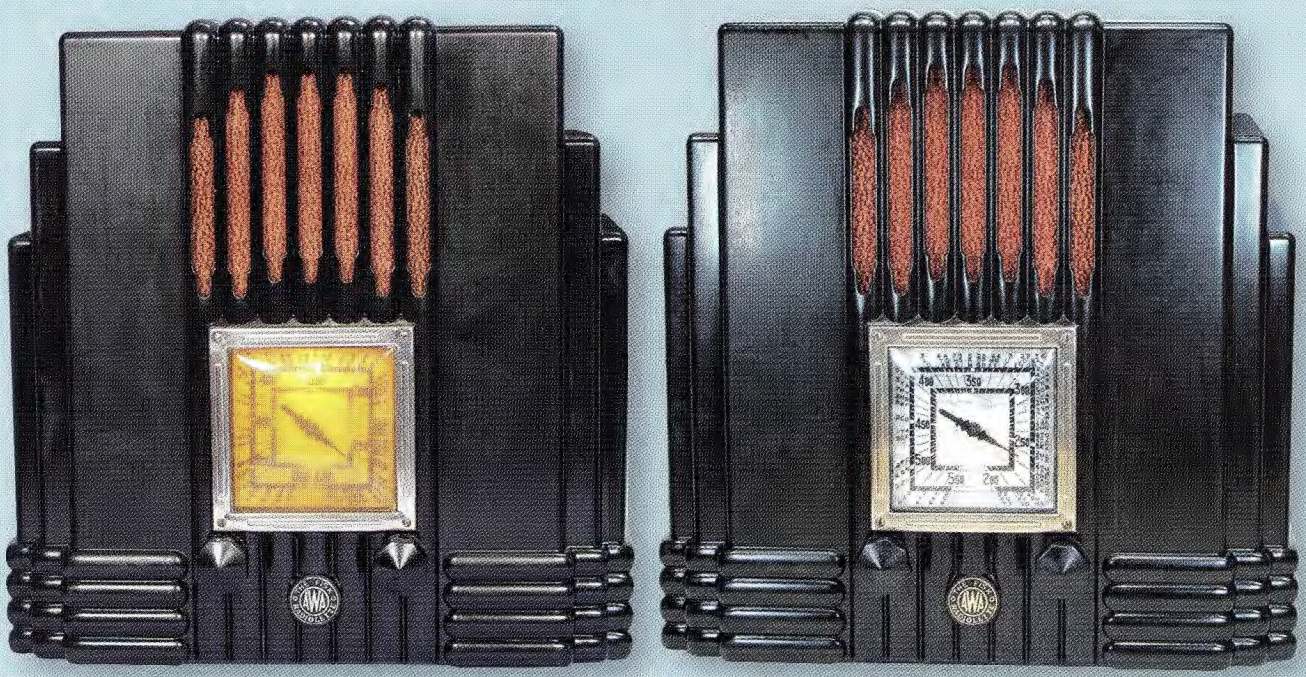
Vintage Radio

By Associate Professor Graham Parslow

The AWA Empire State: the definitive icon of the Bakelite radio



The view at left shows the R28 radio with its original aged (and yellowed) celluloid window and dial face while at right is the restored unit with reproduction dial parts.

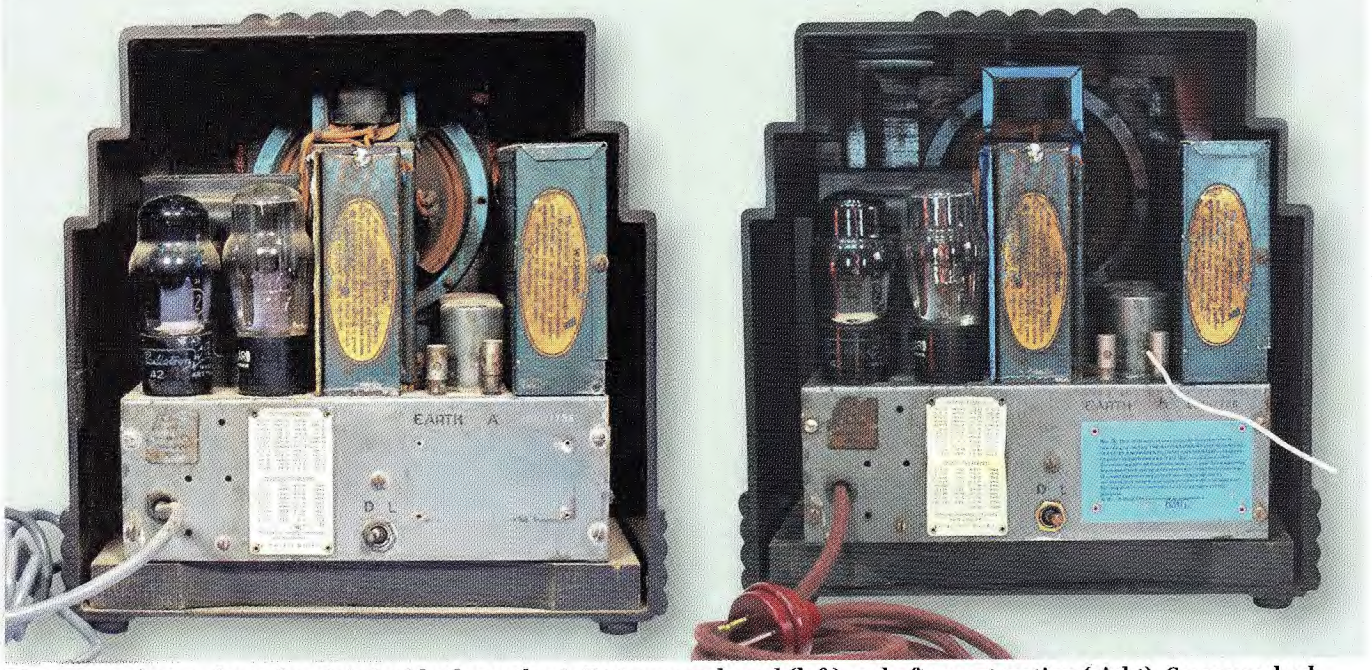
The beauty of the AWA R28 radio has grown along with the nostalgia for the period now called "Art Deco". AWA Empire State radios epitomise art from the "machine age" and have become the must-have radios for collectors in Australia (and beyond). Just as Penfold's Grange Hermitage has become Australia's iconic wine and is now expensive, the Empire State is now a definitive icon and is also expensive.

THE VINTAGE radios featured in SILICON CHIP are usually discussed in terms of the underlying technology of their RF (radio frequency) and audio sections. However, the Empire State's mystique owes little to its technology, although it was a state-of-the-art superhet radio for its time.

Instead, its mystique derives from its perception as a classic of design and in this context it's appropriate to diverge a bit from simply listing the technical details. What makes a classic? It is almost always the intent of a designer to unleash a classic on the world but it is the fickle nature of public taste that determines the outcome.

I can illustrate this through my ownership of a 1965 Ford Mustang fast-back that I bought back in 1975 when it was merely an old car. These days, I can hardly stop at a petrol station without someone coming up to say what a beautiful car it is and wanting to have a chat. It *is* a classic!

AWA produced a series of Bakelite Empire State radios between 1934 and



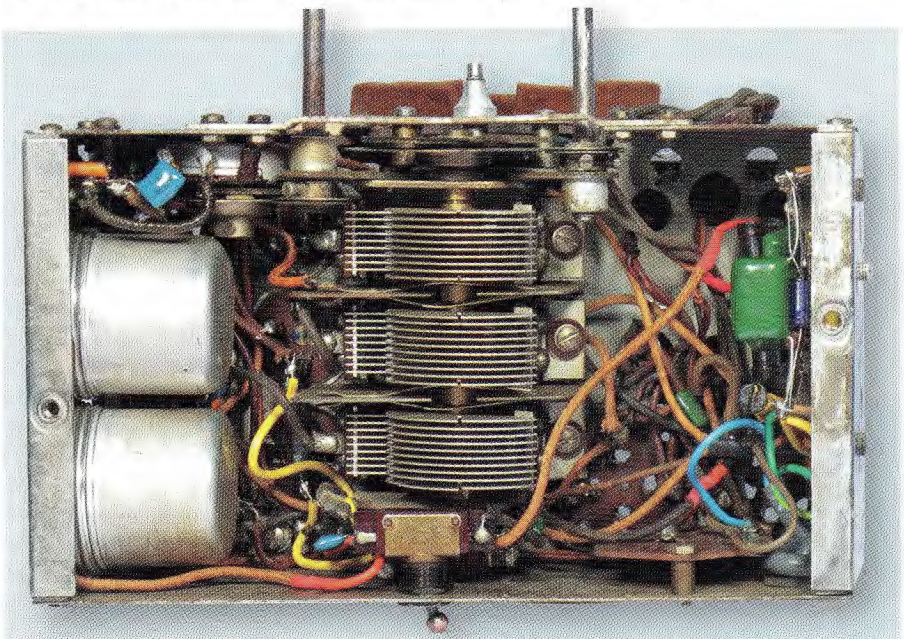
These two photos show the view inside the author's R28 as purchased (left) and after restoration (right). Someone had replaced the mains cord at some time in the past but this non-original item was replaced with a cloth-covered mains cord fitted with a Bakelite plug which is more in keeping with the era. A reproduction ARTS&P label (blue) was also fitted to the restored receiver. The chassis is best removed from the cabinet by unscrewing the four rubber feet at the bottom rather than undoing the two screws that attach it to the wooden base (doing the latter makes reassembly difficult).

1937 (Radiolettes R28, R29, R30, R31, R32 & R37 and Radiola R48). AWA were the biggest Australian manufacturer of radios in the 1930s and their most profitable and best-selling lines were console radios. These were large floor-standing units for the lounge room, which were marketed on the attractiveness of their timber cabinets.

By contrast, there was a stigma at the time about "plastic" items that were perceived as cheap and inferior. Plastic (from the Greek plastikos, meaning mouldable) became the descriptor for all man-made polymers, including Bakelite.

Is the Empire State a truly Australian design? There is an urban myth, found by a Google search, that the shape is modelled on the Art Deco profile of AWA's Sydney headquarters tower. This is easily refuted because the building was not erected until 1939. Borrowing from US radio designs, with inspired adaptation, is a more credible explanation.

The R28 radio was most likely styled after the Air King Model 66 designed by Harold Van Doren and John Gordon Rideout in New York, 1933. It is now a classic for US collectors. For Australia's most iconic radio, there is no accessible information about the decisions made by management and the composition of the design team that led to the Empire State radio.

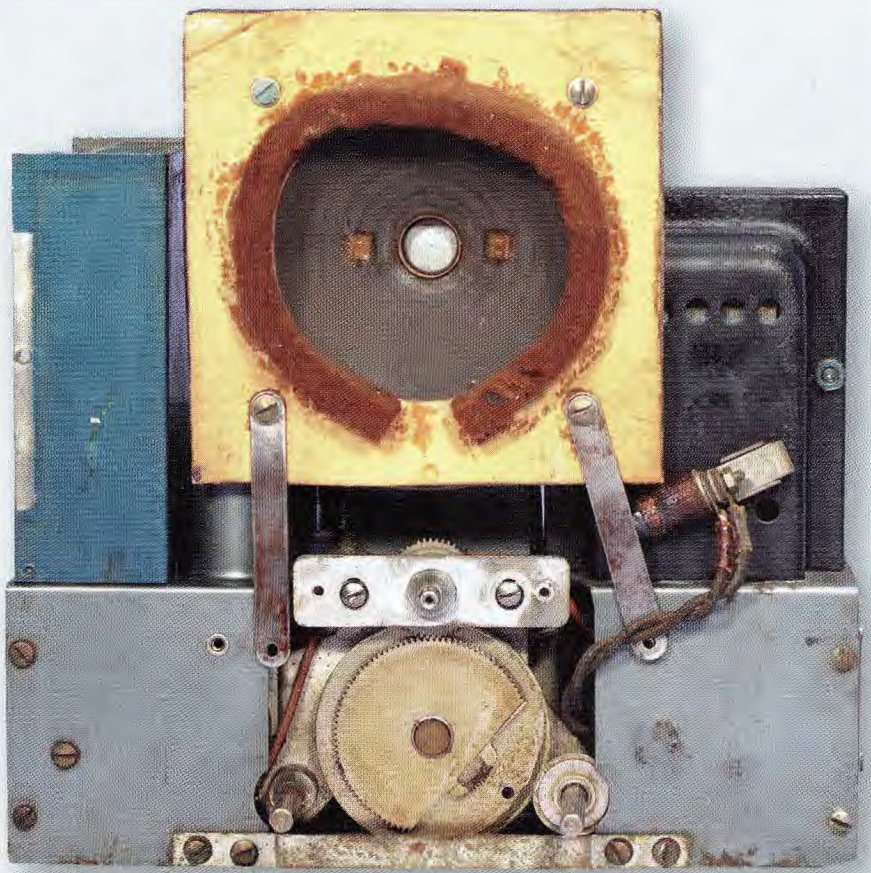


The component layout under the chassis is rather crowded due to the fact that the R28's cabinet has just 240mm of usable width. Even so, the cabinet was one of the largest moulded Bakelite cabinets at the time. A previous owner had replaced the capacitors and the mains cord. The new cloth-covered mains cord fitted by the author was correctly restrained using a cable clamp rather than using a knot (as shown here) which is now illegal.

Bakelite

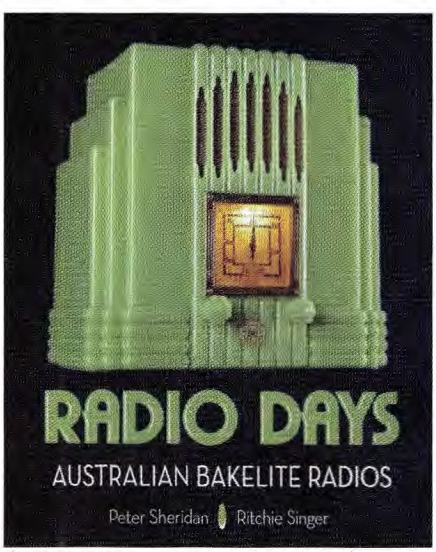
Bakelite is a thermosetting plastic which is a condensation product of phenol and formaldehyde. In 1907, it was the world's first synthetic plastic and marked the introduction of the 'polymer age'. Pure Bakelite resin is a pleasant shade of amber.

Unfortunately, the pure product is



This view shows the front of the chassis without the dial. Note the geared drive mechanism for the dial pointer which rotates through almost a full 360°. The 5-inch (125mm) electrodynamic speaker still sounds good.

brittle and it was Leo Hendrick Baekeland (1863-1944) who empirically modified the properties by strengthening the phenolic polymer with fillers, initially with asbestos and in subsequent commercial applications with cellulose (sawdust) or starch from flour. Moulding Bakelite to useful shapes requires high temperature and pressure. A pressure of 350 tons was used for the moulds that made the Empire State cases.



A rare jade-coloured model features on the cover of this book titled "Radio Days: Australian Bakelite Radios".

The R28 radio featured here is the first of the series and was only released in black. An alternative polymer (formaldehyde-urea, trade name 'Radelec') with added colourants was subsequently used to create a remarkable range of finishes. You can see the colourful results by making a Google image search for "Empire State radio".

An even better way to see the colour variants is to acquire the impressive coffee-table book "Radio Days: Australian Bakelite Radios", by Peter Sheridan and Ritchie Singer. The promotion for this book from Angus and Robertson reads: "A unique and beautiful publication charting the history of the Bakelite radio in Australia. For the first time, a photographic history from the '30s, '40s, and '50s, highlighting art deco design in radio and the extraordinary range of colours. This title will be a must for anyone interested in Australian social history, design and nostalgia. This handsome production displays over 400 radios in colour on 230 pages."

If you are unable to locate a bookseller with stock, try emailing Peter Sheridan at peter@petersheridan.com You can also use Amazon to acquire Peter's latest book: "Deco Radio: The Most Beautiful Radios Ever Made".

Bakelite was cheap per unit in volume production but it required a high investment cost to set up moulds and presses. By contrast, the costs associated with set-up for modern thermo-mouldable plastics, such as PVC, are negligible relative to Bakelite and production rates are much higher.

It's no mystery why the production of Bakelite radio cabinets ended in the early 1950s.

Celluloid

The most plentiful natural polymer in the world is cellulose, the structural material of trees and other plants. Cellulose (as its nitrate derivative) was the basis for an early polymer that was transparent and mouldable, most notably as the base of photographic film.

The use of celluloid dates from 1870 but it's basically a natural product rather than a synthetic formulation. Unfortunately, cellulose nitrate undergoes slow oxidation and changes colour to yellow and becomes more brittle with age (similar to the way its parent polymer, cellulose, contributes to changing wood colour and properties with age). The dial window used for the Empire State radio is celluloid and the example featured here was appropriately aged.

The importance of originality can be argued vociferously but for this radio I purchased reproduction plastic versions of both the transparent window and the celluloid station-calibrated dial. The "as new" result is my preference in this case but the original celluloid dial parts have been put away for safe keeping.

ARTS&P

The Empire State is a superhet design and sets of this type were only just beginning to become widely available at the time of its release. The superhet design was desirable because of its ability to discriminate between stations with small frequency differences. This was becoming increasingly

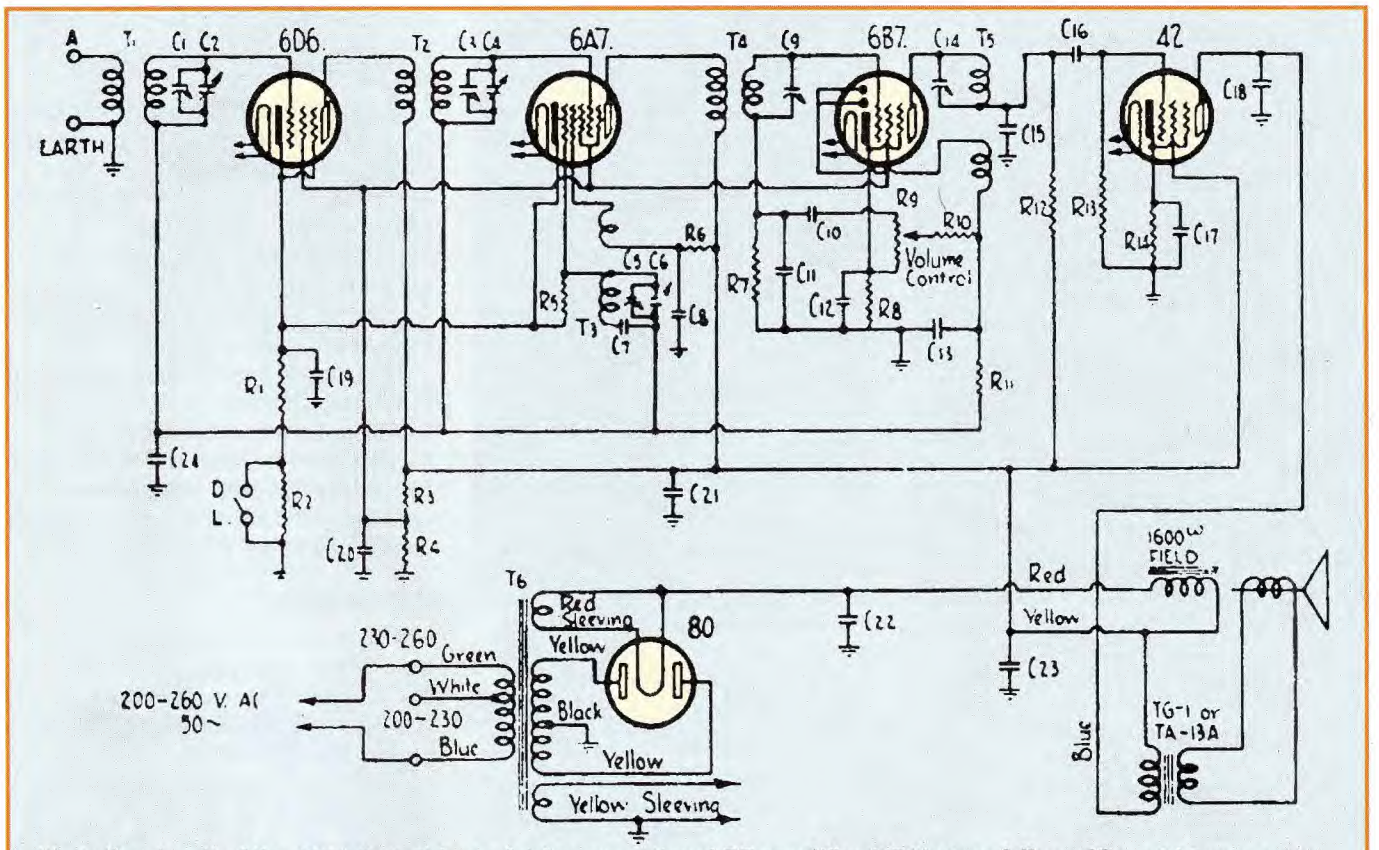


Fig.1: the circuit of the AWA R28. It has a fairly conventional RF amplifier (6D6) stage followed by a 6A7 converter and then a 6B7 IF amplifier/detector/AVC rectifier/audio amplifier. The latter then drives a type 42 pentode output valve, while a type 80 provides full-wave rectification of the transformer secondary to produce the HT voltage. The "D-L" switch across resistor R2 alters the gain of the 6D6 for distant and local reception and was necessary to avoid overload on strong signals.

important as more and more stations began crowding onto the airwaves during the 1930s.

The superhet design goes back to 1918, when it was invented by Edwin Armstrong as a means of obtaining better amplification of RF (radio frequency) signals. This was done by converting the received signal frequency to a lower frequency (the IF or intermediate frequency) that could then be better amplified by the inefficient valves of the time.

Ongoing arguments about who owned the patents and rights to royalties kept the superhet out of general commercial production in Australia until a compromise was eventually reached. This involved manufacturers paying a set royalty to a single agency that would distribute the money. AWA overcame these patent problems to make superhets in the 1920s but these did not perform to modern standards.

A label on the back of the Empire State R28 lists the various patents embodied in the radio and these date from 1919-1932. Also affixed to the back was an Australian Radio Technical Services and Patents (ARTS&P) label that certified that royalties had been paid.

Each label was uniquely identified by a serial number and the first year of issue was 1934, the year the R28 set featured here was made. Unfortunately, only some miniscule white residue of the original label remained when the radio was purchased. I now know that 1934 ARTS&P labels were white but the R28 was also sold during 1935 when the labels changed to blue.

The other R28s I initially looked at all had blue ARTS&P labels and this caused some confusion. After looking at those labels, I made a reproduction for this radio and unfortunately it is erroneously blue and carries a 'B' prefix. A future project to create a white ARTS&P with the correct 'A' prefix for 1934 is planned.

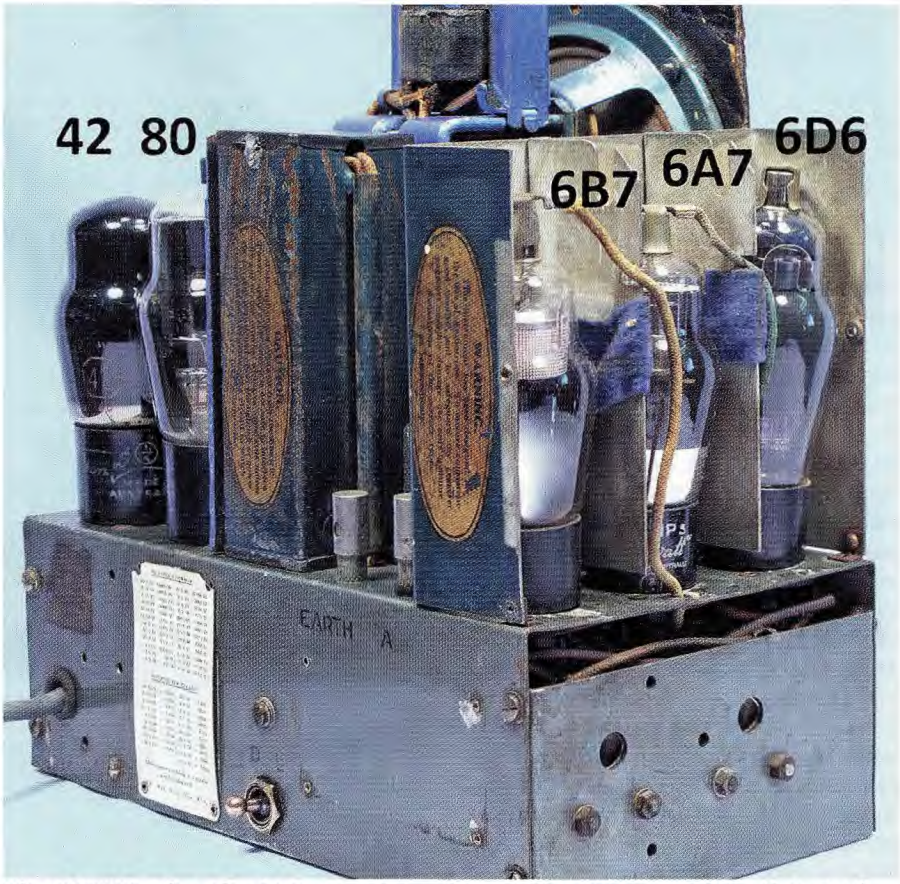
Circuit details

Fig.1 shows the circuit details of the Empire State R28. As shown, it's a 5-valve set with three tuned circuits.

The album cover of this double record set produced in 1982 by Telmak (Balmain, NSW) lists artists and recordings of the heyday of radio from the 1930s to the 1950s. The dial indicates that this is an R48 model but it is fitted with non-genuine knobs. The speaker grille fabric is also non-genuine.

The five valves are as follows: (1) a 6D6 (or type 78) RF amplifier, (2) a 6A7 mixer-oscillator producing an IF of 175kHz, (3) a 6B7 IF amplifier/

The R48 uses asbestos to line one side of a metal can holding the two HT filter electrolytics, to protect them from heat generated by the type 80 rectifier. This asbestos was painted with high-temperature blue paint to stabilise it (see text). The left photo shows the asbestos before painting, while the right photo shows the asbestos after painting (rectifier valve removed).



The 6D6 RF valve, the 6A7 converter valve and the 6B7 IF amplifier/detector/audio amplifier valve are all shielded by a divided metal screen at one end of the chassis (the later R29 model is easily recognised because it has separate shields around the individual valves). The two IF transformers are located under the chassis, immediately below the converter and IF valves. The warning label reads "This instrument has been designed for the use of Radiotrons. To ensure consistent good results and to safeguard against possible damage use only genuine Radiotrons of the correct type as replacements".

detector/AVC rectifier/audio amplifier, (4) a type 42 output pentode and (5) a type 80 HT rectifier.

The three tuned circuits are adjusted by a triple-gang tuning capacitor, the various sections being associated with the aerial coil, the inter-stage RF transformer and the local oscillator. Note that the 6B7 reflexes the output of the detector diode back to the grid so that the valve simultaneously amplifies both IF and audio signals.

The power supply uses a conventional transformer. Its secondary output is full-wave rectified by the type 80 and the resulting HT line is then filtered by C22, the loudspeaker field coil and C23. The filtered HT voltage is then fed to the plates of the valves.

Restoration

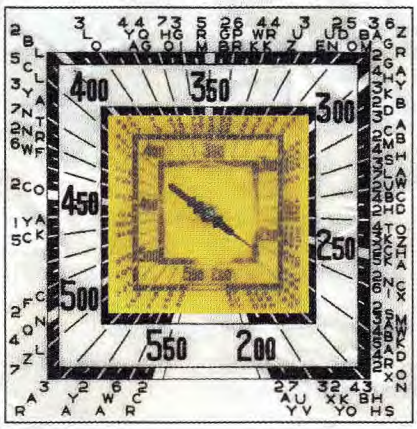
This unit was in quite good condition when received but there's one critical aspect to watch out for in this set. A priority in dealing with an R28 (and other old radios) is to assess the state of any asbestos, if present. Many radios of the 1930s and 1940s incorporated small asbestos sheets to provide heat shielding and these sheets were generally attached to structures adjacent to the hottest valves (rectifier and output pentode).

In the R48, the type 80 rectifier valve dissipates about 8W of the 48W total and asbestos lines the side of the can housing the two HT filter electrolytics. This asbestos was painted blue using high-temperature paint (eg, from Stove Bright or White Knight), to stabilise it against shedding airborne spicules.

It's essential to wear the correct protective equipment when working with asbestos. Miniscule amounts of asbestos can cause deadly long-term health problems if inhaled. Ordinary dust masks are not effective and protection requires a filter respirator fitted with a class P1 or P2 filter cartridge.

Any clothing must also be protected from contamination and you should not use compressed air to blow away dust if asbestos is present. Guidelines for dealing with asbestos are available at **http://www.health.gov.au/**

In this case, the R48's chassis was cleaned with turpentine to remove the dust and grime. Matching blue paint was then applied to some areas of corroded metal work. The grille fabric was thin with some small holes, so a dark brown backing fabric was added behind the original material. This en-



The yellow inset section here is the original R28 dial from 1934 but more stations had joined the airwaves by 1936 when the R29 was marketed. The outer section is the reproduction R29 dial installed on the R28 radio featured here.

Ernest Fisk was the General Manger of Amalgamated Wireless of Australasia at the time the R28 was made and was a familiar public figure in the 1930s. He made various royalty agreements with both Marconi UK and RCA America, the latter also giving him the rights to use the badge names "Radiola" and "Radiolette" (as used on the front of the AWA R28).

This view shows the author's fully-restored 1934 AWA Radiolette R28 with its reproduction R29 dial. Along with restoring the electronics, considerable effort was also put into restoring the cabinet, so that it now looks almost like new.

hanced its appearance while showing no evidence of the added fabric.

Unfortunately, heat from the dial-light (a 6.3V 2W globe) had resulted in a small burn mark on the celluloid dial-scale. This, along with yellowing of the dial-scale, led to the decision to replace it with a reproduction.

Finally, considerable effort went into carefully polishing the cabinet. The result can be seen in the accompanying photo.

The price of an icon

At the time of its release in 1934, the basic AWA Empire State Radiolette R28 was considered an "entry-level" set and sold for £15/15/– (ie, 15 pounds and 15 shillings). This was subsequently increased to £16/16/– (or 16 guineas as it was then quaintly called) for the R39 in 1936. A tradesman at that time earned about £4 a week, so even entry-level sets weren't cheap considering they cost around four weeks' wages.

These sets were advertised as the "second set in the home for the kitchen or sunporch." And in keeping with this theme, later models were promoted as having "a sparkling array of beautifully coloured cabinets which harmonise perfectly with modern interiors".

The basic black and brown units have survived in reasonable numbers but that does not make them cheap today. The unit featured here was purchased on eBay for $1600 in January 2010. The highest price known to be paid at auction is $16,800 in March 2010 for a jade-green example. A jade-green example has also changed hands privately for around $20,000.

These high values have sometimes led to flagrant misrepresentations of kindred radios (and reproductions) as Empire State models. As ever, when purchasing such sets, it is caveat emptor; let the buyer beware. The luckiest acquisition I know of is by a fellow collector who found one at his local tip.

Despite the high prices paid for some models, they're far from being the most valuable vintage radios on the world stage. That honour goes to a rare art-deco Sparton Nocturne which fetched US$120,000 in Los Angeles, USA.

So where do you display an Empire State radio? Easy – taking a cue from the movie "The Castle", it went straight to the pool room.

Acknowledgement

Peter Sheridan and several members of the Historical Radio Society of Australia (HTSA) provided helpful information during the preparation of this article. SC