By Associate Professor Graham Parslow

The Ferris 106 "portable" car-home-radio

"Robust" is the word that sums up this top-shelf portable radio. Everything has been done to make this a sensitive radio, shielded against interference, particularly from a vehicle ignition system. While it is portable, being so robust means that you would have to be fairly strong to carry it long distances, as it weighs around 8.5kg.

The Ferris model 106 was sold between 1954 to 1958, a time when valves reigned over expensive, low-powered transistors. This radio has six valves and is the final evolution of portable radios using 1-series miniature valves, which were in vogue for roughly a decade from 1948.

The advertisement for the model 106 (reproduced later) shows the places that this 'luggable' could be used. It weighs 8.5kg with batteries and mounting brackets, 6kg without. Fortunately, it has a comfortable handle.

This radio's place in history

Not long after the model 106's production run ended, Ferris moved on to building transistor radios that used less power, weighed less and were more compact.

Two of those germanium-transistor radios (successors to the model 106) have been described in SILICON CHIP Vintage Radio articles; one in August 2002 (Ferris 214 car radio; siliconchip.com.au/Article/6751) and one in May 2008 (Ferris 174 portable; siliconchip.com.au/Article/1832).

The model 106 sold for 50 guineas (£52.10s) when the average weekly wage for an adult male was £12.10s. That makes the current equivalent purchase price around $5000; a figure almost beyond comprehension. As a ten-year-old in 1958, my pocket money was 2 shillings a week, so it would have taken me ten years to save for this radio!

A car radio was a significant fraction of the cost of a new car, so many cars were sold with a metal blank in the dashboard-space for a radio. There was an obvious market for adding a radio further down the track, and if that radio could also be a home and picnic radio, so much the better.

Ferris did not entirely have that niche to themselves in Australia, because AWA and Astor also catered to that market.

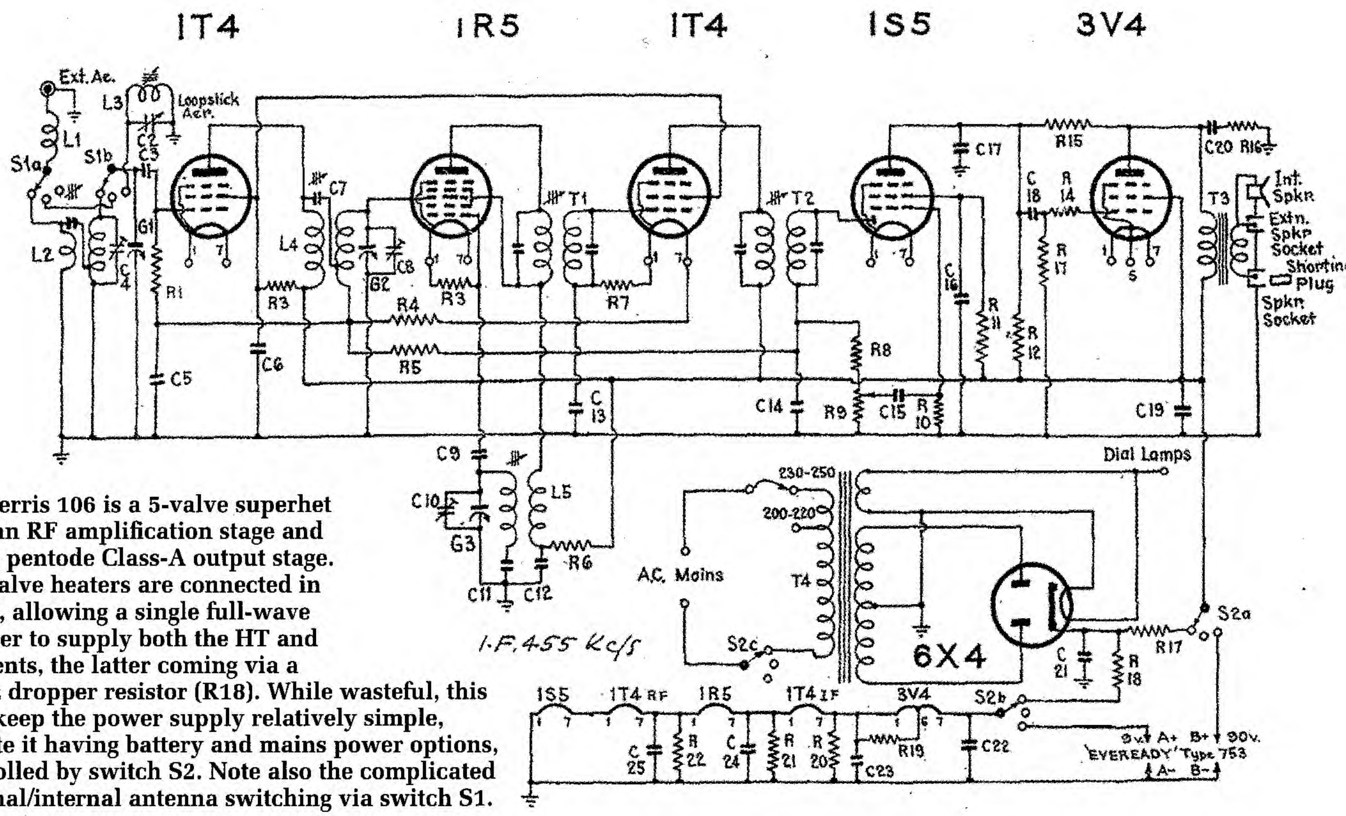
The very first radio to be mounted in a "horseless carriage" (steam driven) in 1901 was made by Guglielmo Marconi. It received only Morse code, so it was not the true antecedent of this radio.

Most people would give that honour to the Motorola Company in the USA. In the 1930s, Motorola worked out how to incorporate an aerial into a car, largely overcoming the ignition spark-generated noise radiated from the copper distributor wires. The Ferris Brothers were not far behind after becoming an incorporated entity in 1934.

Circuit description

The Ferris 106 circuit has a fairly standard configuration for a five-valve superhet with an RF amplification stage. It does have a somewhat complicated antenna switching arrangement, to suit its role as a multiple-purpose car/home/portable radio, along with the necessary dual (mains/battery) power supply.

This radio has four knobs; the lower pair are for volume (R9) and tuning (G1-G3), while another knob acts as the power switch and also selects between mains and battery power (S2). The final knob selects which antenna to use: the car antenna, ferrite rod or "portable mode", with the external antenna and ferrite rod connected in series (S1).



The Ferris 106 is a 5-valve superhet with an RF amplification stage and single pentode Class-A output stage. The valve heaters are connected in series, allowing a single full-wave rectifier to supply both the HT and filaments, the latter coming via a 2.3kΩ dropper resistor (R18). While wasteful, this does keep the power supply relatively simple, despite it having battery and mains power options, controlled by switch S2. Note also the complicated external/internal antenna switching via switch S1.

The signal is received by a plug-in external aerial or a ferrite (loopstick) aerial (L3) concealed in the carry handle. The external aerial socket is for a standard car-aerial termination plug, although a simple wire antenna can also be connected.

The position of S1 shown in Fig.1 is intended for use in a car. Switch S1 connects the vehicle's aerial to the aerial coil (L2), which is designed to match well with the characteristics of a car antenna and has a secondary forming a tuned circuit with one gang of the three-gang tuning capacitor (G1).

The second position of S1 is the "portable" position and couples the signal from the external aerial directly to tuning gang G1 and the control grid of the 1T4 RF amplifier. In this case, the RF input becomes untuned. The loss of gain is more than made up for by the RF amplification stage, and this has the advantage that the set's performance is less dependant on the aerial.

Inductor L1, the red spiral coil at the rear of the chassis, is not there to act as a filter. Instead, it exists to provide a good impedance match between the radio input and a typical vehicle antenna. This is necessary because short antennas as used in cars have a relatively high capacitance and so L1 is needed to prevent the capacitance of this aerial from detuning the first stage of the radio.

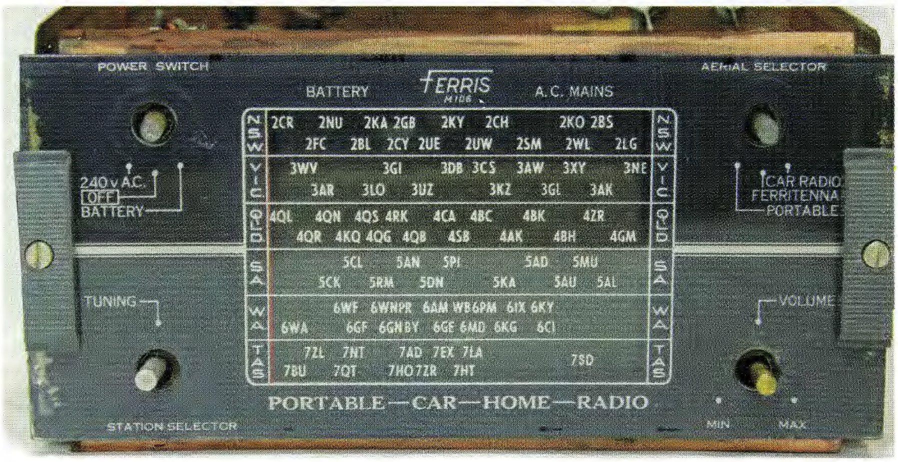
In the third position of S1, only the ferrite 'loopstick' aerial and tuning trimmer capacitor C2 connects to the control grid of the 1T4 and tuning gang G1. This allows the ferrite antenna to be separately tuned for best performance, without affecting the set's performance with an external aerial.

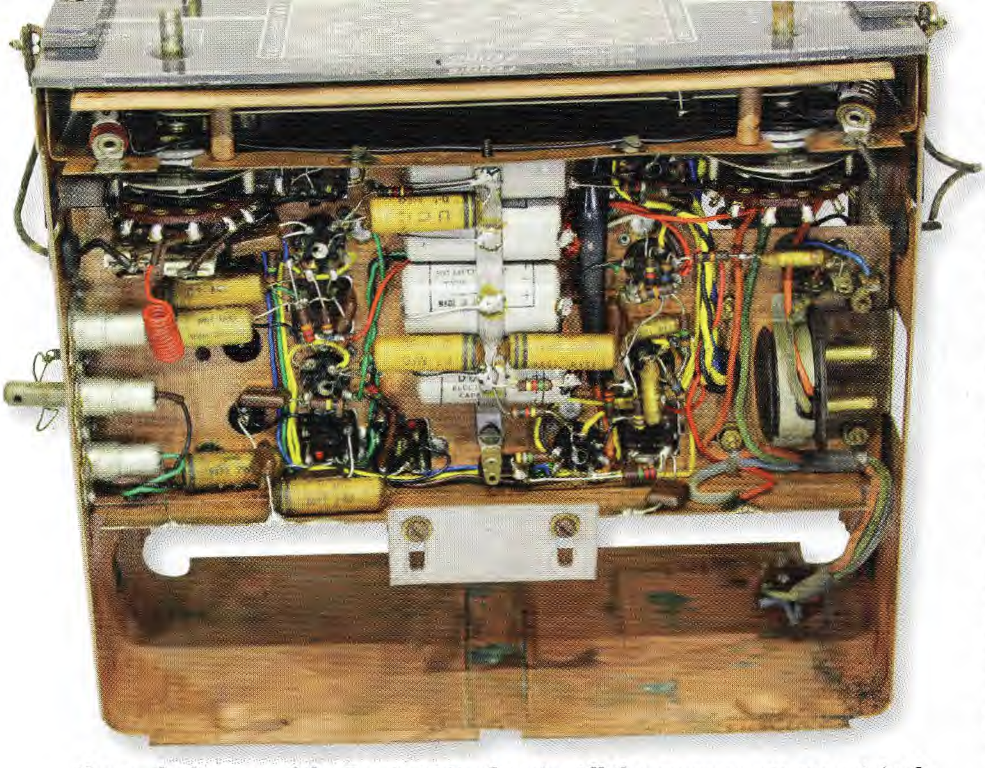
The 1T4 valve is a versatile RF amplifier used both for RF preamplification and IF amplification in this radio. Amplified RF is passed by L4 to the tuned circuit formed by the secondary of L4 (fine-tuned by an adjustable slug) and the second gang of the tuning condenser (G2).

The 1R5 is almost invariably the mixer-oscillator valve of choice in portable valve radios after 1948. The oscillator is driven by the tuned circuit formed by the G3 gang of the tuning capacitor and inductor L5. T1 is the first IF transformer, passing the 455kHz difference signal between the tuned frequency and the higher oscillator frequency.

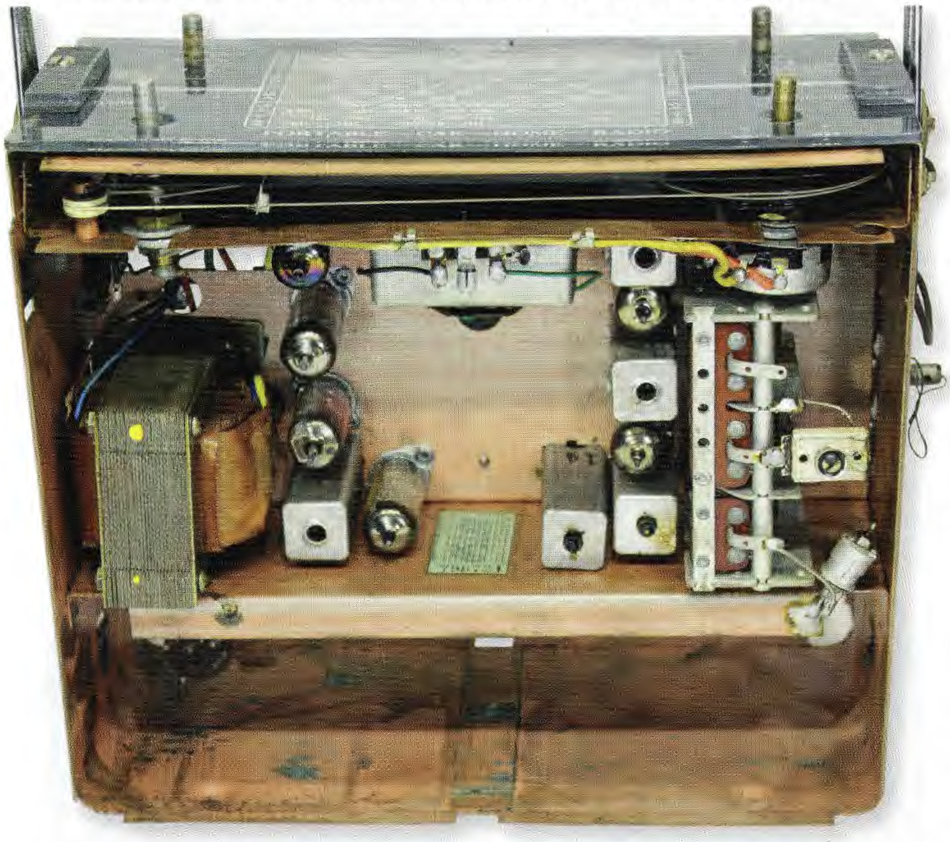
After further amplification by a second 1T4 valve, the audio signal is derived by diode detection of the signal at the secondary of T2, using the 1S5's internal diode. The negative-going output additionally provides negative feedback (AGC) to the preceding valves via resistors R1 and R5, in proportion to signal strength.

Volume control is effected by 1MΩ potentiometer R9, feeding audio to the control grid of the 1S5 valve. The output from the 1S5 anode is conventionally coupled to the grid of the 3V4





Above: the bottom of the Ferris 106's chassis. All the components are original and did not need to be replaced for the radio to work. Note the vertical Earth strip down the centre of the chassis.
Below: the top side of the chassis has the valves, IF transformers, power transformer and three-gang tuning capacitor (G1-G3) in the lower right.



output pentode. No tone control circuitry has been added, presumably to keep the knob count at four.

Output transformer T3 has a primary impedance of 10kΩ, driving a 3.5Ω, 8-inch Magnavox loudspeaker. The speaker certainly acquits itself well in this radio, until reaching 250mW, a limitation imposed by the 3V4 output pentode.

The shorting plug to the extension speaker is a metal cylinder that can be inserted into either of two bayonet sockets. When the plug is in the socket shown in the circuit diagram, the internal speaker is connected. In the other socket, the internal speaker is shorted out, and only the external speaker is fed audio.

This is not a particularly elegant way to handle connecting an external speaker, but it does avoid the need for another switch. The shorting plug can be seen in the under chassis photo, on the left. The plug is tethered so it can't be lost if it falls out or is removed.

The power supply is configured as many other contemporary dual-power portables were. A 6X4 full-wave rectifier produces a DC output of 105V. Series resistor R17 (1kΩ) cuts this back to 90V to supply 15mA to the HT circuitry. Another series resistor, R18 (a 2.3kΩ 5W wirewound type), derives 9V to feed the filament circuitry.

This 2.3kΩ resistor dissipates 4W during operation, so it is not an efficient scheme. The valve filaments each get 1.5V, except for the 3V4, which has its twin filaments connected in series and so is fed 3V. Power consumption from the mains is 24W, which includes the power to drive the two lamps mounted at each end of the dial. On battery power, it only draws around 2W (the dial lights are not powered).

When used in a car, the radio can run off its internal battery pack. But this is wasteful given that drawing power from the vehicle supply is much cheaper than discharging expensive batteries.

So Ferris offered a 30W inverter which could be used to power the radio from a vehicle via its mains input. This could be left permanently connected to the vehicle, and the radio was plugged in while driving.

Restoration

When I acquired this radio, it had no knobs, so the knobs shown here are not original. A clear photo of the original knobs can be found online at: siliconchip.com.au/link/aarj They are also visible in the advert shown at right. The front Ferris badge was also missing, so I had to acquire and fit a replacement.

Perhaps due to the use of quality components, the radio worked the first time I tried it, even though the components all seem to be original. The paper capacitors are made by UCC and the electrolytics by Ducon.

An interesting feature of the chassis layout is that there is an Earth strap running through the centre which allows components to be neatly laid out in parallel or perpendicular to it, giving a pleasing and tidy appearance.

The mains socket is the type used on toasters and electric kettles of the 1950s. I wanted to upgrade to a contemporary socket, so I installed an IEC socket to take a standard IEC power cable, as used for desktop computers, kettles etc (see photo at lower right).

The front of the chassis accommodates the valves, tuning capacitor and mains transformer. The large central void leaves space for the Magnavox speaker, mounted on the front panel. The back-wave from the speaker can pass to the round grille hole in the rear panel via the battery compartment. The front and back panels are the same pressing.

The external covering of the case is steel (it is magnetic) with an internal lamination of copper for high conductivity and shielding; a superior method of construction.

The history of Ferris

This history is abbreviated from a feature article in the Sydney Morning Herald in December 2007 (www.smh.com.au/national/tuned-in-to-consumers-needs-20071217-gdrtek.html).

William Malcolm Ferris was the son of Henry Ferris, a railway worker. Ferris attended Sydney High School and made pocket money by repairing neighbours' electrical appliances. He acquired the nickname "Chum", and this was how he was usually known.

He started his business in 1932, building home radio receivers one at a time in a rented flat above a Mosman butcher's shop. His elder brother George joined him in 1934, and they established Ferris Bros Pty Ltd. In 1938, Chum released the Ferris Fultone 56, the first car radio designed and built in Australia.

Despite the initial success of the Fultone 56, war intervened, bringing petrol rationing and shortages. Ferris Bros diversified into manufacturing devices to provide alternative fuel for cars.

After the war, private car ownership took off, and in 1947 the brothers brought out the Model 74, which operated from either 6V or 12V car batteries or mains power. It was a great success, and the Ferris name soon became a synonym for car radios (or "wireless" sets, as they were known).

The firm diversified into television and antenna production, and even released a line of model trains, which are now collectors' items. The company grew in the 50s and early 60s into a business employing more than 700 workers. While best known for radios, Ferris Bros was a genuinely diverse operation, manufacturing TV receivers, laboratory equipment and even boat trailers and golf buggies.

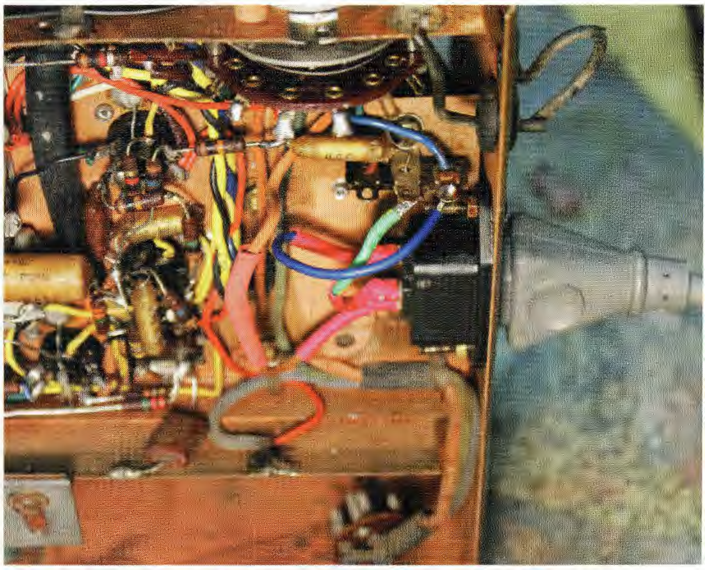
Ferris sold his business to the Hawker Siddeley group in 1970, and changes in tariff law soon meant that it was uneconomical to produce consumer electronics in Australia. By the mid-1970s it was possible to land a Japanese radio for less than the unassembled parts would cost locally.

Ferris was made a fellow in the Institute of Radio and Electrical Engineers in 1981, in recognition of his many inventions and pioneering work in Australian electronics.

In 1998, he donated a vast amount of advertising material, journals and an extensive collection of radios, spanning more than 30 years of production, to the Powerhouse Museum in Sydney.

The Ferris 106 is an excellent example of mature valve technology and superior engineering, as you would expect from a company with a reputation like Ferris. SC

An advertisement for the Ferris 106. You can see the original bright red knobs and logo. The quality of this scan is poor, and we're not too sure where or when this advertisement was originally published.



An IEC socket was installed to replace the 2-pin mains cable, making it a bit safer and more convenient.