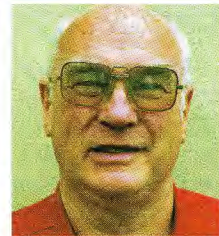


VINTAGE RADIO

By RODNEY CHAMPNESS, VK3UG



The Ferris 214 Portable Car Radio

Ferris Radio concentrated predominantly on producing car radios, some of which were “portable” (and heavy) and could be used in a car on 6V or 12V or in the home on 240V AC. Here we look at their model 214 portable car radio which used germanium transistors.

As well as portables, Ferris produced some DC-to-AC converters and multiband car radios (BC band and a couple of shortwave bands). In addition, during the first few years of black and white TV, they produced a 32V vibrator-powered TV receiver; quite a boon in country areas.

During the era in which Australian manufacturers made transistor radios, Ferris produced some quite high-performance portable sets which could

be used as car radios. AWA and Astor made similar units. They could be changed from car to portable use by just unclipping the set and withdrawing it from the vehicle mount cradle.

This month I am describing one of these later sets, the 214.

Initial inspection

I received a phone call from a man who wanted his Ferris car radio/portable overhauled. It was mounted in an

old Chrysler Valiant utility which he takes to vintage/veteran vehicle gatherings but, unfortunately, the set was not well. And so he brought it (and the Valiant) around so I could have a look at it before committing myself.

When he turned the set on, some rather strangled sounds came out of the speaker. Tuning across the band, I could hear a number of stations and so I thought that the set would be an economic proposition to repair (the owner didn't want to spend a mint). I then asked him to start the engine so I could check whether the vehicle interference was suppressed. Oh boy, the interference generated by the ignition system into the radio had to be heard to be believed! Well, that could wait.

The more immediate problem was the horrible performance of the receiver. The set was removed from the vehicle and it really looked little the worse for wear – rather surprising considering its 30 years of portable and in-vehicle use. A couple of bars in the speaker grille had been broken but in other respects, the case's condition was quite fair.

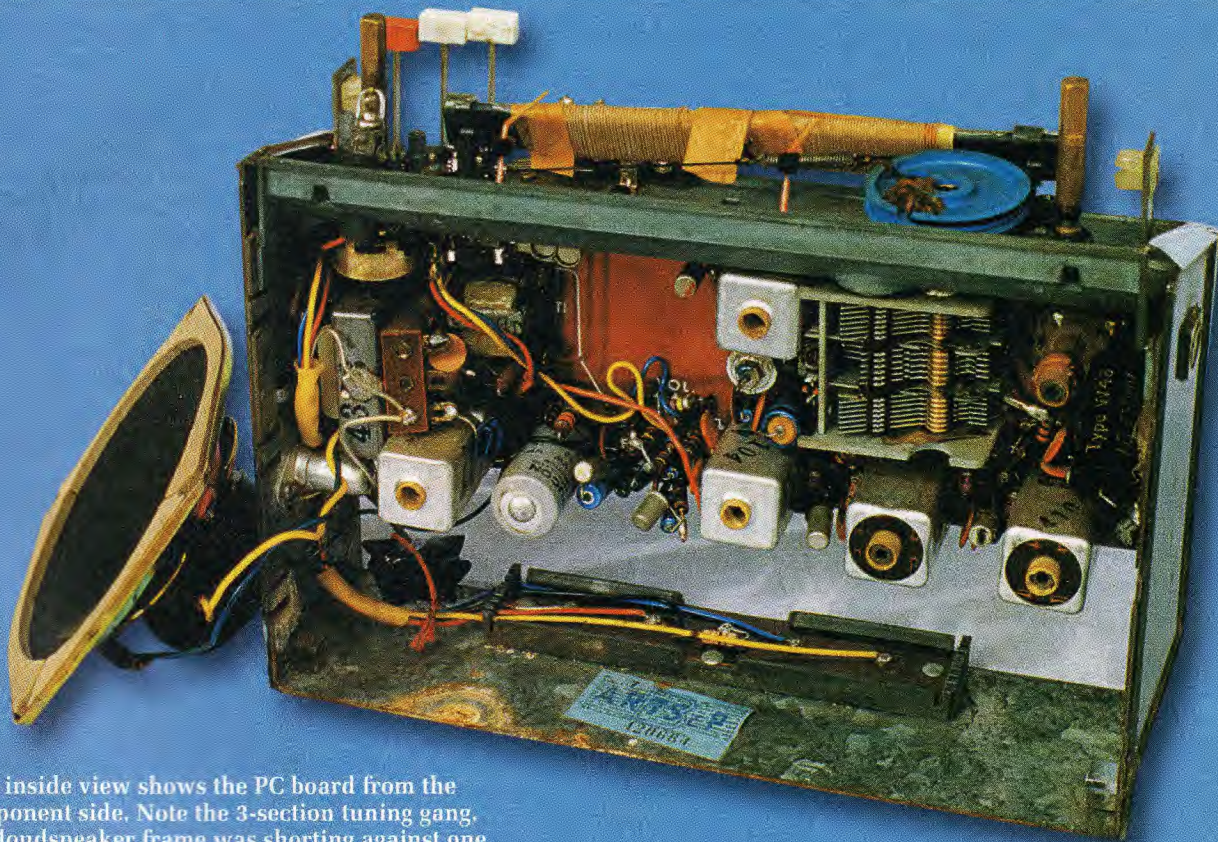
These sets were built into a moulded metal case so that the works are shielded against ignition interference when they were used as a car radio. I told him that I might not be able to replace the missing bars in the speaker grille, which he accepted. He said the grille can't be seen when the set is in the vehicle cradle anyway. He was mainly interested that the set should work – not that it look a million dollars. Once marked, the metalwork on these sets is not easy to restore to pristine condition.

Stripping down

First, it was time to strip the set down and see what was causing the



Despite its age, the old Ferris car radio was in remarkably good condition. For in-car use, the unit slid into a cradle mounted under the dashboard and was switched to use the vehicle's antenna.



This inside view shows the PC board from the component side. Note the 3-section tuning gang. The loudspeaker frame was shorting against one of the metal cans when the covers were fitted.

horrible audio quality. Fortunately, the receiver came complete with a miniature circuit diagram pasted onto the inside of the cabinet. It was rather hard to read but I was able to get a larger copy from a fellow member of the local vintage radio club.

I looked rather carefully at the circuit to determine exactly what each section did and how it did it – particularly the facilities that allowed the change from portable to car radio use and vice-versa. At the aerial/antenna end of the set, the signal input is switched between the loop-stick antenna (when used as a portable) which is outside the metal case and the car radio coil which is inside the shielded case (quite nifty).

I then looked at how the switching was done to go from the 9V portable battery to the 12V car battery. The receiver itself is isolated from the metal case so it can be used with either positive or negative-earth vehicles.

A particular point of interest was how the operating conditions are changed in the set to allow it to work from 12V or 9V. It was quite simple really: the 9V battery was left in cir-

cuit at all times and the 12V vehicle supply “charged” it via resistor R33. This is a rather rough way of doing things as the 9V battery may be “charged” at up to 150mA when the vehicle battery is fully charged and the receiver volume is low.

However, at high volume, the battery supplies some current to the receiver, thus acting as a crude “voltage” regulator in this mode. It must have been rough on the 9V battery and I wonder how long it would have lasted with this sort of treatment.

The receiver circuit is quite straightforward for a set of this era (1960s). Australian manufacturers produced some excellent transistorised designs in the years before the Japanese forced them out of the market.

Australian sets of this era commonly had RF amplifiers and this Ferris design is no exception. The receiver has an RF stage, followed by an autodyne converter, two IF amplifying stages, a diode detector, two class-A audio amplifiers and finally a transformer-coupled class-B push-pull output stage. No fancy, tricky circuits here.

Many will remember that autodyne

converter circuits were not too highly thought of in valve receivers and were replaced by triode hexode converters in the mid 1930s. However, the autodyne works well in transistorised equipment and is almost universally used to do the superhet conversion work in domestic broadcast receivers.

Fixing the audio distortion

Unfortunately, the set had been used as a car radio without the 9V dry battery fitted (this battery is no longer available). This concerned me as it meant that the set had been running on voltages as high as 14V instead of the intended 9V. In particular, germanium transistors such as the AC128s in the audio output section are not particularly tolerant of excessive voltages. Often, they will run for a short time on the higher voltages and then go into distortion, after which there is virtually no output.

This occurs because the transistors draw increased current as a result of the higher voltage and then they go into “thermal runaway” where the current keeps on increasing, in many cases until the transistors are de-

stroyed. Some do return to normal once they've cooled down but failures are common.

I initially thought that one or both AC128 transistors had been damaged. However, before consigning them to the rubbish bin, I decided to do a number of checks. I connected the set to 9V from my small regulated power supply and found that the distortion noted earlier was still quite evident. I then checked the voltages around the AC128s and found them to be as per the circuit diagram.

Signal tracer checks

Remember, with PNP transistors everything is referenced to "+", which is "earth" or common. I suspected that the speaker may have been faulty and substituted my 9 x 6-inch test speaker but the quality was still terrible. I then thought that it was time to bring out the heavy artillery, so I fired up my signal tracer and checked each stage for audio quality and volume.

Initially, all went well – the volume increased as I moved from the base of Q5 to its collector, then onto Q6 and from there to the push-pull bases of the AC128s. However, when I transferred the probe to the AC128 collectors, the volume was down and the distortion was horrific. But despite the low output, the collector current through this stage was high (as shown by the voltage across R31).

So I now knew where the problem lay. I then found that slight pressure on the circuit board could cause the volume to increase dramatically, the quality to return and the collector current to reduce or vice versa. Ah ha, a cracked circuit board track – or so I thought.

And so, with the set operating, I checked the various voltages around the output stage but there was no indication of hairline cracks in any of the copper tracks. I also checked for short circuits all around the output stage of the receiver and could find nothing at fault. In the process, I replaced a couple of yellow ceramic capacitors with the red mark on them (Ducon "red caps"), as they have a reputation of not being all that reliable but that didn't help.

To add to my problems, parts accessibility in this stage is rather poor and it's difficult to inspect components, even with a headset magnifier and a mirror. In fact, once some components

were removed for inspection, their replacements had to be installed on the other side of the board due to the difficult access.

I was getting nowhere fast – just the slightest touch on the board could cause to behave or misbehave. In the end, I decided to replace C25. It is awkward to get at but that fixed the problem.

I checked the removed capacitor and it appeared OK. So what had caused a couple of hours of frustration? Perhaps the capacitor was faulty, despite the test, or perhaps there was sliver of metal causing an intermittent short in this area.

Anyway it works well now. Another serviceman/restorer had apparently given up on the set so the owner informed me.

Fortunately, the set didn't have major problems. However, if critical parts – such as the audio output transformer – had failed and were unavailable, I would have replaced the audio output stage altogether. SILICON CHIP's CHAMP amplifier which uses an LM386 audio amplifier is a good candidate for this job.

By the way, germanium transistors are now harder to obtain than valves. Silicon transistors can be used in place of germanium transistors in many cases but the base biasing has to be altered to suit.

Reducing the voltage

The next task was to reduce the rail voltage to the transistors to around 9V, regardless as to whether the set was connected to its own battery or to the vehicle battery.

There are a few ways that this can be done but I settled for a simple method that closely mimics the set's operation when a battery is fitted. This simply involved fitting three 3V (0.5W) zener diodes in series across the battery plug, to regulate the voltage to a nominal 9V.

In addition, I added a 33Ω 0.5W resistor in series with R33 to reduce the current from the car battery. As a result, the voltage applied to the receiver does drop below 9V at high volume but this doesn't cause any problems with the performance.

Close inspection of the circuit diagram reveals that the 214 was made in two versions: one for use with a 12V car battery (9V internal battery) and the other for use with a 6V car battery

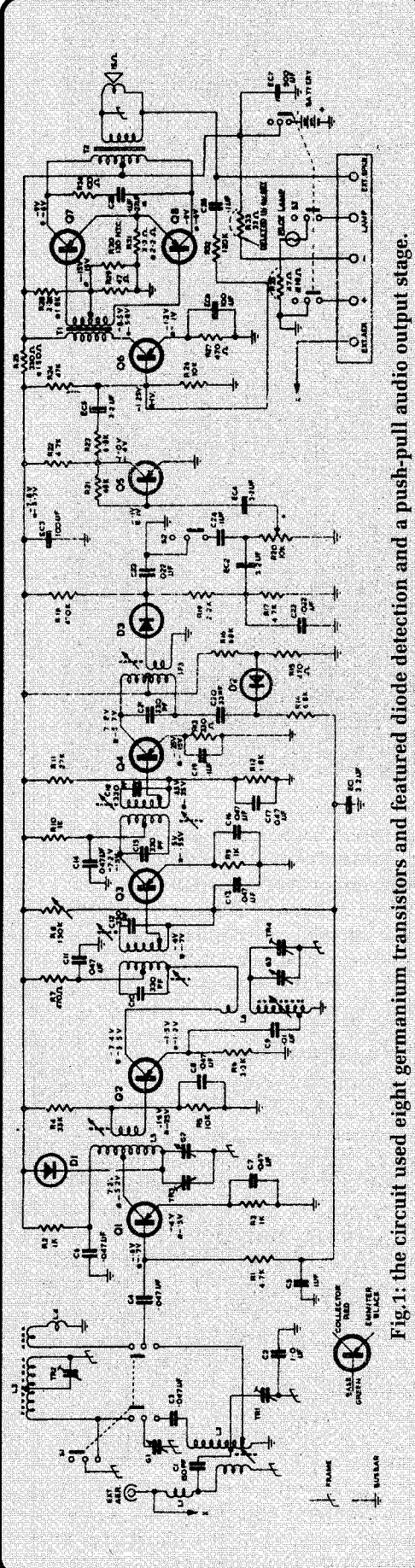
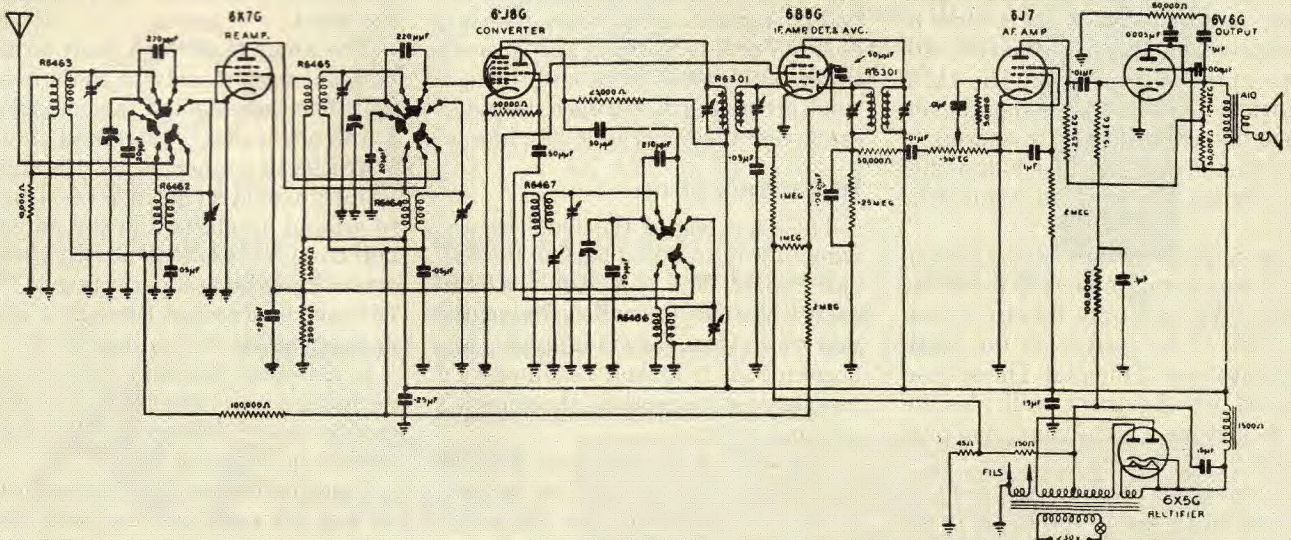


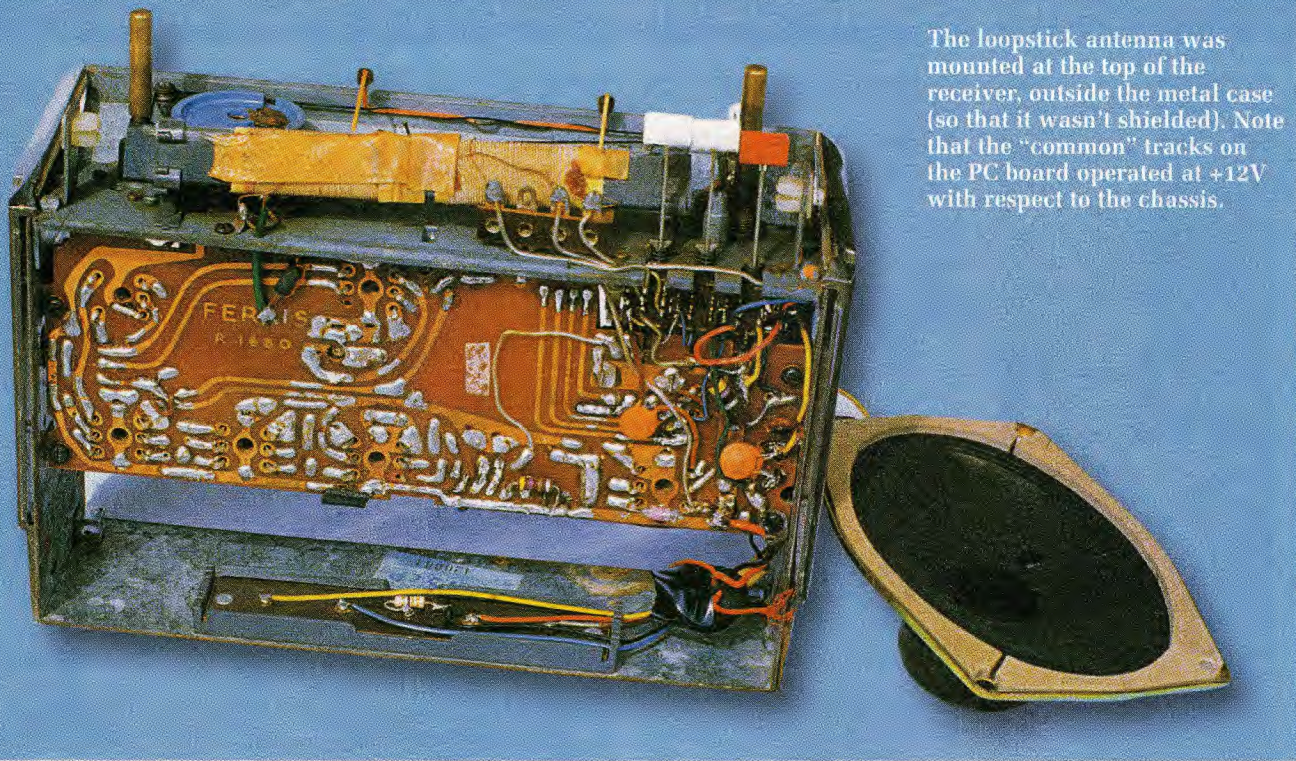
Fig.1: the circuit used eight germanium transistors and featured diode detection and a push-pull audio output stage.

Photo Gallery: Columbus Discovery Model 66



Manufactured by Radio Corporation of New Zealand during the 1940s, the Columbus Discovery Model 66 was a 6-valve 2-band receiver that came in both console and mantel models. They were fairly conventional superhet receivers with 455kHz IF stages and covered the broadcast band from 550-1600kHz and a shortwave band from 9.4-15.6MHz. The valve line-up was as follows: 6K7 (RF amplifier); 6J8 (converter); 6B8 (IF amplifier, detector & AGC); 6J7 (audio amplifier); 6V6 (audio output); and 6X5 (rectifier). (Photographs & diagram courtesy Ted Sherman, Kawhia, NZ).





The loopstick antenna was mounted at the top of the receiver, outside the metal case (so that it wasn't shielded). Note that the "common" tracks on the PCB operated at +12V with respect to the chassis.

(6V internal battery). This simply involved changing four resistor values.

A general check-over

I reconnected the set's speaker and found that it was causing distortion so I rattled my supply of speakers and found a 5 x 4-inch Plessey speaker that exactly matched the faulty one. I also decided that I should check the audio output to see whether the AC128s had been damaged but after listening to the receiver, it was apparent that they had survived their ordeal.

Next, I connected the RF signal generator, modulated by a 1kHz tone, to the receiver and connected an oscilloscope to the audio output. The 1kHz sine wave looked very good and even when the volume was increased to the point of distortion, I found that both transistors clipped symmetrically.

The alignment was also checked and it was found to be spot on in the IF amplifier and only required trimmer TR3 to be peaked at the high-frequency end of the dial. The set had retained its alignment well, despite the rough time it would have had over its life.

As mentioned earlier, the case was marked but it wasn't practical to repaint the painted sections. However,

the chrome work came up quite well using automotive polish and a little elbow grease. The scratches are not obvious now.

Unfortunately, the old battery had been left in the set and the chemicals had leaked and eaten into the case. The battery type used in this set (2761) is no longer made but this is not really a problem. If the owner wants to use the set on batteries, a 6-cell AA battery holder (plus 6 x AA cells) and a battery snap connector would do the trick.

Like anything painted red that is exposed to sunlight, the dial pointers had changed from red to an off-white colour. For this reason, I keep a small tin of red enamel paint and, using a small artist's brush, I painted the pointers so that they now look like new.

In-car reception

The final test of the receiver was when it was mounted back in the Valiant utility. The reception was initially quite fair but when the engine was started up, the interference was horrendous. It looked as though I'd have to do some work on the vehicle's antenna system.

Suddenly, I remembered that we had been using the set on its own internal loopstick antenna. I switched the set to the external car radio an-

tenna and the reception was now delightful, with virtually no interference – the antenna system was in good order.

When restoring and installing a car radio, it is necessary to check two things: interference from the car ignition system and the tuning of the antenna coil. Interference is usually cured (assuming that all the ignition suppressors are in place) by making sure that the base of the antenna is actually earthed (via the coaxial cable braid) to the vehicle. Cleaning rust from around this area usually cures the problem unless there is a break in the braid.

The antenna is very short so it is coupled very closely to the antenna coil. The antenna and the coaxial cable all act as part of the tuned circuit. With this all connected and the antenna fully extended, the receiver is tuned to around 1400kHz and the antenna coil trimmer is adjusted with a small screwdriver for best performance. The trimmer is accessed through a small hole alongside the tuning control.

In this case, the old Ferris receiver performed well right across the broadcast band so the trimmer (TR1) didn't have to be adjusted.

I returned the set to the owner but he rang me a day later and said that it was blowing fuses. He brought it back

and testing revealed that a short existed between the +12V rail and the set's frame.

Dismantling the set revealed that the short disappeared when the back was removed. Some plastic electrical tape was put over the vulnerable sections of the PC board but the short reappeared when the back was replaced. I pulled the front and back covers off and the short disappeared again. At this stage, I suspected a short from the circuit board common (+) to the loudspeaker frame (-).

In this set, the speaker fits between the transistors, various other components and the coil cans. Using a dentist's mirror, I observed that one coil can did seem to be very close to the speaker frame. I put some tape over the can and that fixed the problem – success at last.

Summary

Ferris made some excellent radios and this is one of them. It is capable of being used as a portable or as a car radio with equally good performance. Its all-metal case ensures that it is well-shielded against car ignition interference.



This view shows the Ferris receiver sitting in its cradle, beneath the dashboard of the old Chrysler Valiant utility. They don't make 'em like this any more!

It's also is rather weighty for a transistor radio but is extremely robust.

This is a set well worth having in any collection and it is still a very

practical receiver nearly 40 years after it was manufactured. Vintage radios certainly don't have to sit on a shelf gathering dust. **SC**