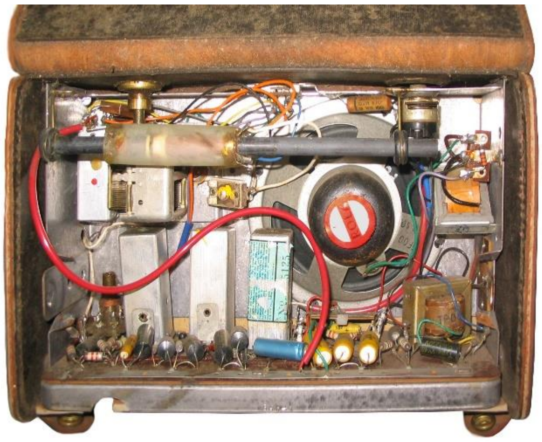
1959 Stromberg Carlson, 7 transistor model 79TII

Australians have shown themselves to be avid adopters of new technology. In the late 1950s customers were lining up to buy their first TV and/or a new-fangled transistor radio. It is generally agreed that the first commercial Australian-made transistor radio to be released was the AWA in 1957, packaged in the same case as a previous model of valve portable. By 1959 every major radio manufacturer in Australia had a *me-too* transistor radio, packaged in a quality leather case (see the picture of leather cased transistors from the author's collection).

The Stromberg Carlson radio featured here follows the basic formula of the others. The case is SOLID HIDE made by Frank Carew &Co, as proclaimed by a small label, slightly damaged, on the back flap.

The obvious difference in the Stromberg Carlson model is that the controls are mounted at the top. The calibrated tuning knob turns through 180 degrees. It is driven by a smaller concentric knob coupled through a reduction gear to facilitate accurate tuning. Interestingly the half of the tuning scale facing forwards is readable from the front and registers with a dot on the case. The rear features the same stations, but printed upside down so it can be read when looking down on the knob from above. This allows for slotting the radio into a car-cradle. An external aerial connection is at the bottom of the case to mate with a car aerial.

The construction of the chassis is straight out of valve heritage engineering. The only sign of a smaller component, other than the transistors, is a brass-plate tuning capacitor which is still medium size. The way this radio is constructed like a valve radio, gives it only a small weight advantage over valve portables. It weighs 2.52kg without batteries.

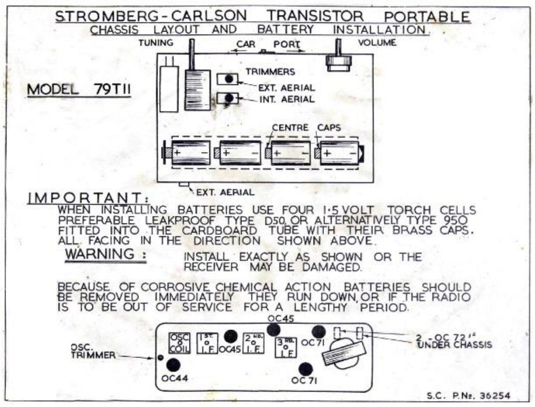


The sight of a bank of yellow Ducon electrolytics tends to make the heart sink. Few of them have survived through 60 years without the electrolyte drying out. Miraculously this batch did survive and they have been left in situ to maintain the original appearance.

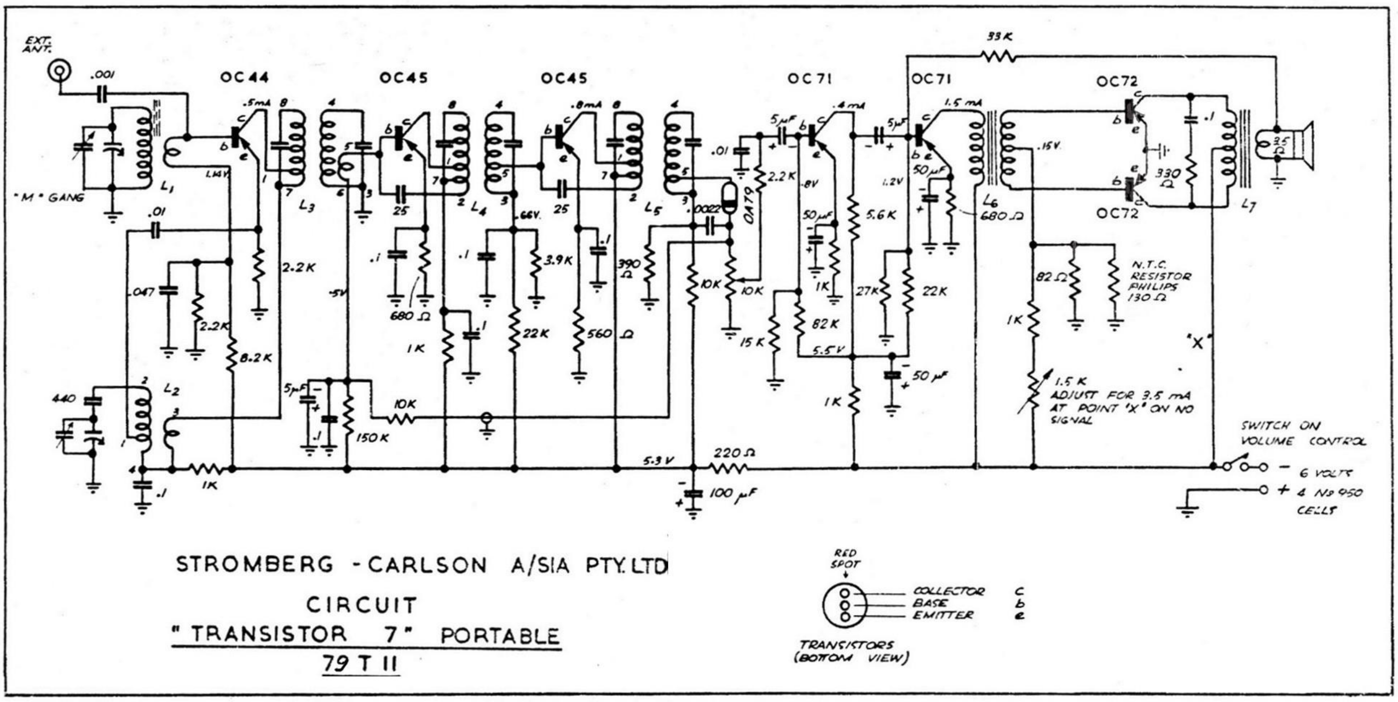
Printed circuit boards were known at the time, but none of the radios shown here used one. In my collection Admiral is the only Australian manufacturer from the 1950s to use printed circuit boards in both their valve and transistor radios. See further comment on the early use of printed circuit boards in Silicon Chip *Vintage Radio* May 2019, "The admiral 5ACW valve radio".

Other radios of the time used a combination of tag strips and point to point wiring. This one uses small brass grommets inserted into a phenolic polymer base-board at custom spacings for this circuit. All major linkages are made above board so it is easy to follow the circuit for servicing.

Below the board the connections to the seven transistors can be seen. Five glass-encapsulated transistors are inserted into rubber grommets. This layout mirrors the way a valve radio would be set out. The metal-cased OC72 output transistors are mounted at the bottom with a heat sink.



A label pasted to the back-flap of the radio sets out the location of the major components including transistors. The model 79TII is the successor to Stromberg Carlson's model 78TII of 1958 and shows a radical change in component layout. It is interesting to see how extensive the changes were and fortunately Ian Batty has contributed an article on the model 78TII published in the July 2015 Silicon Chip. While many physical changes differentiate the two models, the circuits remained the same.



THE CIRCUIT

The drafting of the circuit diagram follows the same style as Stromberg Carlson's representations of valve circuits.

The circuit omits the inclusion of a DPDT switch that selects between portable (PORT) or car. An aerial coil taking input from an external aerial is located adjacent to the tuning capacitors at the top left hand side when viewed from the rear. When the switch is set to CAR the aerial coil secondary winding becomes the inductor of the tuned circuit for station selection. In the PORT position the ferrite rod antenna is switched in and functions as shown in the circuit diagram. The extra circuitry for the external aerial is drawn in Ian Batty's Vintage Radio article of July 2015.

PNP germanium transistors are used in all stages. An OC44 is used as an oscillator-mixer in the common-base configuration. The oscillator function is sustained by coupling between collector and emitter via the oscillator coil L1. The collector receives negative DC through a 1k resistor. decoupled by a 100nF capacitor then connection through the feedback winding on the oscillator coil L2 and the lower portion of the primary winding of the first IF transformer L3. The OC44 base voltage is supplied by a voltage divider of 8.2k and 2.2k, bypassed by a 47nF capacitor. As the emitter presents a low-impedance load, it is connected via a 0.01uF capacitor to a tap on the oscillator coil. The base of the OC44 also connects to a winding on the ferrite rod aerial coil so that the signal is mixed with the local oscillator signal to provide the 455kHz IF output.

Throughout the IF stages low-impedance transistor elements are connected to taps on the tuned circuits via capacitors. This impedance matching achieves high efficiency and sensitivity. The first OC45 is used as an IF amplifier with common-emitter configuration. The collector is fed DC through a 1k resistor and a 100nF decoupling capacitor and then through the primary of L4. The base voltage is supplied by a voltage divider comprising a 150k resistor (decoupled by 5µF and 100nF capacitors) and a 10k resistor in series with the 10k volume control.

Automatic gain control (AGC) alters the bias to the first OC45. Detected signal from the OA79 is fed from a tap on L5 to provide positive DC to the top of the volume control. This affects the output of the voltage divider to the base of the OC45. Positive AGC voltage reduces the negative bias applied so that amplification decreases with increasing signal.

Unlike valve IF transformers L3 has an additional low-impedance winding that optimises signal coupling to the base of the first OC45.

The transistor IF amplifier is equivalent to a triode so capacitance between base and collector tends to cause positive feedback. To prevent this a 25pF capacitor and feedback winding between terminals 2 and 7 on L4 act as a neutralising circuit.

The second OC45 is a second IF amplifier with common emitter configuration. The collector is fed DC through the winding between terminals 1 and 7 of L5. Base voltage is supplied by a 22k and 3.9k voltage divider bypassed by a 100nF capacitor. The IF signal is coupled to the base from terminal 5 on L4. As before neutralisation is carried out by at 25pF capacitor and a feedback winding on L5.

The audio signal from the OA79 detector is fed via the 10k volume control to the base of the first OC71 via a 2.2k resistor, a 10nF IF filter and a 5µF coupling capacitor. The collector DC supply is through a 1k resistor decoupled by a 50µF capacitor and collector load of 5.6k. The base has an 82k and 15k voltage divider, with an emitter resistor of 1k and a 50µF bypass capacitor contributing to the stability of this stage.

The output of the first OC71 is fed via a 5µF capacitor to the base of the second OC71. This stage is stabilised similarly to the first audio stage. The base voltage divider is 22k and 27k. The emitter resistor is 680 Ohms, bypassed by a 50µF capacitor. The collector DC supply is fed through the primary of the driver transformer L6. The centre tapped secondary feeds the push-pull signal to the pair of OC72 output transistors. This pair acts as a class AB output stage with grounded emitters. The base potential is provided by a voltage divider consisting of an adjustable 1.5k resistor, a 1k resistor and an 82 Ohm resistor shunted by a negative temperature coefficient (NTC) resistor of 130 Ohms. The NTC resistor (thermistor) compensates base potential for temperature variation and stabilises the stage. The 33k negative feedback resistor acts on the base of the driver transistor (the second OC71) and the 270pF bypass across this resistor prevents phase reversal at high frequencies from causing instability. The 100nF capacitor and 330 Ohm resistor across the output transformer primary prevent instability in the output stage due to increased speaker impedance at higher frequencies.

A 1.5k variable wire-wound resistor is provided to adjust the output stage for minimum distortion. This is achieved by adjusting the quiescent current to the OC72 collectors to 3.5mA total, or by watching an injected wave form on an oscilloscope.

RESTORATION

The radio was acquired with the original carry handle in poor condition and it was replaced with a different handle. Another example of this radio was available for salvage, but it had completely lost its handle. The tuning knob of this radio did not have the original inset knob. The salvage radio provided a replacement knob.

The case was soiled, but cleaned up well.

This transistor radio and the contemporary Stromberg Carlson valve mantel radio (the Baby Grand) share the same model Rola 5F speaker for output. Both cases provide comparable baffling to the speaker.

How do the valve and transistor radios compare in a side by side listening test? At low levels there is little to choose between them. Both are fine for undiscriminating listening. However, the valve radio can put out 2W before sounding distressed; not so for the transistor.

An audio oscillator, calibrated for true RMS output, was coupled to the volume potentiometer of the transistor radio and achieved clipping with 18mV of signal input. Using a 400Hz signal, and observing the oscilloscope waveform, clipping corresponded to an output of 160 mW. This result is much as expected and less than the typical 250mW output from a 3V4 valve in portables of the 1950s. This transistor needed 27mA at 6V so, relative to a valve portable, it has the advantage of less quiescent power consumption (0.16W compared to 1.5W for a typical valve portable). Also the four D-cells needed by this radio are much cheaper than the A & B combination of batteries for a valve portable.

Transistors were an expensive component in 1959 and transistor radios like this Stromberg Carlson sold for twice the price of a modest valve radio. Just as well Australians have a passion for adopting new technology.

Transistors were the way of the future, but the solid engineering and custom craft work shown by this radio were soon to disappear. Japanese manufacturers became masters of mass assembly and Australian manufacturers scrambled to catch up.

This Stromberg Carlson is a favourite among my collection of its contemporaries.

Acknowledgement. For circuit analysis I am indebted to insights provided by Rex Wales in the Historical Radio Society of Australia magazine *Radio Waves*, April 1998 p20-22.