

# VINTAGE RADIO

By JOHN HILL



## Tuned radio frequency receivers

**Because of their basic simplicity, TRF receivers are usually fairly easy to restore. These receivers are usually worth collecting although their performance is not up to superhet standards.**

TRF (tuned radio frequency) receivers were popular during the early years of radio, particularly in the first decade of broadcasting. In the 1920s, they took the form of multi-dial sets with two or three tuning dials, while in the early 1930s they had the more conventional single knob tuning of that era. These latter types look a bit like early superhets but a close examination soon reveals that they are not.

The TRF receiver had a band of devoted followers that kept it in production for a longer period than it deserved. A comparison between

a TRF and a superheterodyne receiver would soon prove that the superhet is the better of the two. But despite this, many listeners preferred the TRF because of its straightforward design and simple alignment procedures.

A TRF receiver can have from one to three stages of tuned radio frequency amplification prior to the detector stage. It may or may not have reaction but if it has the set will give a better account of itself. A good TRF will also have a couple of audio stages as well.

In other words, a TRF receiver has no frequency converter valve

or intermediate frequency amplification stages such as a superhet has. The TRF simply amplifies the radio frequency input from the aerial, detects that signal and further amplifies it in the audio section.

Perhaps the worst aspect of a TRF receiver is its poor selectivity. Nearby radio stations will occupy a considerable portion of the dial compared to a superhet. This is particularly evident with smaller TRFs having only one stage of RF amplification. Such sets have very poor selectivity and there could be positions on the dial where two or three programs can be heard simultaneously.

TRFs with two or three RF stages are much more selective but still do not approach the selectivity of a superhet.

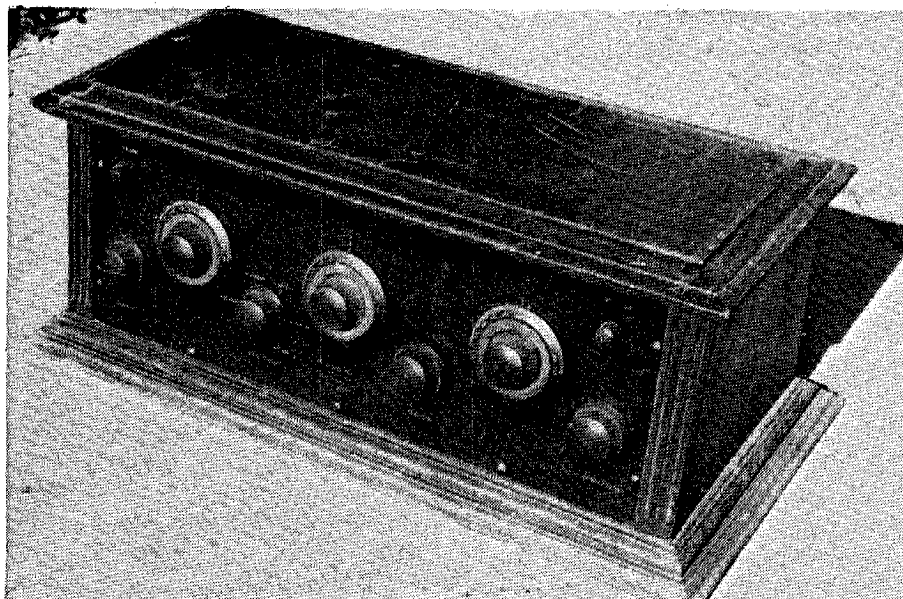
Most TRF receivers have two or three aerial terminals and using these to advantage will make the receiver more selective. So too will increasing the reaction control if the set has reaction. As the reaction is increased to almost the point of oscillation, selectivity improves greatly.

However, although a reaction control gives a considerable boost to volume and can improve selectivity, it also gives rise to distortion when used at maximum levels.

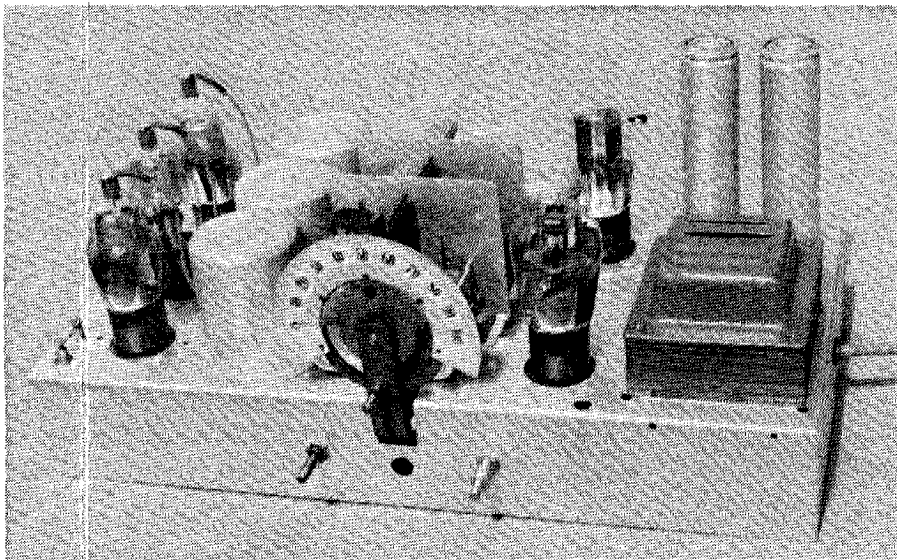
TRF receivers are comparatively rare and to find such a set today is indeed a lucky break. TRFs are very collectible items, even if they do not perform as well as a superhet.

Most TRFs, particularly the AC-operated receivers from the early 1930s, are easily restored due to their relatively simple construction, but one can always strike unexpected problems.

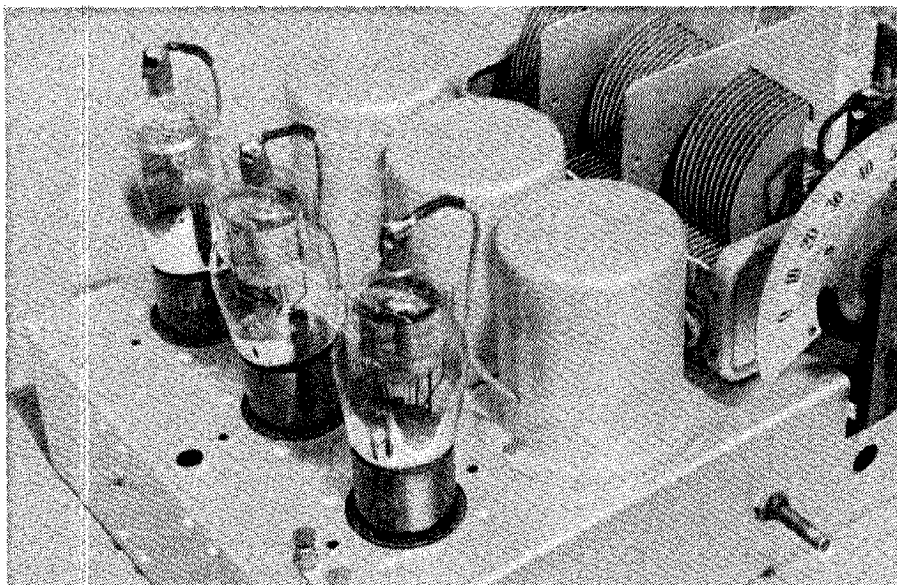
The 5-valve TRF shown in the ac-



Early TRF receivers had individually controlled tuning stages. This particular set has two stages of radio frequency amplification ahead of the detector.



The chassis of the old 5-valve TRF receiver scrubbed up really well. A TRF receiver has no frequency converter or intermediate frequency amplification as in superheterodyne models.



This close-up view shows a typical TRF layout. The valve, coil and tuning gang section of each RF stage are in line. The three grid-cap RF valves are type 24As.

companying photographs gave more than its fair share of trouble. The speaker was a total write off with a busted cone and open circuit field coil and speaker transformer. The set had only one valve and the dial was jammed up solid. The power cord had been cut and much of the wiring needed replacing, not to mention numerous other incidental repairs. What's more, as the set belonged to a friend, it would have to be a job at minimum cost.

A few preliminary checks are always in order before starting a restoration job and the power transformer was checked out to see

if it was still operative. Both the high and low tension windings were OK. Likewise the radio frequency coils. At that stage of the proceedings the set appeared to be restorable.

When repairing an old receiver for someone else, it is important to find out what type of restoration the owner wants. In this case, the owner was only interested in getting the set working again and whether it was original or not didn't really matter.

That suited me because of the speaker problem. I haven't many spare electrodynamic speakers and



This beautiful TRF console model should be sufficient proof that TRFs are very collectible. It is the 5-valve unit mentioned in the story and was recently restored by the author for a friend.

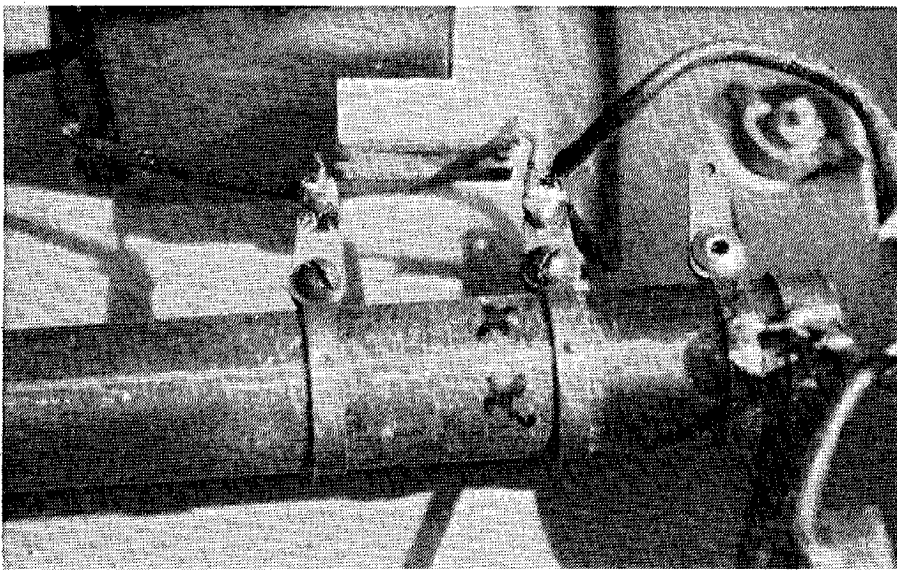
really didn't want to part with one. Therefore, a relatively modern permag speaker was used as a replacement.

Now that type of repair will make some readers shudder with disgust and as the replacement speaker was made in Brazil, it makes the originality aspect even worse. However, I was only doing what the owner wanted and what was practical. What's more, the end result sounded very good indeed.

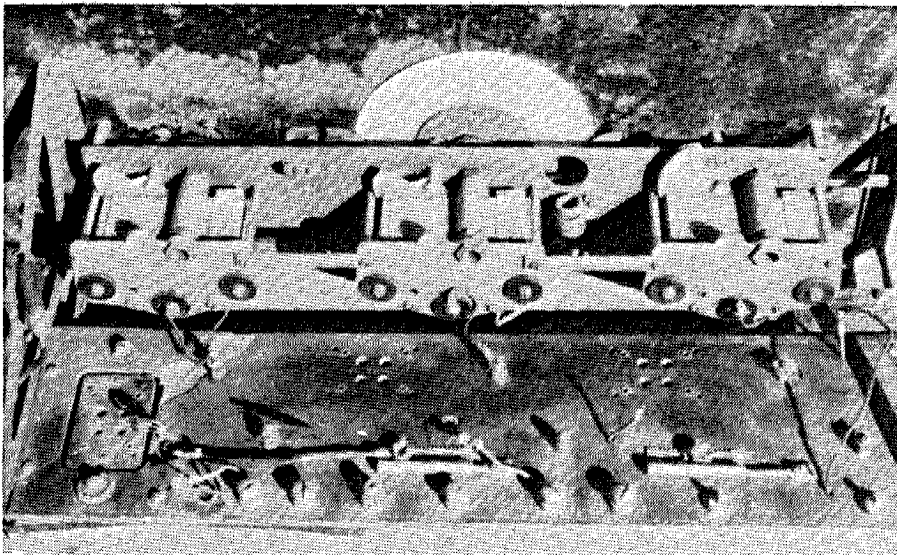
A little experience always helps when selecting unknown valves for an ancient receiver. A 4-pin rectifier socket suggested that an 80 would do nicely in that particular location. A 5-pin output socket indicated that an old 47 should work OK and two 24As should restore the radio frequency stages to working order.

The owner was given the phone number of a valve supplier and I suggested that he obtain an additional valve of each type for spares. The seven valves cost \$90 which really isn't expensive considering their age.

Nearly all TRF receivers were made prior to 1935 and, as a result, are usually fitted with 2.5V valves. Many of these old valve types are



The high-tension dropping resistor in the 5-valve chassis was open circuit in one of its sections (near crosses). This problem was overcome by bypassing this section with a wirewound resistor.



This old chassis shows an early attempt to gang individual tuning capacitors. They are rack and pinion driven from a single central dial. Note the small trimmers at the front of each tuner to correct misalignment.

fairly rare and one major problem regarding the restoration of a TRF receiver could well be obtaining suitable valves. In some instances, substitutions may have to be made.

### Scraping plates

Restoring an old valve radio is simply a matter of repairing or replacing worn and defective components. On this particular receiver, one thing that really needed repairing was the tuning capacitor. The tuner was a 3-gang type with a nasty problem — all the plates of all three gangs were scraping. The tuner was a plain

bearing type with riveted end plates.

In this instance, the small brass rivets had come loose, allowing the main shaft to move forward under the pressure of a strong spring that took up the end float in the shaft.

Trying to re-rivet the end plates was impossible because there was no room to fit anything inside that was strong enough to hammer on. One can only rivet if the rivet head is backed up by something solid.

A different approach was tried. The loose end plates were pulled into position using G clamps; then Superglue was run into the joints to

secure the endplates in position. This was followed by a couple of dabs of solder to ensure that the end plates were electrically connected to the main body of the tuner.

The Superglue repair was completely successful and holds the end plates far better than the original brass tubular rivets ever did.

Finally, the capacitance of the three gangs was checked with a digital multimeter and corrective adjustments were made to the outside movable plates. The tuner tracked very well for two thirds of its travel, but one gang wandered off a bit over the rest of the movement. Nothing much could be done to correct this error.

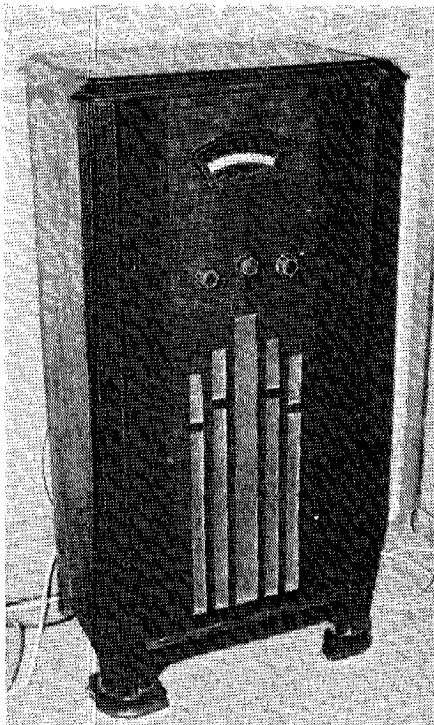
Removing the tuning capacitor from the chassis makes cleaning up much easier and the chassis was wire brushed and repainted. By this stage of the proceedings, the old TRF looked a good deal better than before.

The previously mentioned tight dial mechanism was mainly due to the problem with the scraping luner plates and the gear driven dial mechanism required no further maintenance other than a thorough clean and a smear of grease. The dial lamp holder, however, required attention as it had come apart.

Like the tuning capacitor, the dial lamp holder was of riveted construction and had come apart due to poor assembly. The repair required a couple of fibre washers for insulation and a few drops of Superglue to hold everything together. Handy stuff, Superglue!

It is jobs such as the dial mechanism and the lamp holder repair that come under the heading of "incidentals". While nothing much in themselves, they collectively add up to quite a lot of time at the end of any restoration project.

The next item to check out was the 10kΩ wirewound volume control. A multimeter check indicated serious internal problems and it was replaced with a modern counterpart. As mentioned in previous stories, modern wirewound potentiometers have very short control shafts and so an extension shaft was fitted to overcome this problem.



**This 4-valve TRF radio has only one RF stage and no reaction. It is a very poor performer indeed. The styling is hardly a thing of beauty either.**

As the high tension supply was still connected to the original electrolytics, it seemed like a good idea to replace them. Likewise with half a dozen paper capacitors. In keeping with many early AC receivers, the high tension was exceedingly high and 600 volt electrolytics were used on both the input and the output sides of the HT filter.

Originally, the speaker field coil was part of the HT filter, but as the electrodynamic speaker was to be replaced with a permanent magnet speaker, a substitute field coil was used.

Unfortunately, the original loudspeaker was in such a poor condition that the field winding resistance was illegible. When this is the case, a suitable resistance must be built up so that the HT filter output voltage is approximately 250 volts when the set is operating.

As the set was not operative at this stage, a 2k $\Omega$  20W resistor was wired into the circuit in place of the speaker field coil. If its value needed to be increased or decreased, it could be sorted out later on.

The speaker plug and socket then had to be rewired to suit the new

arrangement. The speaker transformer also had to be wired in somewhere and this was wired under the chassis for convenience. It's not a bad idea to do this because it keeps all the high voltage components out of the way. The worst thing that could happen to probing fingers in the back of the set is a mild burn from a hot valve.

A few more incidentals needed attention. The frayed grid cap connections were tidied up. A few carbon resistors were also checked and although they had gone high, they were still close enough to their original 20% tolerance. Wagging a couple of suspicious looking solder joints revealed two exceedingly bad connections which were carefully resoldered. A couple of mica capacitors were also checked and found to be OK.

One component that would have caused trouble if it had not been inspected was the high tension dropping resistor. In this case the resistance winding between two taps was open. Rather than replace the whole unit, the faulty section was bridged across with a wire wound resistor. The value of this resistor was estimated by measuring the resistance of a similar length of the dropping resistor in an unbroken section.

### **Silence is not golden**

It was time to see if my many hours of work had restored this old TRF to working order. The valves were inserted, the speaker plugged in, the aerial and earth connected, and the set switched on — nothing but silence. Total silence!

The rectifier did not light up. A quick check showed that green corrosion on one of the socket contacts was possibly the cause of the trouble. With no valves in the sockets for so many years, it was not surprising.

Try again. Success — all valves light up and music fills the room.

The final job was to adjust the trimmers on the tuning capacitor and the task was completed.

This 5-valve TRF receiver was the second radio of that type I had worked on in less than a fortnight. The 5-valve model was a much better performer than the 4-valve one, but neither can match a superhet. 🎧