – see photo. The coils consist of two formers in each stage and each former has half the tuned winding wound on it. The primary is wound inside one of the coils. This is a similar style to that used in some Atwater Kent receivers of the same vintage.

The radio/gram changeover switch and the six terminal strip were originally wired in such a manner that the pickup head was live to a few volts from the receiver HT supply. However, if the earth parted company, anyone touching the pick-up terminals received a nasty shock. Occasionally, equipment was wired like this in the early days but not for me thank you. I made a minor alteration to the wiring so that no HT (or part thereof) appeared on the pickup.

The audio from the detector (or from the pickup) is applied to an audio transformer, which feeds a pair of UX226 valves in push pull. An interesting feature here is that a choke and capacitor (wired in series) are switched into circuit between the two plates when the unit is in radio mode. This is a series-tuned hum-reducing circuit and it does quite a reasonable job. However, it isn't economically possible to completely rid a set of hum when directly heated valves are used on alternating current.

The controls are relatively simple and include a volume control (left), a central tuning knob and a power switch (right). The local/DX switch below the tuning knob is probably not an original feature.

In this case, I believe that some of the problem relates to poor circuit layout around the detector stage. The 226s are connected by the large multi-conductor cable to a push-pull to push-pull audio transformer on the power supply/audio output chassis.

This transformer in turn drives the push-pull audio output stage (2 x UX245) which then drives the loudspeaker.

By the way, this is the first audio amplifier of this vintage in which I've seen a push-pull stage driving a push-pull stage.

The fixed capacitors in the "front-end" chassis were tested and although a couple were quite leaky, they were only RF bypasses from filaments to earth in the RF stages. As a result, the voltage on them was quite low and so the leakage was not of any real concern. Another RF bypass capacitor on the HT line was replaced as a precaution, as it has 170V across it when the set is operating.

The mica capacitors throughout the set were all found to be in good order.

Finally, the voltages in the RF section of the receiver were checked with no valves fitted and found to be in the range expected. The valves were then plugged in, the power turned on and the voltages rechecked. There were no nasty surprises and the set started to play music.

How good is it?

I connected an aerial and earth to the receiver and was greeted with reasonable performance on quite a few stations. Certainly, the set has plenty of go and it doesn't disgrace itself when compared to many more modern sets.

The tracking is reasonably good and no double-spotting or odd tuning characteristics were observed. The volume control works quite well and the local/distance switch is quite effective. However, the latter appears to be unnecessary as no sign of overload was evident and there are a couple of reasonably powerful broadcast stations within 20km. As mentioned earlier, I suspect that it was an add-on.

Next, I checked the alignment of the four tuned stages. There are no iron dust cores in the RF coils (well before their time) and there are no trimmer capacitors either, so I wanted to find out if the stages tracked each other reasonably accurately.

To test them, I slid a small ferrite rod into each coil in turn and noted whether there was any improvement or drop-off in performance. In some cases, there was a slight "lift" in performance as I approached the coil, while in the other cases the performance deteriorated. This occurred at both ends of the dial. The alignment, despite the lack of adjustments, was close and it was only possible to lift the performance slightly at the high frequency end by connecting two small trimmers across two of the coils.

However, for some reason, the set will only tune from 530kHz to 1350kHz. This may have been planned although I suspect that moisture over the years has added distributed capacity across the coils and tuning capacitors, causing them to tune a lower range of frequencies than they did when the set was new. Normally, the tuning range should be from 550kHz to 1500kHz.

The overall sensitivity of the set was such that a 100-300μV signal was necessary at the antenna to get reasonable performance. I received a dozen stations effectively here in Mooroopna, northern Victoria.

Directly-heated valves

It's interesting to note that the sets of this era almost exclusively used directly-heated valves. As a result, several techniques were employed to overcome the inevitable hum in the receiver's output when low-voltage AC was applied to the filaments.

Low-voltage filaments

One "trick" was to use low-voltage high-current filaments which had high thermal inertia. Another was to centre-tap the filament winding on the transformer and connect the bias resistor from this point to earth. However, this was not always practical because of the number of filament windings involved (there are five in this set).

There are no centre-tapped filament windings in this set, so two 11Ω resistors are used across some windings and the bias resistor connected from their junction to earth. The exception is the audio driver stage, where the resistor across the filament winding is a variable wirewound pot and the bias resistor is connected to the wiper. This pot is adjusted for minimum hum in the output.

Because the low-voltage filaments draw such high currents, it is necessary to have heavy filament supply wires. The four 226 valves in the RF section draw 4.2A at 1.5V which means that the cables must be heavy to minimise the voltage drop. In this case, the filament transformer is on the lower chassis and the 226s are on the upper chassis and are fed via a lengthy cable. As a result, the voltage on the valve filaments is around 1.3V instead of the intended 1.5V.

The final word

I wasn't around in 1929 to observe the relative performance of this set and others of its era in the conditions that prevailed then. However, I believe that this set would have been at the top of the pile when it came to dragging in stations and giving good quality reproduction on both radio and records.

Its biggest disadvantage would have been its enormous cost. As such, not many would have been produced and there would now only be a few left in collections.

In short, the AWA C58 is a magnificent example of a top-of-the-line Australian receiver from the late 1920s. It is a worthwhile addition to any collection if you have the room. **SC**