VINTAGE RADIO

Monopole D225 tombstone radio from 1934

By Assoc. Prof. Graham Parslow

Made in France in 1934, this 'French Cathedral' style radio was also sold separately as the model D25, which consisted solely of the chassis. The model D225 is a superhet design featuring five valves, with a total weight of nearly 16kg. Its original price was 1850 French francs.

G. Bouveau et Cie Constructeurs started business in 1925 in Paris. Its name was changed in 1928 to Societé des Établissements Monopole and in 1934, it moved to the Montreuil-sous-Bois area of Paris. It manufactured a range of radios through the 1930s, ceasing after the German occupation in 1940.

The radio featured here was one of their prestige models and nicely brings together form and function in the prevailing tombstone style. Radios of this era typically came with internal speakers, rather than requiring separate speakers as in the previous 'coffin box' era.

This radio came to me for electrical restoration via Darren McBride, a French polishing professional with Hecdar Heritage in Melbourne. He restored the case magnificently but the electrical, fabric and mechanical restoration were my challenges.

I have restored many timber cabinets using polyurethane, but French polishing is far more labour intensive and is justified by the unique quality of the outcome. As Darren McBride relates on his website, this traditional technique results in a high-gloss surface with deep colour and a striking three-dimensional vibrancy.

The process of French polishing consists of applying many thin coats of shellac dissolved in alcohol, using a rubbing pad lubricated with oil (or even a microfibre cloth without oil). It is a lengthy and repetitive process, requiring a specific combination of various rubbing motions, waiting, and repeating, building up layers of polish.

One advertisment poster (shown at the end of the article) states "Vague de Puissance et Harmonie etc" which translates roughly as "A wave of Strength and Harmony [will be delivered by your Monopole Radio], made by hand in France with the latest technology."

Monopole claims to have used the latest technology for 1934, which is a reasonable claim. The D225 is a superhet with fundamentals that would continue to the end of the valve radio era in the 1960s. It was not so much the basic superhet design that would evolve after this, but the efficiency and performance of the valves would increase.

The valve sockets for the D225 were designed to match the number of pins needed by a valve, rather than using a standard socket. The octal base was only released onto the market in April 1935 and did not immediately gain traction.

The photo of the top of the chassis shows four different valve bases of 4 to 8 pins. It also shows the mains transformer without the top cover and reveals the unusual pattern of winding and lamination.

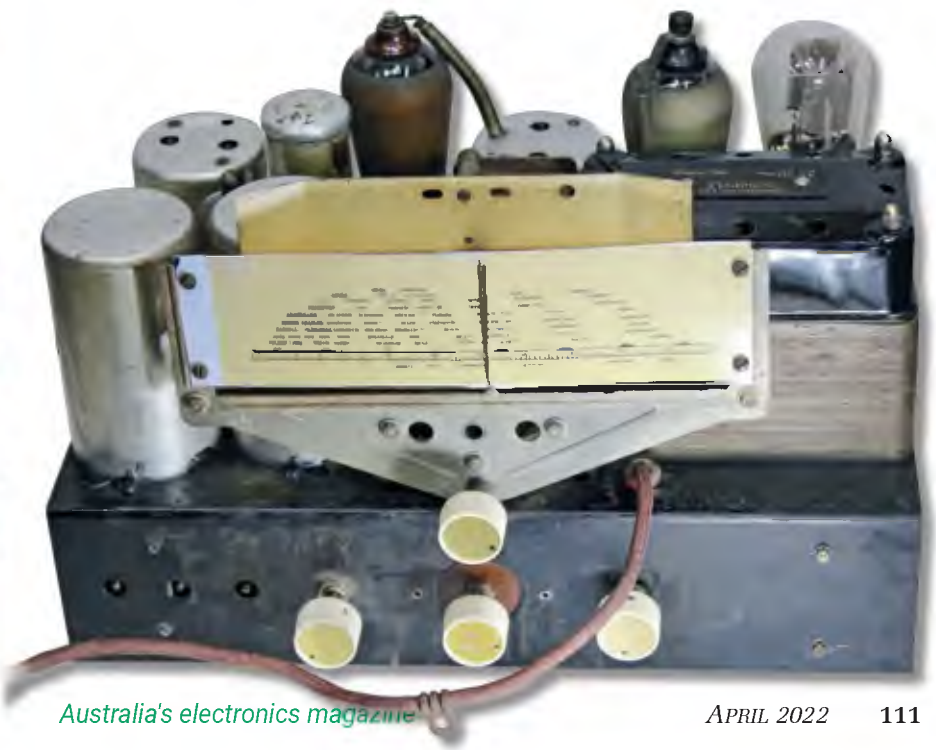
Circuit details

The model designation D225 describes the cabinet; the chassis mated to it is the model D25. The Monopole circuit diagram is among the clearest to be found from the early 1930s, with only one significant use of French notation – "H.P." for haute parleur (high speaker), the primary of the output transformer.

All of the valves have indirect heaters driven by 4V except the mains rectifier, which has a directly heated 4V cathode. In the radio featured here, the superhet mixer valve was an AK2 (equivalent to AK1 indicated on the circuit, but with an alternative base). The IF amplifier was an AF2, while the detector-audio preamplifier was a type TE44 (equivalent to the E444). The output valve was missing.

The full-wave rectifier was type AZ1. The high tension filter choke is the field coil of an electrodynamic speaker.

The restored tombstone radio, along with some shots of the chassis during restoration. Note that the photo below has the dial already repaired.



The RF section has a tuned aerial coil primary as well as the usual tuned secondary. The radio has good selectivity for tuning, helped by the double-tuned aerial coil. More significantly, the double tuning (preselection) improves image rejection generated by the intermediate frequency (IF) of 120kHz.

Images (a second tuning spot) would exist at 120kHz × 2 = 240kHz above the transmission frequency. I did not find images generated by this radio.

The third gang of the tuning capacitor is linked to the local oscillator, configured as an Armstrong tuned grid oscillator. They possibly chose an intermediate frequency of 120kHz because valves of the time were more effective amplifiers at lower frequencies.

The normal MW range is calibrated on the dial as 200-550 metres. Shortwave is tuned by shorting sections of the coils used for MW.

The radio is not highly sensitive, and strong local stations are noticeably louder than medium-strength stations. This is despite automatic gain control (AGC) mediated by the 1MΩ resistor feeding back from the audio detector to the AF2 valve. That 1MΩ resistor also feeds back to the mixer valve via a 250Ω resistor and the secondary of the aerial coil.

The circuit diagram shows that the voltage to be expected at the first filter electrolytic is 328V DC, with 248V DC after the choke. These values proved useful in restoring the radio.

Electrical restoration

The top of the chassis was grubby and stained with a resinous film that is thought to be from material in the mains transformer that sublimates (turns from a solid to a gas) to cover surrounding components. Otherwise, its condition was fair.

The temptation to immediately clean the components is one I try to resist because the radio probably worked in this state before. Sometimes cleaning introduces new problems, so I leave it for later unless the presentation is severe.

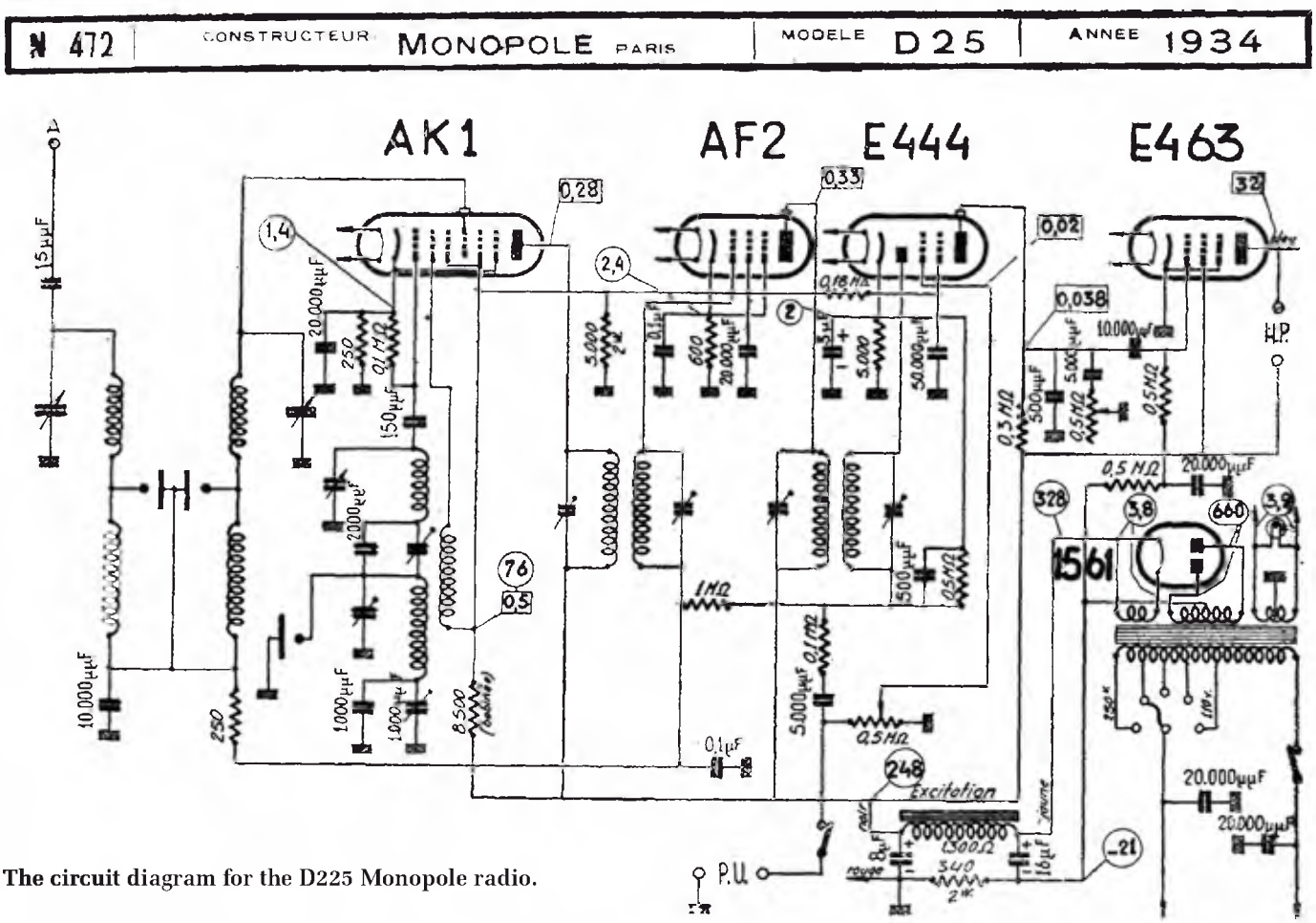
The bad news at the top of the chassis was that the E463 audio output pentode was missing. The Historical Radio Society of Australia (HRSA) valve bank listed the E463 valve, but had no stock.

This is not surprising for an old European type. I later came up with a work-around for this problem.

The elegant AZ1 double diode mains rectifier was wrapped with bandage material at the base, but this no longer held the glass envelope to the base, and any knock may have separated them. I ran a line of thin-CA glue around the base. This glue sets relatively quickly and strongly (CA is cyanoacrylate, a form of superglue).

Unfortunately, some leaked into the base where it continued to leak down the pins and glued the valve to the socket. The recovery from this mistake was tedious, but eventually successful. A lucky circumstance is that these veteran valve sockets have elongated claws rather than sockets, and I could prise the claws apart.

Below the chassis was a mostly pleasant surprise. Someone had replaced all capacitors and many resistors with 1960s-vintage components.



The circuit diagram for the D225 Monopole radio.

The electrodynamic speaker was a replacement Australian 8-inch (200mm) Rola of 1930s vintage, with the cone in perfect condition.

The niggling thought when encountering such a comprehensive component replacement is to resolve whether it was motivated by the need to fix a difficult fault, and if so, whether it was successful.

The HT filter electrolytics were contemporary black sheathed types (other replacement capacitors were from the 1960s). It appears that more than one person had worked on restoring this radio. For a radio of this vintage (with uncertain integrity) I decided to ramp up the AC input using a variac to avoid self-destruction.

I monitored the HT voltage at the first filter electrolytic, knowing that the circuit diagram indicated 328V. There was no surge of power consumption, but the HT reached 350V at 205V AC from the variac. On reflection, this made sense because the E463 output valve was missing, and this load would generally reduce the HT due to an increased drop from the internal resistance of the AZ1 diodes.

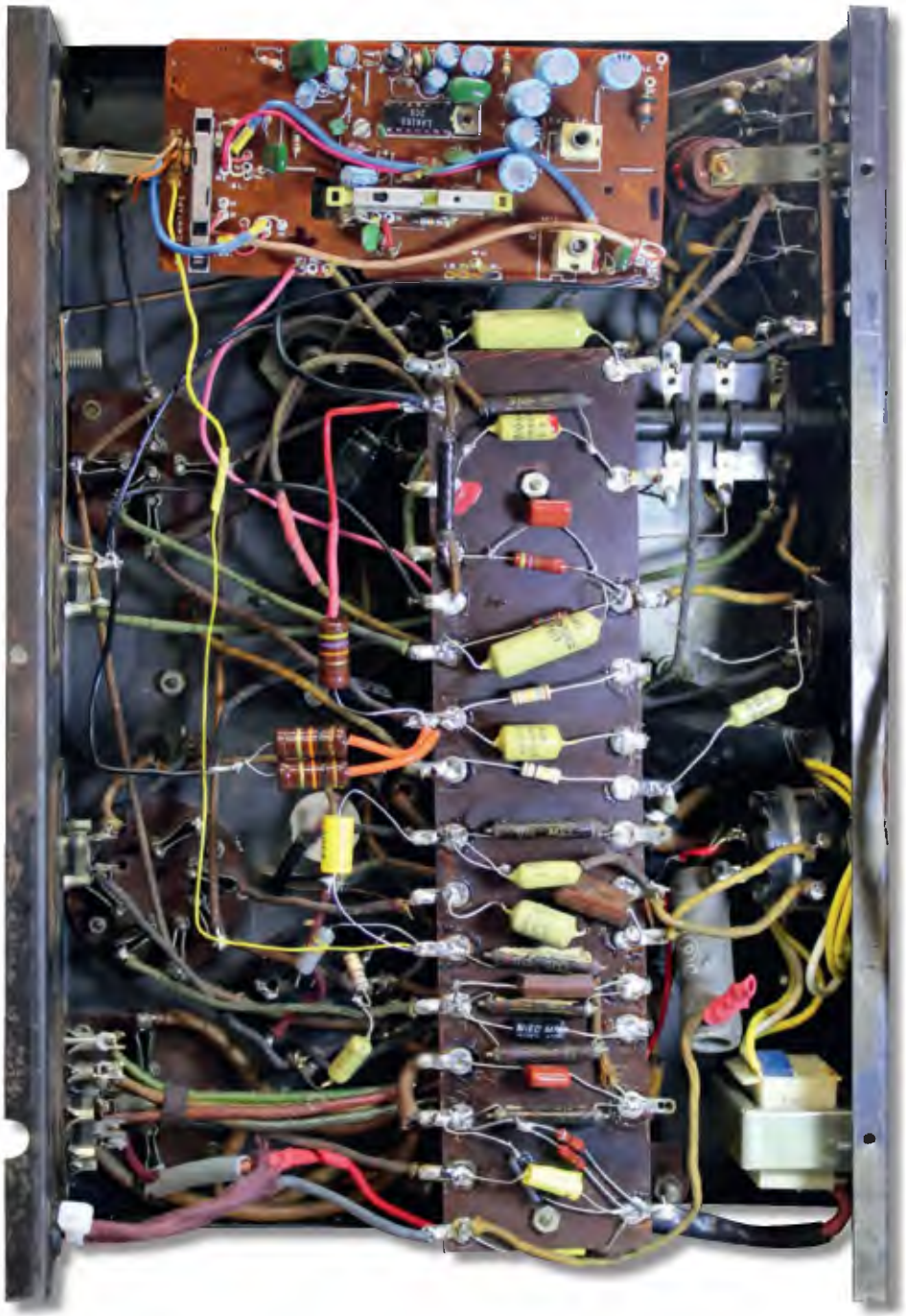
Was the radio working? Linking a signal tracer to the volume control input gave instant gratification that audio signal was coming out of the RF section.

This was a qualified joy because the signal crackled and intermittently dropped out. Tapping anywhere on the chassis upset the signal.

After many hours, I located one dry joint and another joint that was merely a wire resting on a solder lug. Fixing these improved matters considerably, although, even at the end, there was still an intermittent crackle and sensitivity to tapping the radio. I concluded that one or all of these old valves was susceptible to microphonic instability. Unfortunately, no swap-in valves were available.

To allow safe operation without the variac, I inserted a 400Ω 20W resistor in series with the primary of the mains transformer. The result was a drop of 40V across the resistor and an HT voltage after warm-up of 310V DC.

At one point, the radio stopped working, and the HT rose to 395V. I traced this to a 5kΩ 2W resistor loading the screen grids of the AK2 mixer and AF2 IF amplifier. It had gone open-circuit, so I replaced it without difficulty.



As the power supply was weak, and the output valve missing, I replaced that valve with an LA4160-based amplifier module at the top of this photo (taken from an old Sanyo cassette radio).

Unexpectedly, the HT fell to 110V DC after this replacement, but this could be reversed by removing the AF2 valve. The screen voltages of the AK2 and AF2 valves were originally derived from an 8.5kΩ series resistor from the second filter electrolytic. A previous restorer had increased this series resistor to 15kΩ, a change that lowered the current drawn by the AK2 and AF2 valves.

Even with this limited screen current, the power supply was not coping. Increasing this limiting resistor to 27kΩ brought the HT back, and the radio worked well.

The severe limitation of the old AZ1 diodes to supply current was reinforced when I rigged up a 6V6 output tetrode to replace the missing E463 valve. I provided the heater current for the 6V6 from an external 6.3V source because the radio didn't have any suitable windings.

Initially, this replacement produced absolutely nothing, leading to the

A French advertising poster showcasing the D225 radio. The advert is stated to be from "Damour-Editions", and measures 120cm high and 80cm wide.

The earlier chassis photo had the transformer cover removed so that its windings and laminations could be seen. This is what it looks like with the ventilated cover in place.

discovery that the output transformer (labelled HP on the circuit diagram) had an open-circuit primary. This could explain why the E463 valve was missing. When the anode has no HT because the output transformer is open-circuit, a high current flows through the screen grid, which can destroy the valve.

With a good output transformer, the 6V6 again produced nothing, this time because the HT had fallen to 88V. It was evident that the AZ1 dual diode valve had such low emission that it was not up to providing more than a few milliamps. Any output valve was going to over-tax the power supply.

Looking through my collection of 1980s cassette radios (that my wife wonders why I keep), I selected a Sanyo model M2553F to sacrifice for the greater good. This model has a discrete amplifier section, separate from the radio module, that runs at 7.5V DC rectified from a small mains transformer.

The Sanyo LA4160 amplifier IC on the module is good for 1.2W audio output. This is comparable to the 1.5W output from an E463 valve. Bench testing proved that this was a workable solution and that the old electrodynamic Rola speaker was in good condition. I mounted both the small power supply transformer and the amplifier module under the chassis so that the radio continued to look original.

The other option would have been to replace the AZ1 with a solid-state rectifier, but the resulting inrush current can cause problems, so it isn't as simple an option as it first appears.

Restoring the dial

The celluloid dial was discoloured and cracked. It was so brittle that an attempt to glue the pieces together fragmented it even further.

The chemistry of this is interesting. Celluloid dials are fabricated from nitrocellulose with an added plasticiser like camphor that makes the product supple. With age, the camphor evaporates, leaving a brittle sheet. UV light also catalyses denitrification of the cellulose with the release of nitrogen oxides that give the celluloid a brown colour (note how the area exposed to light is darker).

The only solution was to completely redraw the dial at a larger scale and reduce it to size. I used PowerPoint to create the text and lines on a yellow

background, then printed it on 60gsm paper with adequate transparency to allow the dial light to shine through. I mated this to a rectangle of clear polycarbonate for support.

The original dial lamp was open-circuit, so I replaced it with a 3.5V torch globe.

Finishing touches

The original speaker grille cloth was in tatters. Fortunately, I had material in my fabric drawer that closely matched the original, with a brown and gold pattern (unlike the plain fabric shown in the Monopole poster).

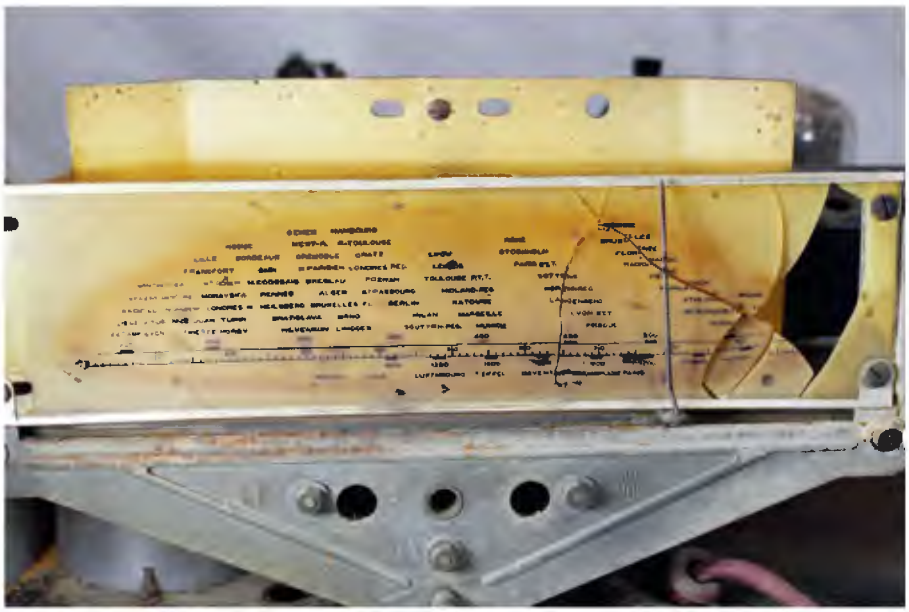
I carefully installed the chassis into the cabinet to avoid damaging the French-polished finish. I then added a ventilated rear panel along with a warning of the high voltage hazard inside – the top caps on two of the valves are the anodes, not low-voltage control grids. I also included a note telling the user that an aerial must be installed (which you can see in the adjacent photo).

I needed to give the radio a final check before all 15.7kg of this hefty unit could be returned to Darren. After warming it up, I was listening to only crackle, dreading the need to start again. My first check was to see that the wave change switch was still set to MW. It was not, so a click later, happiness prevailed.

The radio produced excellent sound, with the speaker now baffled in its resplendent cabinet. SC

This shows the rear panel and label I fabricated. Also present are (from left-to-right) the power cord, mains voltage selection switch, speaker socket (hidden), a 'pickup' audio input socket, Earth connection and antenna connection.

This speaker was not original, it was instead an Australian-made 8-inch Rola speaker of the same vintage.



The celluloid dial originally came cracked and yellowed, due to the way celluloid degrades as it ages. It was much easier to make a new dial than fix it.