Vintage Radio

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The Pye TRP-1 Portable HF Transceiver

Despite government opposition, radio communications spread rapidly in Australia following the end of WW2. Released in 1949, the Pye TRP1 was one of the new breed of HF portable transceivers designed to meet the growing demand for suitable equipment.

This view shows the fully restored transceiver. The original brown cabinet was resprayed a hammertone green colour and looks new again.

FOLLOWING THE END of World War 1, many groups pushed for the widespread adoption of radio communications despite strong government resistance. In Australia, these groups initially included people who were remote from telephones and the telegraph systems of the day.

One pioneer, the Rev. John Flynn oversaw the development of radio communications for what was to become the Royal Flying Doctor Service. The first of his innovative pedal-powered radios came into use in 1929 and used several shortwave frequencies. Fishing trawlers also started using radio communications at about this time.

Early radio transceivers were quite bulky but as World War II approached, a number of "compact" transceivers were developed for the Flying Doctor Service, rural fire brigades, small aircraft, fishing vessels, forestry and farming groups, and surveyors and government departments. However, the number of sets produced during this period was not large as the government was still reluctant to licence radio communications services and placed many obstacles in the way of those wishing to use this medium.

In addition, suitable radio transceivers were expensive to produce, were still relatively bulky and were nowhere near as effective as communications equipment is today.

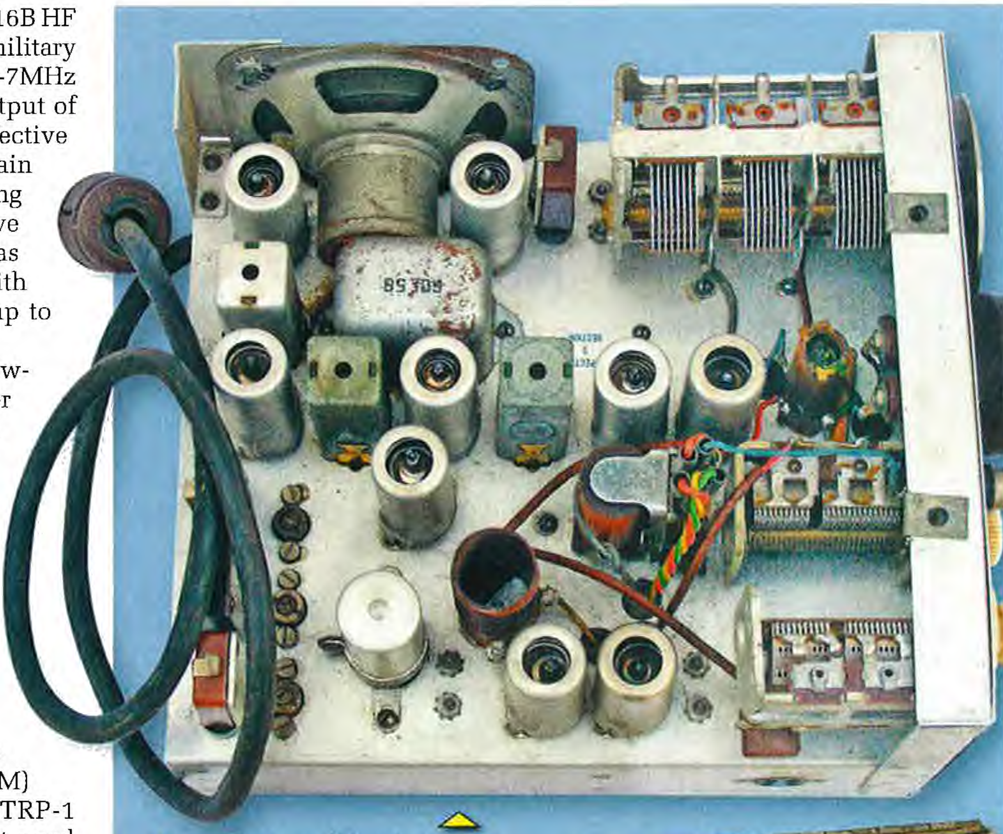
After being exposed to HF radio communications during WWII, many returned servicemen could see the value of HF communications in peacetime. As a result, radio communications began to rapidly expand in the civilian sector and a number of companies produced suitable equipment to meet the demand. One such company was Pye-Electronics Pty Ltd, which included Electronic Industries Ltd and Radio Corporation (Astor).

The TRP1 transceiver

Just prior to WWII, Radio Corporation designed and built the RC-16B HF transceiver (and the ATR4A/B military version). This covered the 3-7MHz band and had a transmitter output of around 1.5-2W. It was quite effective for its time but its battery drain was quite high, the set consuming around 4W of power on receive and 12W on transmit. It was hardly a lightweight either, with the equipment packs adding up to around 19kg.

With the availability of low-current miniature valves after the war, Pye decided to design and build a replacement for the RC-16B. It would have similar performance to its predecessor but would be considerably lighter and use less power. In addition, its tuning range would be 2.7-7MHz, which is slightly wider than the tuning range of the RC-16B.

The result was a portable HF amplitude modulated (AM) transceiver designated the TRP-1 and released in 1949. This set used a conventional chassis made from "Duralium" (a lightweight aluminium alloy) and this in turn was housed in an aluminium case to keep the weight down.



Above: the top of the chassis is neatly laid out, with good access to all parts.

Designed for use either as a semi-fixed portable or as a true portable transceiver, the TRP-1 consumes around 2.6W on receive and around 9W on transmit (considerably less than the RC-16B). Configured as a "Walkie-Talkie" station, it weighs just 9.5kg and the receiver draws 350mA at 1.5V, 14mA at 150V and 0.06mA at -10.5V.

As expected, the transmitter draws considerably more, with 540mA at 1.5V, 50mA at 150V and 100-200mA at -10.5V. The portable battery weighs 3.6kg while the larger "camp" battery weighed in at a massive 16.7kg.

Circuit details

Fig.1 shows the circuit details. The receiver is a conventional superhet with a 1T4 RF stage, a 1R5 converter, a 2-stage IF amplifier using 1T4 valves, a 1S5 detector/AGC/audio amplifier and a 3V4 audio output stage. A bias of -4V is used for the 3V4 and this is obtained directly from a tapping on the -10.5V bias battery.

The RF, converter and the first IF stages all have simple AGC applied to them. The converter can either be manually tuned across the 2.7-7MHz band or accurately tuned to a spot frequency using a crystal oscillator. The high tension (HT) for the receiver is supplied by a 150V battery via two parallel 10kΩ resistors. These drop the voltage to around 75V when the receiver is operating.

Now let's take a look at the transmitter section. As shown, it uses a 3S4 as a crystal oscillator and driver for the output stage. This stage has -4V of bias applied to protect the valve in the event that crystals are not fitted to all three possible positions (ie, if a vacant position is selected by the frequency switch). The oscillator plate circuit is tuned by C31, C32 or C33 to suit the particular crystal selected by switch S2.

The RF output stage consists of two double-triode 3A5 valves, with all sections in parallel. Each plate is fitted with a 50Ω "parasitic stopper" resistor to prevent spurious signals from being transmitted.

With four triodes in parallel, it is mandatory to include a neutralising circuit. In this case, neutralisation is achieved by feeding back energy in anti-phase via the tapped secondaries of driver coils L5 and L6. The resulting anti-phase signal is applied via neutralising capacitors C27 & C28 to

The cabinet had been knocked about during its life and had quite a few dents and flaking paint. The dents were knocked out and the cabinet resprayed green to match an earlier production run (see facing page).

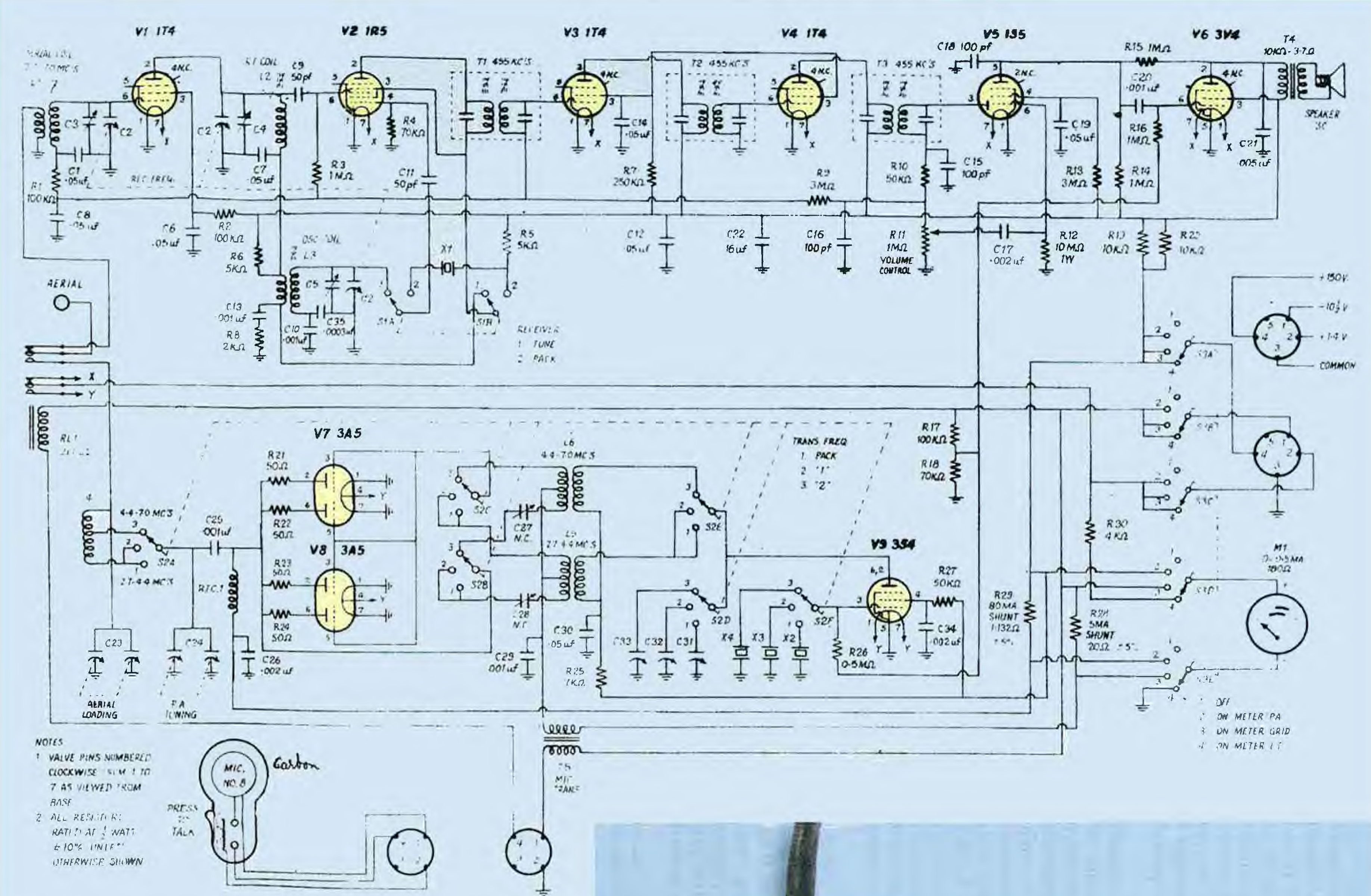
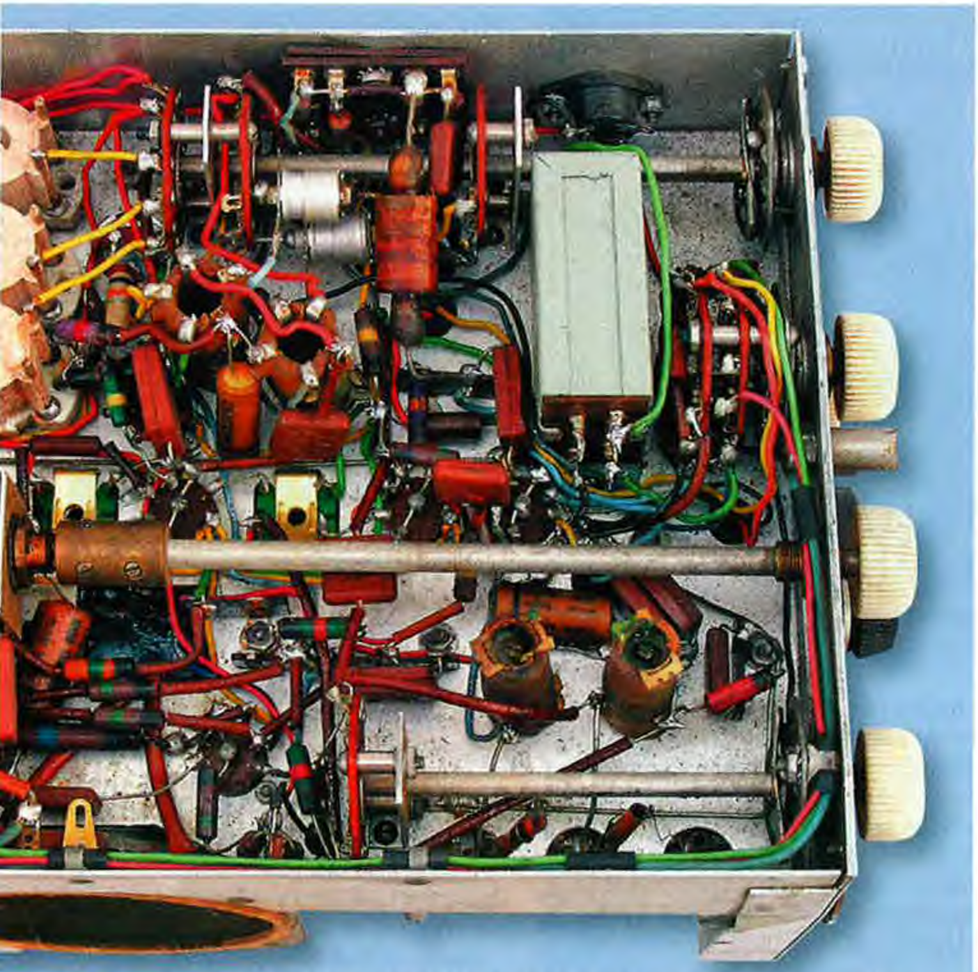


Fig.1: the receiver section is a conventional 6-valve superhet based on V1-V6. The transmitter circuit is also conventional and uses a a 3S4 as a crystal oscillator and two 3A5s in parallel for the RF output stage.



Although neat, the wiring under the chassis is quite crowded, making some parts difficult to access. The paper capacitors all required replacement.

switches the antenna from the receiver to the transmitter, disconnects the receiver filaments and applies 1.5V to the transmitter filaments.

Note that the HT is left on at all times in both the transmitter and the receiver. This means that no work should be done on either the transmitter or receiver sections with the set turned on.

Restoration

As can be seen from the photographs, the cabinet of the unit featured here had been knocked around quite a bit. In fact, the paint was flaking off and the cabinet had a few dents in it but this is understandable considering the type of work the set did.

I knocked out the dents in the case using a small hammer and a heavy flat piece of metal which was placed behind the surface being worked on. That done, the case was cleaned with a turpentine-soaked rag to get rid of any grease and then sanded to remove any loose paint.

Next, I covered the rubber grommets and the labels on the cabinet with masking tape and gave the worst areas a coat of spray primer. The first production run of these sets was painted a green hammertone colour but this one, part of a later run, was painted a salmon colour. However, I repainted this unit hammertone green like the

null out the grid-to-plate capacitance in the valves (this circuit is similar to that used in the early triode-tuned radio frequency (TRF) receivers).

Note that the output circuit is manually tuned and the circuit loaded for best output on each transmission frequency selected.

The modulator is the essence of simplicity. It consists of a carbon microphone, a -10.5V supply to power the microphone and provide bias for the RF output stage, plus a microphone transformer (T5).

In operation, speech signals are picked by the microphone and fed to transformer T5. This then modulates the transmitter by applying the audio signal directly to the grids of the 3A5 valves which operate with the full -10.5V of bias.

The changeover from receive to transmit is accomplished by pressing the press-to-talk (PTT) button on the microphone. This grounds one side of the changeover relay which then

Taken from the handbook, this photo shows the TRP-1 transceiver (centre) complete with all its accessories, including batteries, antennas and the microphone. The large "camp" battery at top left was optional

Photo Gallery: AWA 7-Transistor Radiola

MANUFACTURED BY AWA in the 1960s, the Radiola Transistor Seven came in quite a few model numbers, each based on a small upgrade. These model numbers included the B19, B19Y, B19Z B24, B24Z & the B52. The transistor line-up was as follows: 2N1639 converter; 2N1638 first IF amplifier; 2N406 overload; 2N1638 second IF amplifier; 2N408 audio driver; and 2 x 2N408 push-pull audio output stage. The diode detector was a 1N87A. The audio output was just 150mW before noticeable distortion and although this doesn't sound much, it was still very acceptable. Photo supplied by the Historical Radio Society of Australia Inc (HRSA), PO Box 2283, Mt Waverley, Vic 3149. www.hrsa.net.au

first production run, as I had almost a full can of this relatively expensive paint. In fact, I had previously used it to repaint another communications transceiver (ie, the Harbros 12/54B featured in October 2005).

With the painting completed, I removed all the knobs and cleaned them with warm, soapy water and a nail brush. They were then thoroughly rinsed and allowed to dry before being put back on the set. I also had to remove the receiver's tuning-dial for service and this is done by loosening two screws on the gang shaft. The dial is then slid forward along with the tuning knob and the edge-drive mechanism slipped off the edge of the dial.

I cleaned the dial-drive system and then proceeded to carefully reassemble it. The two pressure washers, which grip on opposite sides of the dial scale, are under quite some pressure from a coil spring. They took some separating but with perseverance I succeeded in getting them to once again grip the edge of the dial. That done, I reassembled the drive. All of the control shafts were then lightly oiled so that they operated smoothly, although none was stiff due to congealed oil or grease.

Perished battery cable

The battery cable had perished rubber leads, which could have caused shorts in the set or placed 150V onto the valve filaments with disastrous results. The safest thing to do was to replace this lead entirely.

I removed the 4-core cable from the set, along with its plug. The plug cover was a bit rusty so it was cleaned up and spray-painted matt black.

Originally, I intended making up a lead using four strands of heavy hook-up wire but then I remembered that I had some 5-core automotive trailer cable. This looks much the same as the original except that it has plastic covered wires inside the sheath. It has five wires so I just ignored the spare and went ahead and wired the lead to the plug and to the set.

The wire colours are different to those in the original cable so I had to be careful that I didn't wire the 150V HT lead to the 1.5V filament line. However, just to make sure I hadn't made any errors, I removed all the valves and applied power from my power supply. A quick check with a DMM then confirmed that everything was correct.

While the valves were out, I sprayed each valve socket with Inox to clean any corrosion off the socket pins.

Fortunately, the chassis was relatively clean on both sides and only needed a light dust out with a small paint brush. An air compressor can also be used (with care) for this job.

Overhauling the receiver

Now that the set and its cabinet had been cleaned up, it was time to overhaul the electronic circuitry. Unfortunately, the parts are difficult to access in some areas, particularly around the transmitter section, but I was eventually able to replace all the paper capacitors. They were all quite leaky, even though it was obvious that they had been replaced about 40 years ago.

Some of the sub-miniature metallised paper capacitors were smaller than my polyester capacitors, so fitting new ones wasn't all that easy. One or two resistors had drifted in value and were also replaced. At this stage, with no shorts or other circuit faults evident, I applied power to the receiver. It came on immediately with a rush of noise from the speaker. I connected it to an antenna and although I couldn't hear many stations (at least not during daylight hours), it appeared to be working just like it had nearly 60 years ago.

Next, I decided to check the alignment of the various coils. The oscillator coil was slightly out of adjustment at the low-frequency end of the dial and adjusting it brought both the low and high ends of the tuning range back in line with the dial markings. However, the performance dropped off for frequencies above 6MHz so I checked the alignment of the RF and antenna coils. At the low-frequency end, they were slightly out of adjustment and I corrected them by adjusting the core slugs at around 2.8MHz.

Conversely, at the high-frequency end of the dial, I found that the per-

This close-up view shows the front panel controls on the fully-restored unit. It tunes the frequency range from 2.7-7MHz and has a transmitter power output of between 1.5W and 2.3W.

formance improved if I placed a piece of insulated rod near the RF coil. Unfortunately, I couldn't adjust the wire trimmer due its awkward position in the set so I soldered an adjustable trimmer across it and adjusted this for best performance instead.

The receiver's performance was now quite good, with a fairly even noise level from the speaker across the whole 2.7-7MHz band. The set was also working well in the "Pack" frequency position. In this position, a crystal is switched into the converter circuit and the set will only tune to the frequency of the crystal minus the IF frequency (455kHz). However, the manual tuning control is quite critical to set in this mode.

Note that the set can also be tuned quite easily to an image frequency, ie, to a frequency 910kHz higher than the desired frequency. I fitted a 3247kHz crystal into the holder and the set now tunes on crystal control to 2792kHz (3247kHz - 455kHz), or to the image at 3702kHz (3247kHz + 455kHz). I selected this particular crystal frequency because the set came equipped with a 2792kHz crystal in the transmitter.

Overhauling the transmitter

There was only one paper capacitor fitted to the transmitter section and this was replaced with a polyester type. The remaining capacitors are all mica types and were in good condition.

I examined the wiring carefully and could see no signs of any short circuits or other problems. However, it's not easy to trace the wiring in the transmitter and I could only hope that there were no nasty faults deep down in the "jungle" of wiring near the RF output stages in particular.

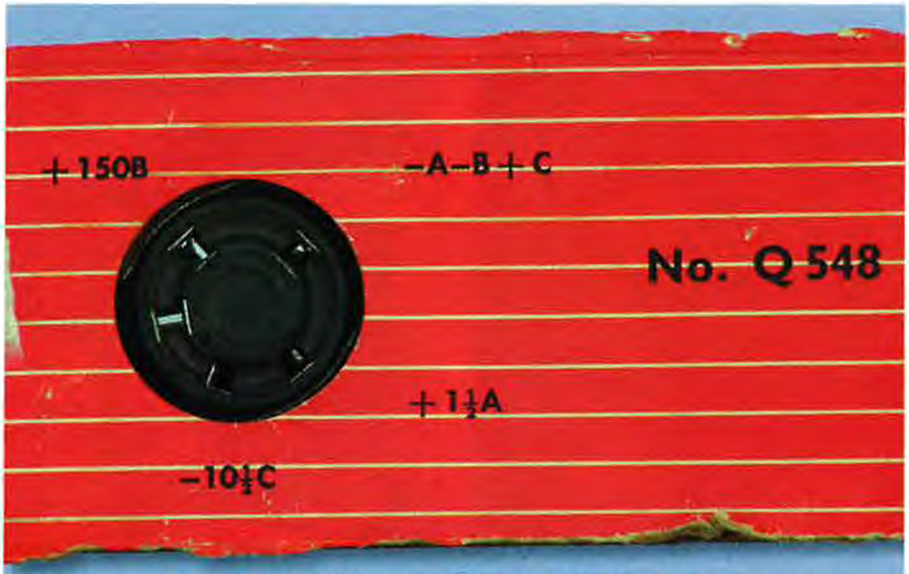
Of course, if there were any shorts on the HT line, this would have shown up as soon as I applied power to the receiver earlier on. With this in mind, I applied power to the transmitter stages and all appeared normal.

Both valve stages have protective bias applied. This bias is -4V in the case of the 3S4 in the oscillator and -10.5V for the two parallel 3A5s in the RF power amplifier (PA) stage.

Next, I attached a 50Ω dummy load (this acts as an artificial antenna) to the transmitter, so that the signal would not be heard outside my home. I then clipped a test lead between the end of the changeover relay coil and the chassis and endeavoured to tune the 3S4 oscillator stage.

This tuning is accomplished by adjusting a preset tuning capacitor that's adjacent to the crystal (either C31, C32 or C33). However, I could get no indication on the "grid" meter position of the main switch (S3).

I checked the voltages (with dif-



This view shows the top of the portable battery that's used to power the TRP-1. It not only supplies +150V for the HT rail but also -10.5V to bias the valves and +1.5V for the valve heaters.

ficulty) on the 3S4 and found that they were in the range I would expect while transmitting, ie, 90V on the plate and 50V on the screen. However, the 3A5 valves were drawing no discernible plate current due to the standing bias applied to the output stage, so I assumed that the 3S4 wasn't oscillating.

I tried another 3S4 with exactly the same results, then took a close look at the wiring around the 3S4 but this was all correct. I then tested the two driver coils (L5 & L6) using my Leader transistor dip meter but got no indications of resonance. The meter is just not sensitive enough to give a reading.

Next, I checked the bias voltage applied to the secondary of the microphone transformer and got -10.5V. I then measured on the side going to the taps on the driver coils and found nothing. I had tested the continuity of both audio transformers before and they had proved to be in good order, so I rechecked the secondary of the microphone transformer and it too was OK. However, the multimeter was indicating a short from this point to ground.

Some parts in the TRP-1 are difficult to access, particularly around the transmitter output stage.

There aren't many components in this part of the circuit so I removed both 3A5 valves and the short disappeared. Subsequent checking showed that that a grid in one 3A5 had shorted to the filament.

I replaced the faulty 3A5 and the short cleared. I then proceeded to go through the tune-up procedure again.

With crystals fitted to the three crystal sockets, I turned the transmitter on and was then able to tune coils L5 and L6. The tuned circuits are adjusted via trimmer capacitors C31, C32 & C33 and the tuning is at optimum when the maximum grid current is indicated on the meter. It's necessary to check a few times that the crystal-controlled oscillator operates each time the PTT switch is operated. If this doesn't happen reliably, it is necessary to slightly detune the relevant tuned circuit so that the oscillator does start reliably.

That done, all that remained was to adjust C23 and C24 for maximum output. The output of the transmitter varied from around 1.5-2.3W.

The transmitter was now working well but I had to find a suitable microphone insert to suit the set, as the original was missing. I have good supply of old mobile radio microphones, both carbon and dynamic types, and after a bit of searching I found a carbon insert to suit the microphone case used on the set.

With the insert installed and a new plug fitted to the lead, it was time to see if the microphone worked. I switched on the scope, placed the probe near the antenna lead to the dummy load and pressed the PTT switch. The result was an expanded pattern on the scope when I spoke into the microphone, showing the normal envelope modulation pattern for an AM transmitter.

At this point, the restoration was complete. Note, however, that a licence is required to operate a transceiver like this. In my case, I have crystals that would allow me to use the transmitter on the 3.5MHz amateur band.

Summary

In summary, the TRP-1 is an interesting little transceiver designed for use in relatively remote locations. The receiver is sensitive and easy to tune but because the dial drive has very little reduction, it's important not to tune too fast to avoid missing stations.

The transmitter also tunes up quite nicely and has a quite reasonable output of between 1.5W and 2.3W. Its main drawback is that it is capable of being over-modulated by the simple modulator, which will cause "splatter" on adjoining channels.

Using four triode sections in parallel in a transmitter is risky in my opinion. However, Pye achieved stability in this configuration, partly through the use of the 50Ω plate stopper resistors.

Access to the workings under the chassis varies from reasonable to virtually impossible. It suggests to me that the transceiver's physical layout had been finalised and the designers then ran into problems with the neutralised 4-triode RF power output stage. As a result, they had to cram more parts into an already crowded chassis to fix the problem.

I am unsure as to why all valves are enclosed in shielded valve sockets. Perhaps it was to make sure the valves didn't work out of their sockets in the course of the set being bumped around. Finally, I don't understand why both a 3S4 and a 3V4 were used at different locations in the set. Either one would have worked quite OK in each position, with one less valve type needed in the parts inventory. **SC**