

Vintage Radio

By RODNEY CHAMPNESS, VK3UG



The Sprague 500 multi-band receiver

Ever wondered how interference to radio and TV reception is tracked down? In the 1960s, it was done using specialised multi-band receivers such as the Sprague 500.

The Sprague Electric Company of America produced a wide range of electrical components and other apparatus. They also produced a number of specialised radio receivers, generically described as "Interference Locators".

These Sprague receivers nominally covered the frequency range from around 550kHz up to at least 220MHz. In practice, they were mainly used to trace sources of interference to radio and television reception (and occa-

sionally to 2-way radios), although they were never originally intended to be used for this purpose.

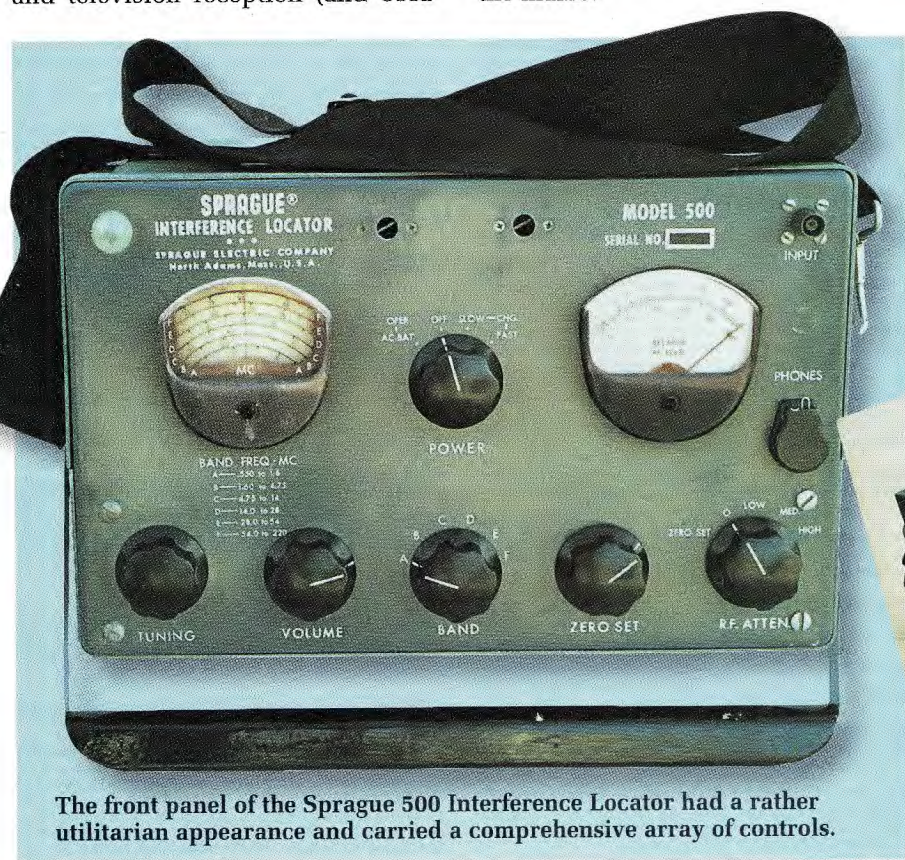
In order to successfully track down interference, it was necessary that the sets be fully portable. This meant that they could be powered from an inbuilt battery, as well as from 110/120V and 240V AC power. The internal wet-cell battery was automatically recharged whenever the unit was connected to the mains.

In this case, "portability" is a relative term as the Sprague 500 weighs in at a hefty 12.5kg and measures 333mm high x 320mm long x 200mm wide. At the time of its manufacture (around 1960), portable equipment was still quite heavy and bulky.

The Sprague 400 was the first in this line of receivers, followed by the model 500 in 1959 (the last of the "valved" units). This was then followed by the model 600, model 610 and finally, the model 700 in 1977. I understand that either Eddystone or Belling Lee (I'm not sure which) also made an interference tracing receiver but I've not seen one.

I've personally used all the Sprague models at one time or another, with the exception of the 400. In my opinion, the 500 was the best – it gave minimal spurious responses and boasted good design and mechanical quality.

Despite being well and truly obsolete by the late 1980s, the 500 soldiered



The front panel of the Sprague 500 Interference Locator had a rather utilitarian appearance and carried a comprehensive array of controls.

Below: the front and back pages of the operating manual.



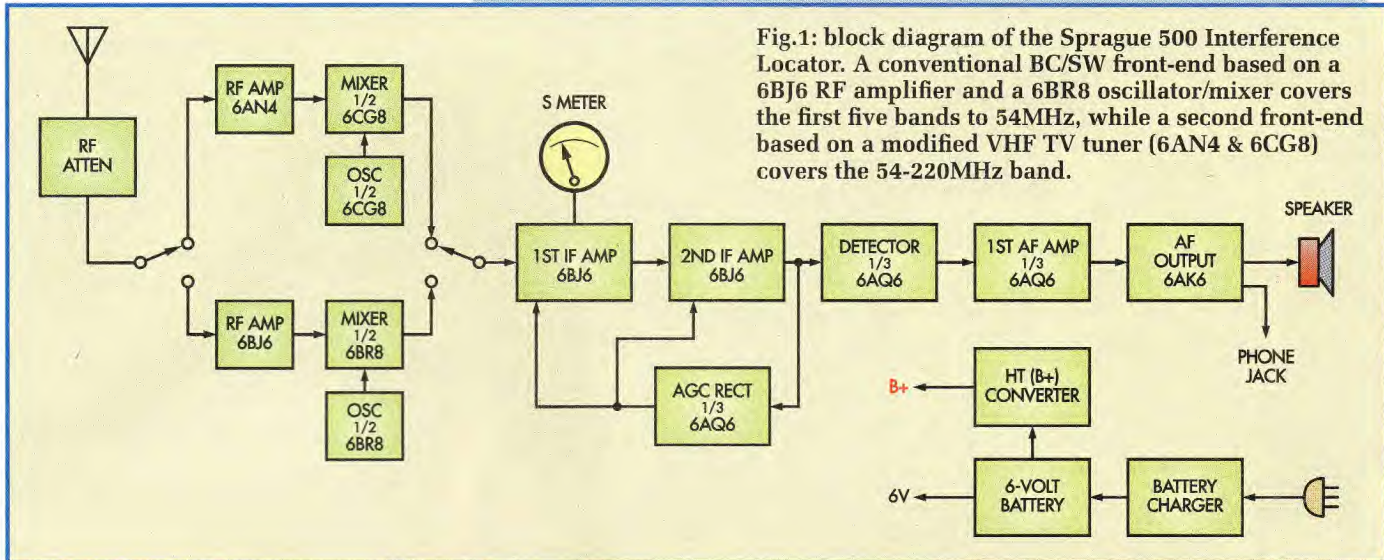


Fig.1: block diagram of the Sprague 500 Interference Locator. A conventional BC/SW front-end based on a 6BJ6 RF amplifier and a 6BR8 oscillator/mixer covers the first five bands to 54MHz, while a second front-end based on a modified VHF TV tuner (6AN4 & 6CG8) covers the 54-220MHz band.

on well after many of the later models had been pensioned off. In some cases, they were even modified to suit the requirements of the government department that used them!

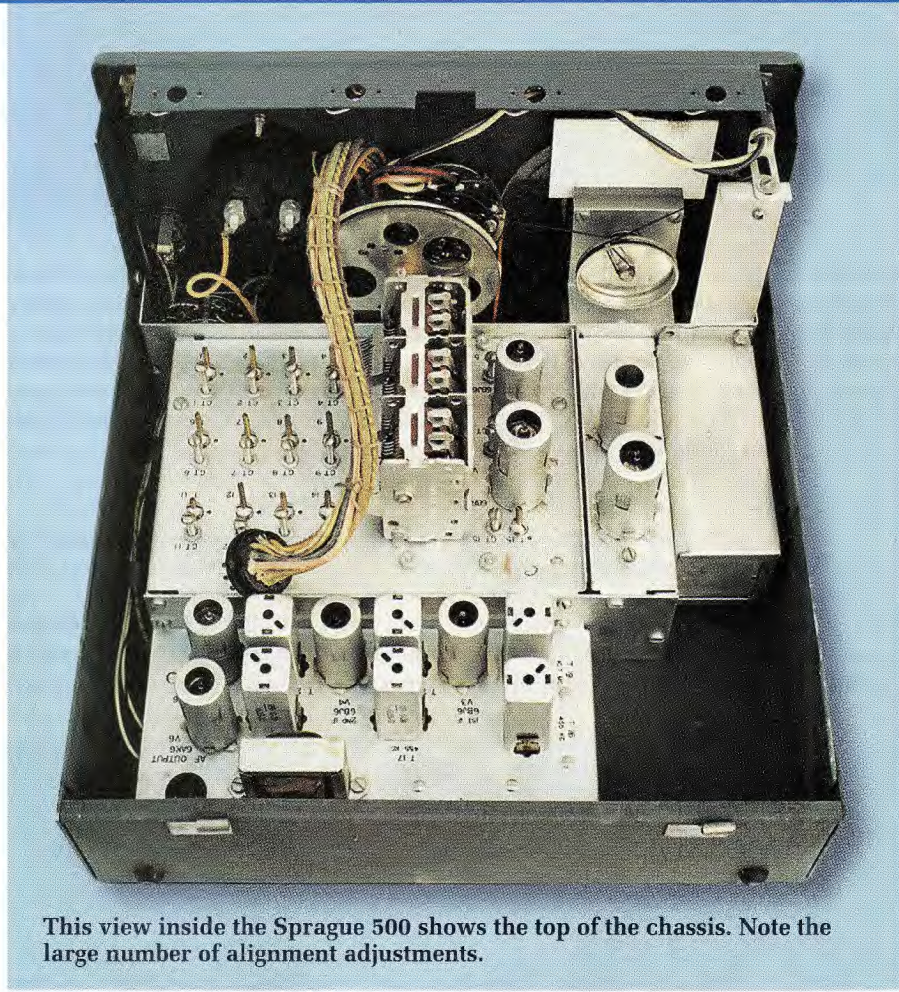
But even the venerable 500 couldn't keep going indefinitely. It was bulky, lacked the sensitivity of later equipment and didn't have facilities to trace interference in the UHF band. It also lacked facilities for multi-mode reception and spectrum analyser operation. In the end, it was the Icom R7000 receiver that took over where the Sprague 500 left off.

The Sprague 500

A quick glance at the Sprague 500 reveals that it's not the sort of set you would set up in a lounge room. Unlike domestic radio receivers, it has a very utilitarian appearance, with a grey "crinkle-finish" aluminium case and a front panel style that resembles an item of test equipment. It also has a carrying handle and a fabric strap to aid portability.

As previously stated, the receiver tunes from 550kHz to 220MHz over six bands. Its dial scale is located behind the meter case on the top left of the panel, while a second meter at right is "calibrated" for relative RF (radio frequency) signal level. The knob in the centre is the on-off control and is also used to switch on the inbuilt battery charger.

The tuning control is at the bottom left of the panel, followed (from left to right) by the volume, band-change, meter zero and RF attenuator controls.



This view inside the Sprague 500 shows the top of the chassis. Note the large number of alignment adjustments.

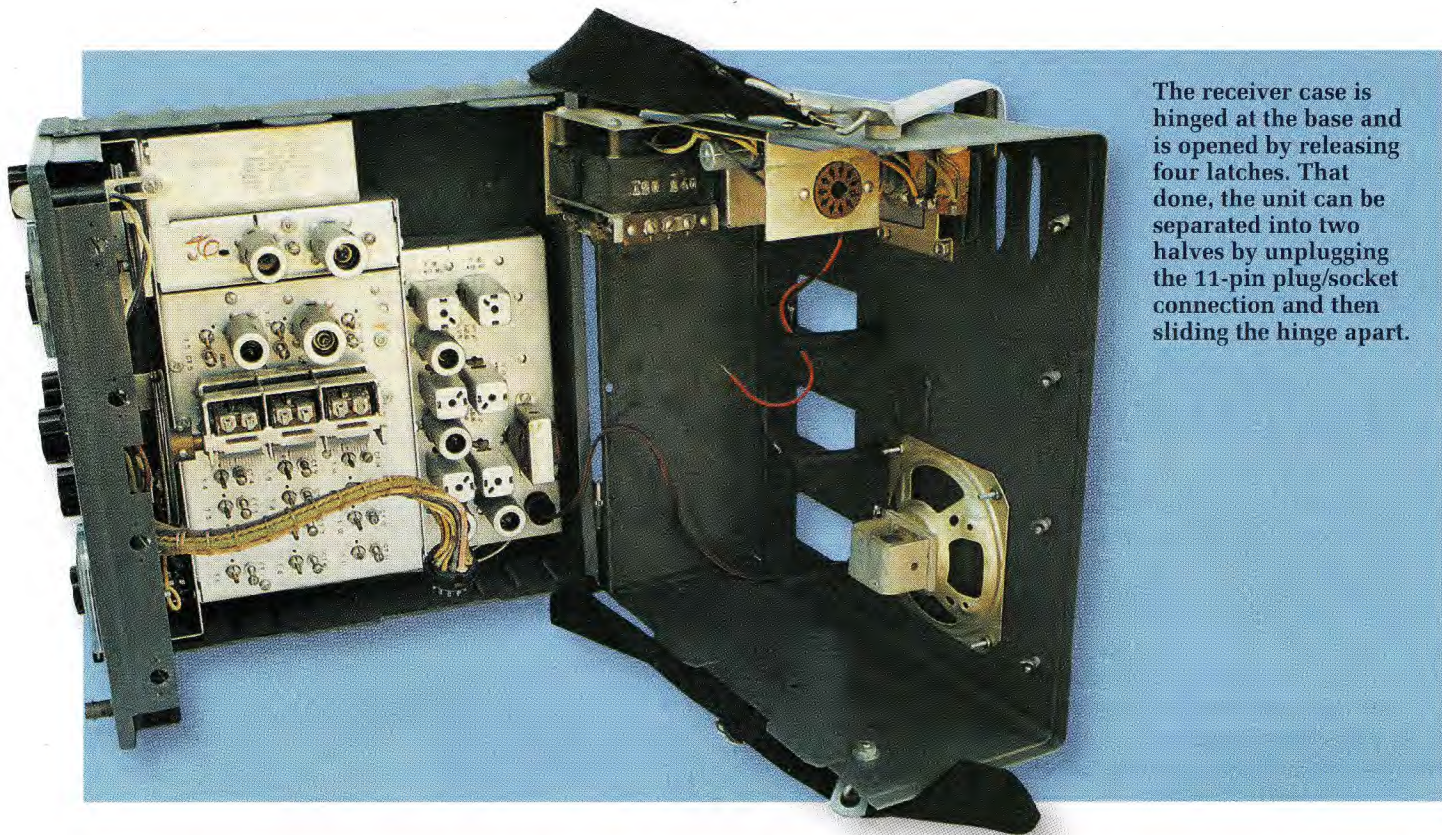
In use, the RF attenuator is adjusted so that the meter needle stays somewhere near the centre of the meter scale, even when the RF probe used with the set is quite close to the source of interference being traced.

On the righthand side of the panel is a jack for a set of low-impedance headphones (the set has an inbuilt

100mm speaker as well), plus a BNC coaxial cable socket for the signal input. Finally, a neon indicator at the top left of the panel lights when the set is turned on.

Antennas

The specialised antennas used with the unit are generally mounted onto



The receiver case is hinged at the base and is opened by releasing four latches. That done, the unit can be separated into two halves by unplugging the 11-pin plug/socket connection and then sliding the hinge apart.

a socket at the top of the front panel. These antennas and other accessories include a telescoping rod or dipole antenna (depending on how it is set up), a directional loop antenna for broadcast band reception, an RF probe, a roof mounting bracket for the antennas, two coaxial cables, a canvas carry case and a set of headphones.

The cover that protects the front-panel controls is missing on my unit, as it is on all the sets I have seen. That's because it was invariably regarded as a nuisance by the operator and discarded. In addition, the headphones,

the roof mounting bracket and most of the other accessories were rarely used. In practice, the sets were mostly used in cars and an antenna mounted permanently on the vehicle was connected to the set via a 50-ohm RG58 coaxial cable.

Circuit details

The circuit is quite conventional and uses eight valves. The first five bands cover to 54MHz using a conventional BC/SW front-end based on a 6BJ6 RF amplifier and a 6BR8 working as the oscillator and mixer.

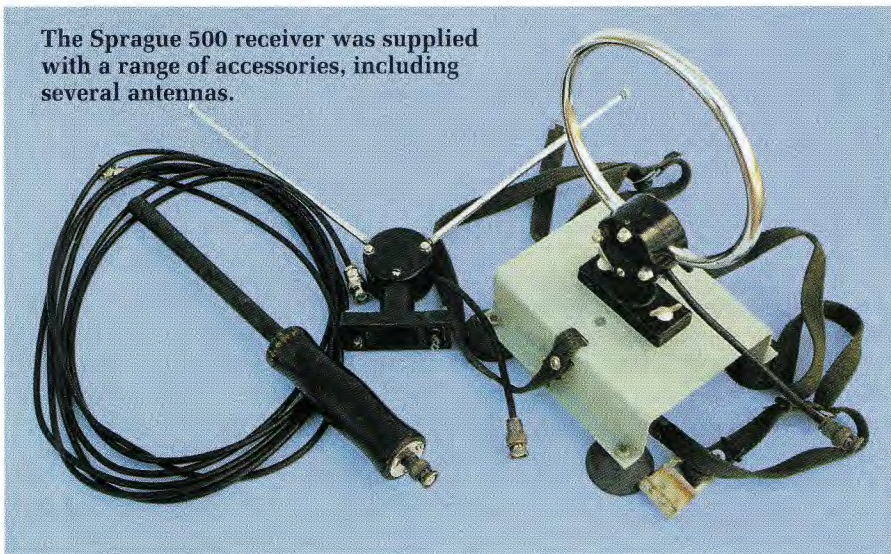
The 54-220MHz band is covered using a second front end. This uses a modified incrementally-tuned VHF TV tuner, with a 6AN4 as a grounded grid RF stage and a 6CG8 oscillator and mixer stage.

The rest of the receiver is common to both front ends. It consists of two 6BJ6 IF amplifier stages, a 6AQ6 detector/AGC and first audio amplifier stage, and finally, a 6AK6 as the audio output stage. AGC is applied to both IF stages and the signal strength meter is wired into the plate and screen circuit of the first IF amplifier.

The IF amplifier is more complicated than the 455kHz IF stages found in domestic receivers. On the three bands up to 14MHz, the IF is 455kHz, but on the three bands above 14MHz, it's 10.7MHz. The broader IF on the higher frequencies means that it is much easier to tune VHF signals, as there is no bandsread in the tuning system. The wave-change/tuner/IF selector is quite a complex switch, with no less than 14 sections!

AGC is applied only to the two IF stages which means that, on strong signals, the unit is prone to overload. That's where the attenuator comes into play – it's situated between the antenna terminal and the RF amplifier and is used to reduce the signal strength. Note that, in some cases, the

The Sprague 500 receiver was supplied with a range of accessories, including several antennas.



signal strength can be quite high; eg, if the detection probe is just a few centimetres from the interference source.

Power supply

With the exception of the 6BR8 and 6CG8 oscillator/mixers, the valves are all low heater current types and also draw low HT (high tension) current. The HT is only 120V on the plates of the valves and this helps to reduce the set's current drain – important for minimising the load on the internal lead-acid battery.

The battery was a special 6V 20Ah type which is no longer available. To further reduce the current drain, the valve heaters in each front-end were powered only when that particular tuner was being used. This meant that if you switched from band A to band F (or vice versa, you had to wait for about 20 seconds for the selected tuner to become operational.

In operation, the receiver is powered from the 6V battery at all times. This battery is continuously float-charged when the set is plugged into the AC mains, except when the power switch is set to one of the charge positions.

In the latter case, the battery can be charged at a “slow” or “fast” rate. The battery also acts as a ripple filter for the power supply.

The charging circuit isn't regulated, so it was necessary to observe the hydrometer balls in the battery to determine its state of charge. This was quite easy to do, as each battery cell could be viewed through special holes in the back of the cabinet.

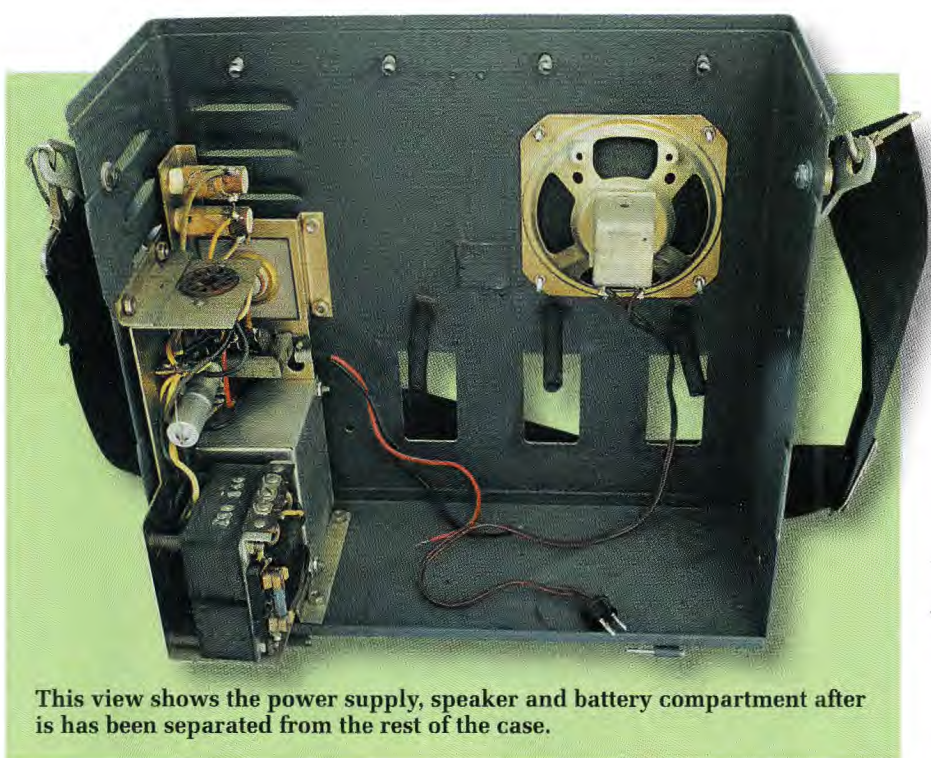
It's also interesting to note that the battery used was an early leak-proof design. It had several inches of rubber tubing going up from the filler on the battery. This meant that accidentally tipping the set over did not cause acid to spill (these sets were produced before fully sealed batteries were commonly available).

As mentioned before, this battery is no longer available but a 6V sealed lead-acid battery of around 10Ah capacity will fit into the space available.

Because the set operates from 6V, it was necessary to include a DC-DC converter to provide a 120V HT rail. This was achieved using a simple 2-transistor inverter circuit.

Getting it going

In Australia, these sets were used



This view shows the power supply, speaker and battery compartment after it has been separated from the rest of the case.

extensively by the Radio Branch of the Postmaster General's Department (PMG), for tracing interference to radio and TV reception. As a result, they led a fairly hard life, although most units generally survived quite well.

However, the cases usually took a battering and the paint was chipped and worn away on many units. The front panel markings also tended to wear with extensive use. It all meant that these sets did look rather “beaten up” towards the end of their working life.

Restoring the case

In my case, I managed to obtain three of these sets and quite a few of the accessories, including an operating manual – that latter including a circuit diagram and a lot of other helpful information. I picked the one with the best cabinet and front panel and did a bit of swapping around of some the bits and pieces from the three units to get the very best set I could.

The receiver case is hinged at the base and is opened by releasing four latches. That done, the unit can be separated into two halves by unplugging the 11-pin plug/socket connection and then sliding the hinge apart. The power supply can then be worked on without further dismantling the set.

If necessary, the receiver chassis can be removed from the case by undoing the 11 screws that secure both it and the front panel in position. Once this

is done, access to the underside of the receiver chassis is quite good.

Unfortunately, various holes had been drilled into both the case and the front panel of each set. These were repaired by first gluing a small

Photo Gallery: Aristocrat Battery Console



Manufactured by Electrical Specialty Manufacturing Company Ltd, Sydney, in 1935, this receiver was intended for use in areas not supplied with mains power. It was fitted into an Art-Deco style cabinet and required a 2V accumulator for the valve filaments and a 135V dry battery for the HT. The valve line-up was as follows: 34 RF amplifier, 15 autodyne mixer, 34 IF amplifier, 30 detector, 30 audio amplifier and 19 push-pull audio output stage. Photo: Historical Radio Society of Australia, Inc.

piece of metal behind each hole (using Araldite), after which the holes were filled with Plasti-Bond and allowed to set. The Plasti-Bond was then carefully sanded down until it was level with the front of the panel, ready for painting.

Another problem area was corrosion inside the case where the battery is mounted, no doubt due to acid leakage at some stage in the past. I scrubbed the affected area with soapy water and a scouring pad and it came up quite well.

That done, I “colour-matched” the original paint and, using a spray pack, painted the whole of the outside of the case. I also spray-painted the cleaned area inside the case where the battery had been.

The front panel is a slightly different colour to the rest of the case, so this too was “colour-matched” to retain an authentic appearance. This paint job also covered a Plasti-Bond repair to a hole in the front panel. It’s not perfect – the edge of the hole can still be seen if you look closely enough but it’s still quite good.

The aluminium handle also has a wooden section attached to it and the paint on this had well and truly disappeared from most of its surface. I sanded the handle lightly, then hand-painted it with black enamel so that it now looks like new.

Circuit tweaks

The Sprague 500 receivers have always been reliable sets and restoration has usually been quite simple. The power supplies were trouble free and a sealed lead-acid battery is quite easy to fit in place of the original battery.

Occasionally, a valve needs to be replaced but that’s quite rare as all the valves were run well below their maximum ratings. A full RF alignment is also sometimes required but the IF amplifier stages usually remained in tune. The passive components were also very reliable and seldom require replacement.

The alignment points for the RF sections of the set are accessed when the case is split in two. That done, the two sections can be laid alongside each other and the 11-pin plug/socket reconnected. Be careful when operating the set like this though, as the mains is exposed at one point in the power supply!

Aligning the IF stages is a bit more complicated, as the chassis must be removed from its case section to gain access to half the adjustments. This takes a while to do but it’s not as hard as dismantling an AWA 617T.

Summary

Due to its specialised nature, this is not a receiver that would appeal to a large number of restorers. In fact, I doubt that there are even a dozen such units in the hands of restorers in Australia, as it is now a relatively rare receiver. **SC**