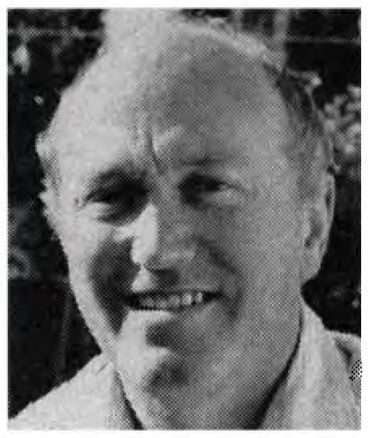
VINTAGE RADIO



By JOHN HILL

Converting a battery set to mains operation

I recently completed a particular vintage radio project that had been at the back of my mind for quite some time. A fairly ambitious scheme, it involved the conversion of a battery receiver to 240V AC operation.

The reason for such an insane idea is simple. I live in country Victoria and the area abounds with old battery receivers of various types. In some localities, SEC power was not available until the late 1960s, hence the abundance of battery sets. If these battery radios could be successfully converted to mains operation, then such a conversion could be well worthwhile in some instances. Well, that was the theory anyway.

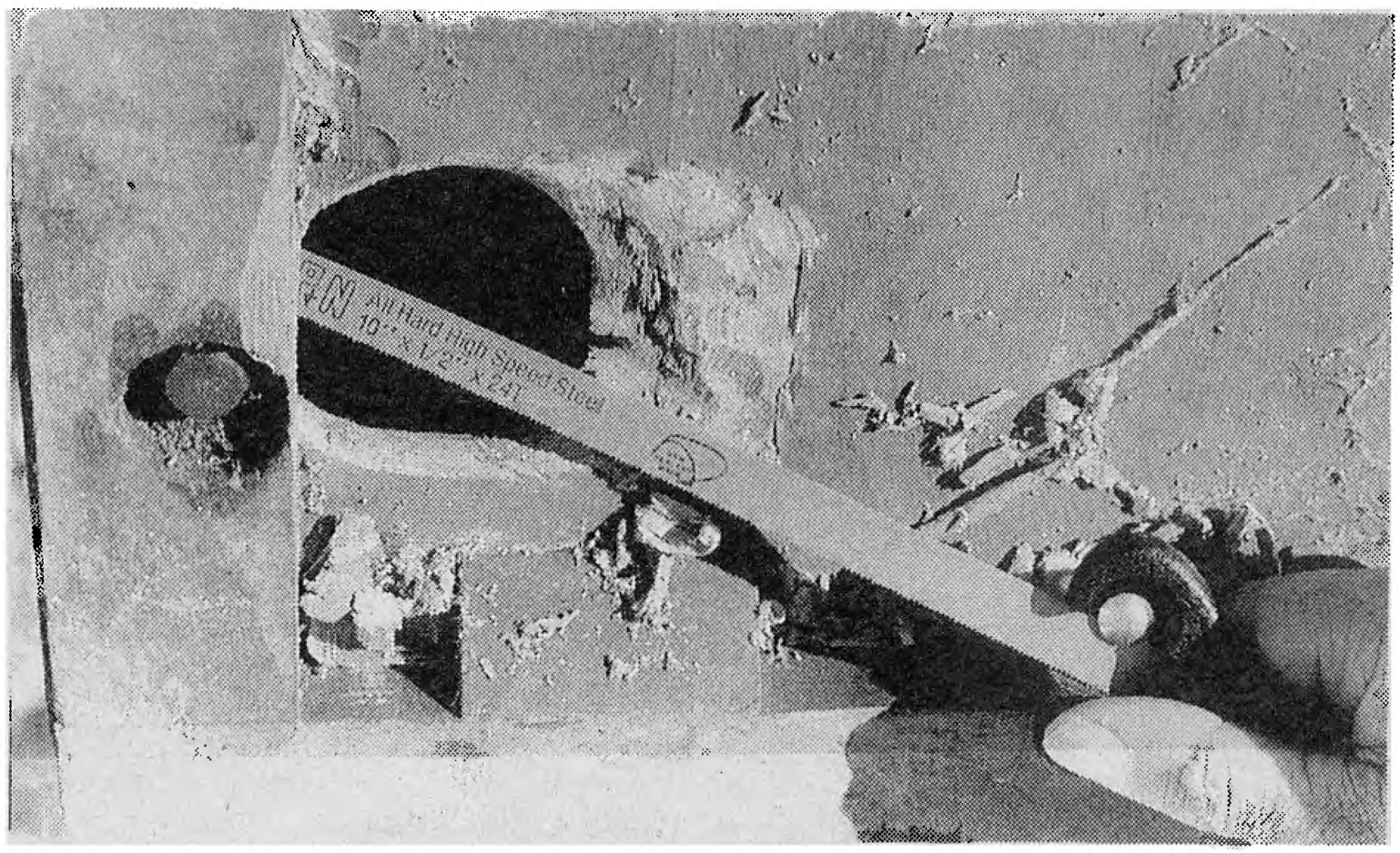
There are two ways of going about such a conversion. One would be to build a power supply that would duplicate the receiver's battery requirements. Although the receiver would operate on mains power, it would still be a battery set in both design and performance.

The alternative approach is a fully-fledged AC conversion whereby the set has additions such as a power transformer, rectifier valve, and a suitable complement of AC-type signal valves. An appropriate loudspeaker and output transformer would also be needed. I was to find out, however, that this approach was not without its problems and that it wasn't as easy as I originally thought.

In theory, battery to AC conversion should not be that difficult and should be a straightforward project. After all, it only involves totally rebuilding about two thirds of the receiver and adding a power supply!

The radio I converted was a 1935 4-valve table model Radiola. I have two of these receivers and the idea was that if one ended up wrecked due to an unsuccessful experiment, then the other could still be retained as a battery set. That theory didn't work out as planned either.

The project was nearly abandoned at an early stage because I could not remove the chosen chassis from its cabinet. Due to mouse infestation, the much piddled-on mounting bolts were well rusted into round brass nuts which were riveted to a turned-under flange at the bottom of the chassis. Three of the four bolts "squawked" their way free but the last one only turned the nut.

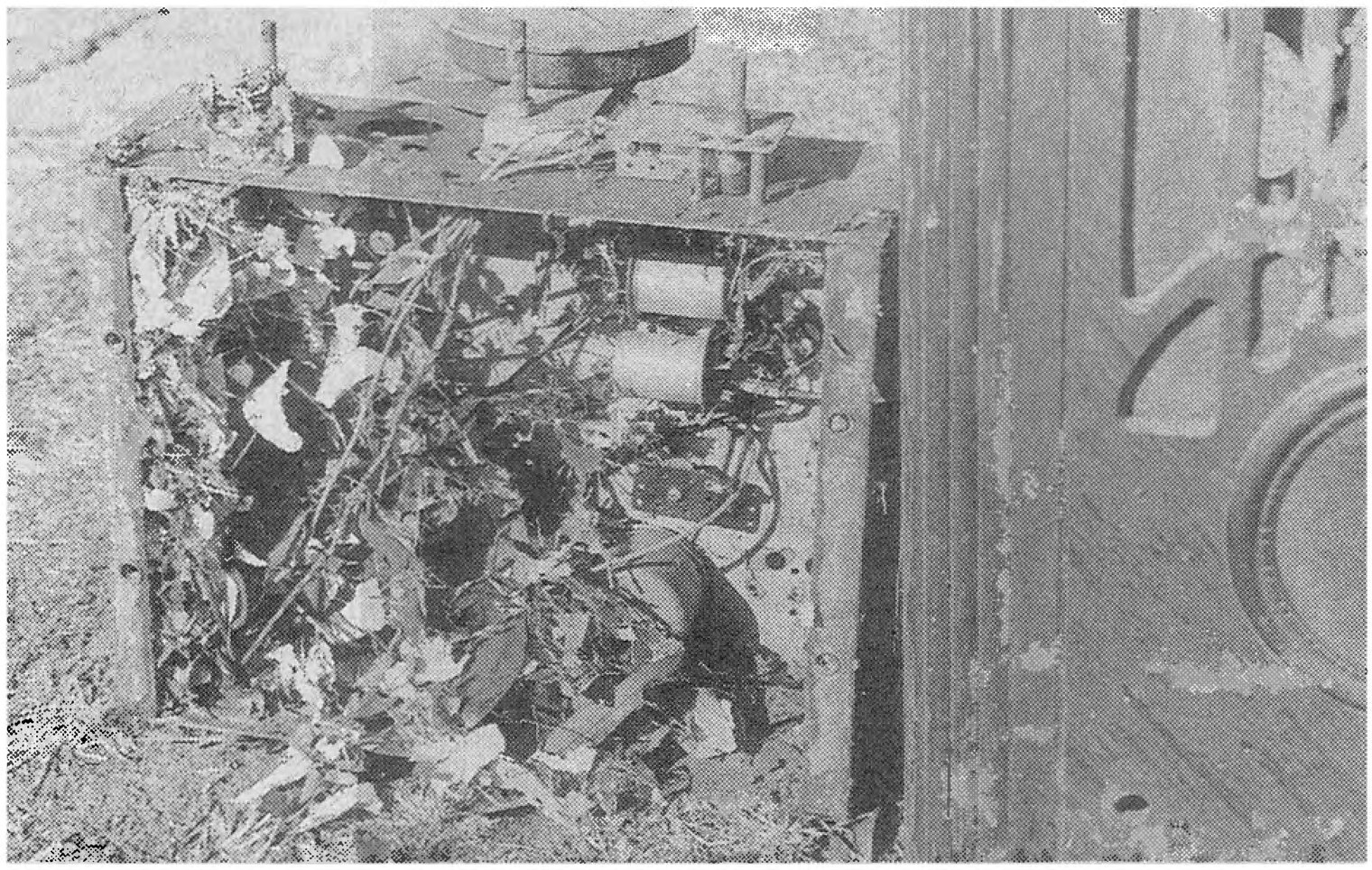


A large hole had to be cut in the cabinet of the old Radiola to gain access to a rusted nut & bolt so that the chassis could be removed. Eventually, the bolt had to be cut with a hacksaw blade to free the chassis.

The big hole

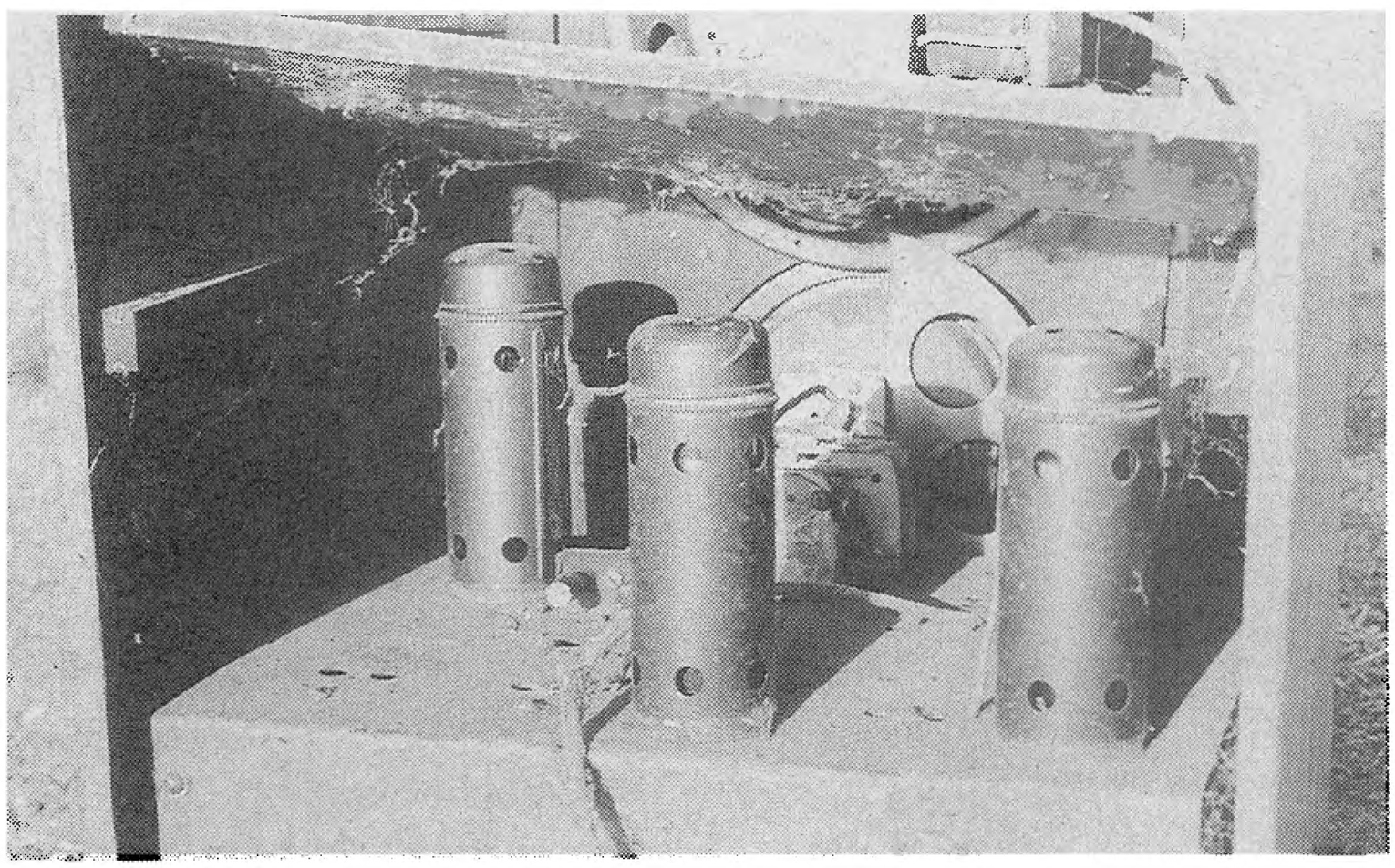
It was at this stage that I realised why there was a big hole in the bottom of the other cabinet. It hadn't been chewed by rats as I had first assumed. Instead, it had been hacked in by some distraught serviceman so that he could obtain access to a problem brass nut that turned with the bolt.

I did likewise but, despite the size of the hole and the use of a pair of locking pliers, I could not prevent the round nut from turning. Eventually,



All this garbage didn't blow in during the last storm. Mouse infestation can cause serious problems when it comes to restoring old radio receivers.

This photo shows one of the two 1935 Radiolas mentioned in the text. The chassis and knobs from this set were combined with the cabinet of the other. Both were originally battery-operated receivers.



The coils & IF transformers were mounted underneath the original chassis, leaving the top of the chassis fairly bare. The dial drive mechanism was a friction type but this was converted to cord drive for more reliable operation.

after cutting through the bolt with a hacksaw blade, the chassis was freed from its cabinet.

The original Radiola circuit is typical of the early to mid-1930s. Although the tuning capacitor is a 3-gang type, the set does not have any radio frequency (RF) amplification. The extra tuning gang is for a preselector bandpass stage, which was a fairly common arrangement for a superhet of that vintage with a 175kHz intermediate frequency. The extra tuned stage was essential to avoid double spotting, a natural characteristic of the low IF.

The valve complement of the battery-powered Radiola was as follows: 1A6, 34, 32 and 33. The 33 output valve was one I had not encountered before and while it looks like a 1D4, it is a little different. According to the valve specification manual, the 33 has twice the output; ie, 0.7W as compared to 0.35W. Wow – what power!

Replacement valves

Suitable valves for the AC conversion were next on the list. The following were used: a 6A7 converter; a 6D6 IF amplifier; a 75 detector, AGC and first audio stage; a 42 output; and an 80 rectifier. Unfortunately, this meant changing every existing socket and adding an additional socket for the rectifier.

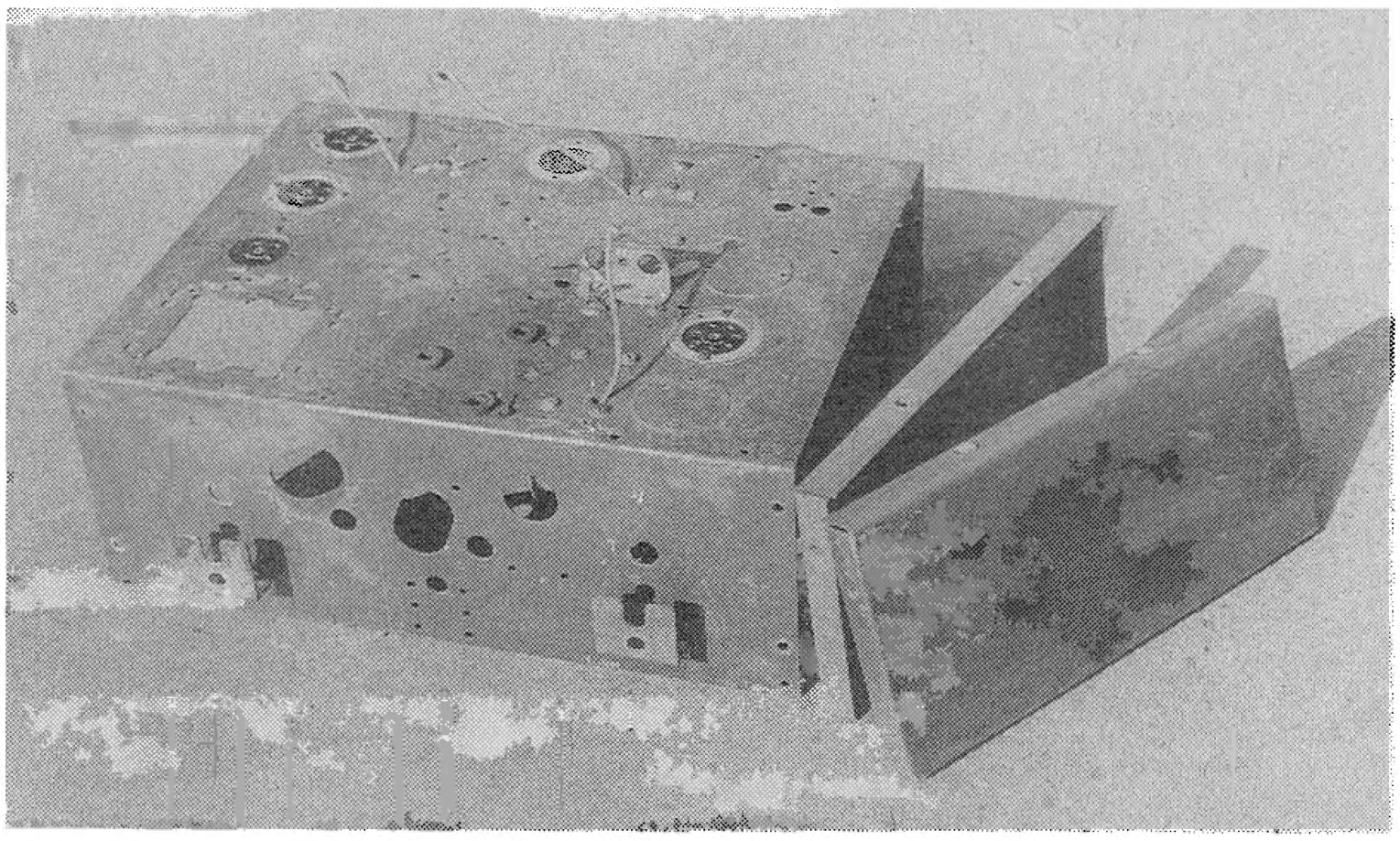
Power transformer

A power transformer was the next item to be obtained and I was sure that I had an AWA type that just might fit the holes already punched in the chassis. Unfortunately, it was different and the mounting lugs did not match the hole positions.

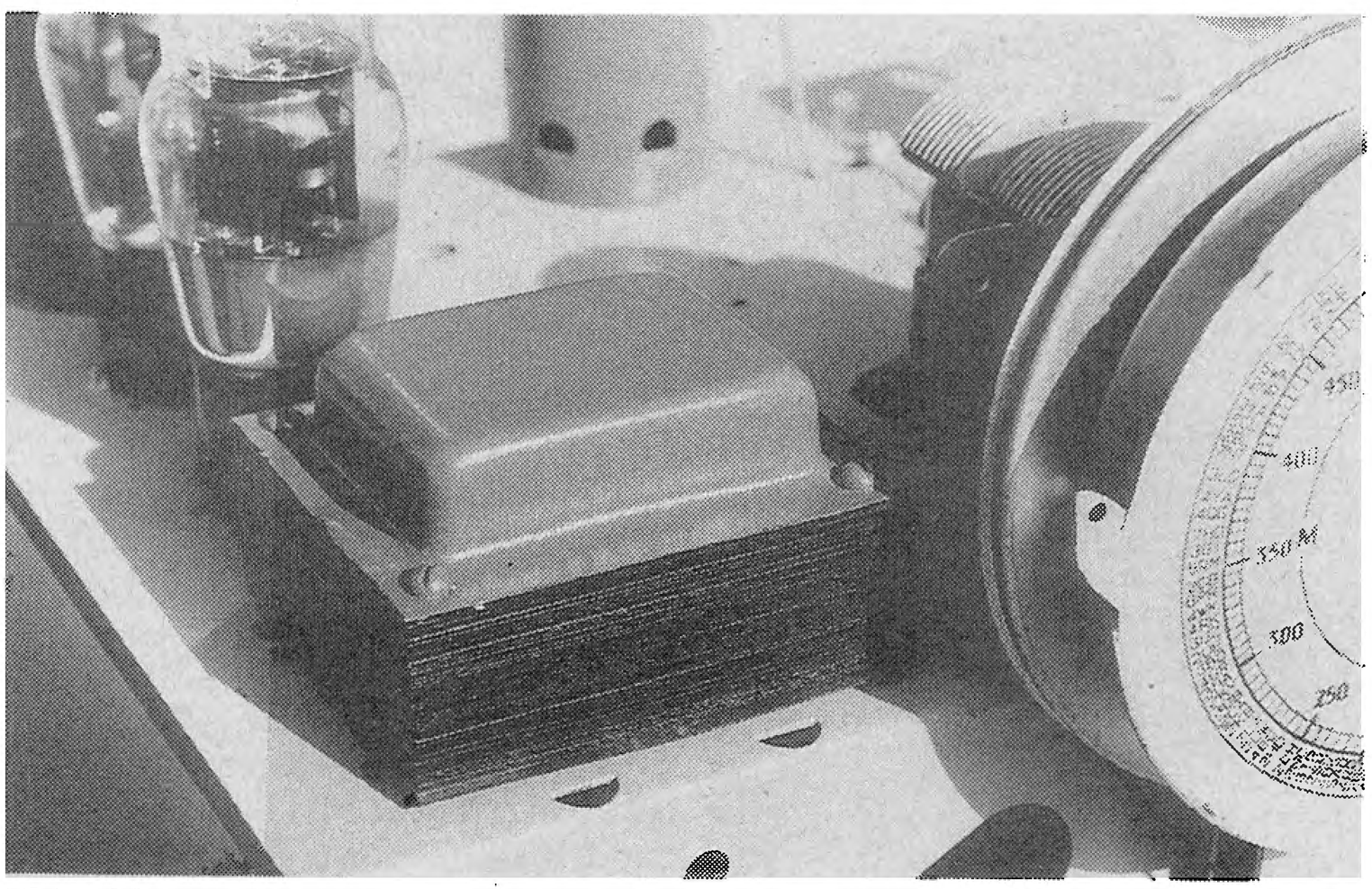
The next transformer to be considered was an old "Red Line". It had 5V and 6.3V filament windings and a 290V high-tension winding. It seemed a bit of an odd one but it would have to do. A rectangular hole was cut in the chassis to mount it and it was relatively easy to install. The 5V winding and the high-tension winding were connected to the appropriate type 80 valve socket pins.

High tension filtering consisted of a 550Ω resistor with appropriate electrolytics on either side. This produced a relatively hum-free DC supply of around 250V, under a 50mA load.

Once into the conversion, it quickly became apparent that there would be only one complete receiver at the end of the project. An open oscillator coil and IF transformer set a pattern for stripping the other set for spare parts. What's more, one of the cabinets had been previously refurbished and the



The AC conversion resulted in the chassis being almost completely stripped. Note the mounting hole for the power transformer at front left. One of the end panels is from the other chassis.



This old "Red Line" power transformer worked in well with the receiver's requirements. The 80 rectifier valve is immediately behind the transformer.

veneer had been rubbed down to paper thin.

The plan was to retain the front end of the receiver as it was. The tuner, its associated coils and the IF transformers would remain as original. The leads to the 1A6 and the 34 valve sockets were disconnected and tagged with labels – G1, G2, A, etc. That way, they would be easy to reconnect to the new valves with their different socket connections.

In the original wiring, the 1A6 pentagrid converter had no dropping resistors to supply the valve elements. The plate and screen grid voltages came straight from the B battery.

When using a 6A7 converter, grid 2 (anode grid) and grids 3 and 5 (screen) require dropping resistors from the HT rail so that they operate at the correct voltages. The old wiring cannot simply be reconnected to the new valve without these circuit modifications.

A conversion of this nature requires such additions so that the substitute valves will function properly. One must be prepared to experiment a little, though. Without a suitable circuit diagram, one plays the trial and error game and a couple of substitution boxes (resistance and capacitance) are handy in this regard. By using a substitution box, components of differing values can be switched in and out of circuit at the turn of a knob.

IF stages

The IF transformers and the IF amplifier valve were the next to be wired and this was a straightforward job. What was to follow the IF stage was quite another matter, however.

The AC version of this receiver uses a reflex circuit whereby a particular valve amplifies both radio frequency and audio frequency signals simultaneously. But no way was I going to invite trouble by converting to a reflex circuit!

I had on hand a 5-valve Airzone circuit which uses a 6Q7 as a detector, AGC and first audio stage, ahead of a 6F6 output. This circuit was followed fairly closely and was the basis for the audio stages of the conversion.

The general wiring layout underneath the chassis ended up a bit of a mess. There were connections on top of other connections, joins in the wiring and some of the components used were far from the 1935 originals. It would make any purist throw up his hands in horror, hence there is no under-chassis photograph accompanying this story.

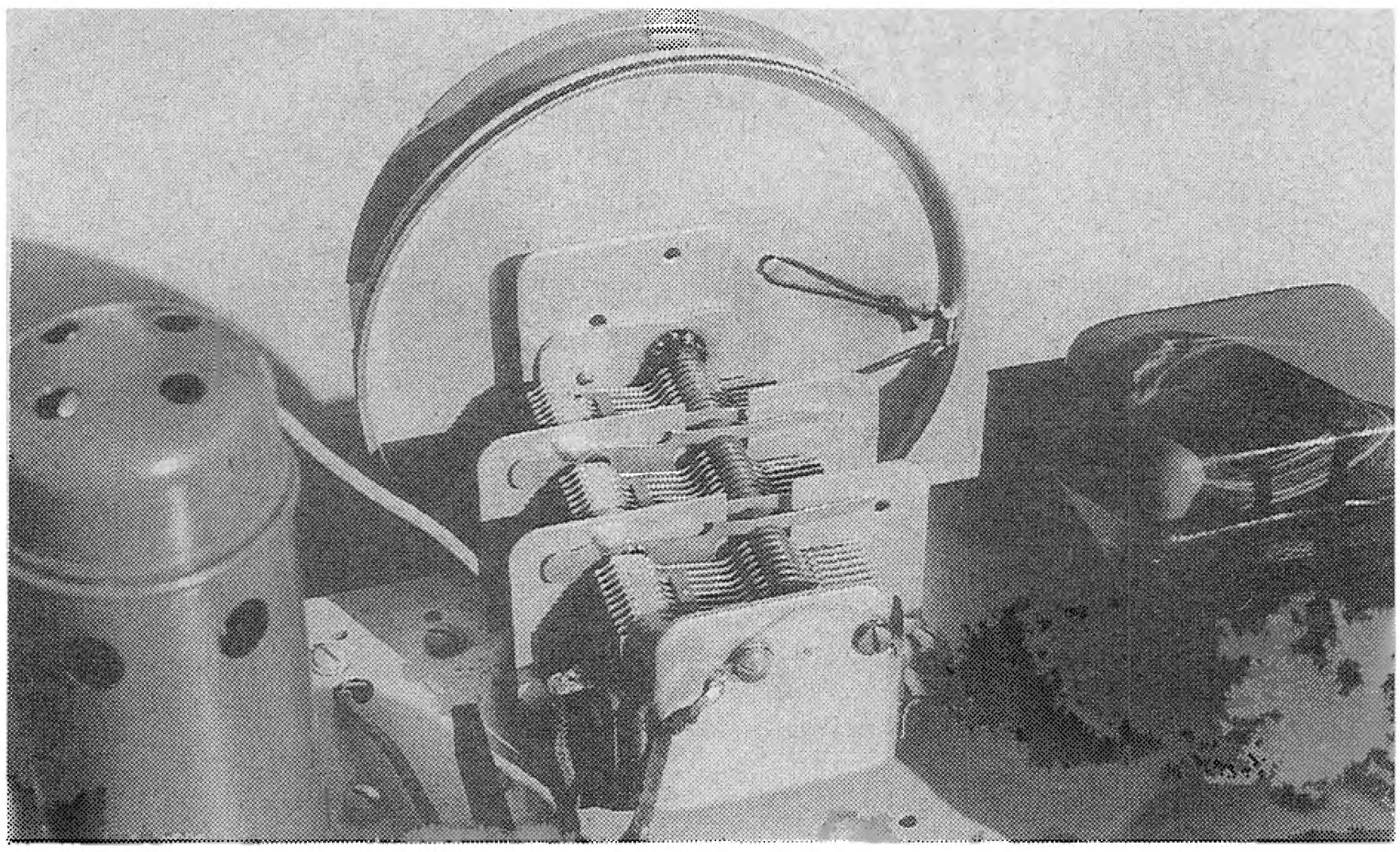
Next time, I will use a few more tag strips to make component mounting neater and more secure. One really needs to do a few of these AC conversions in order to know where best to arrange all the components.

Dial mechanism

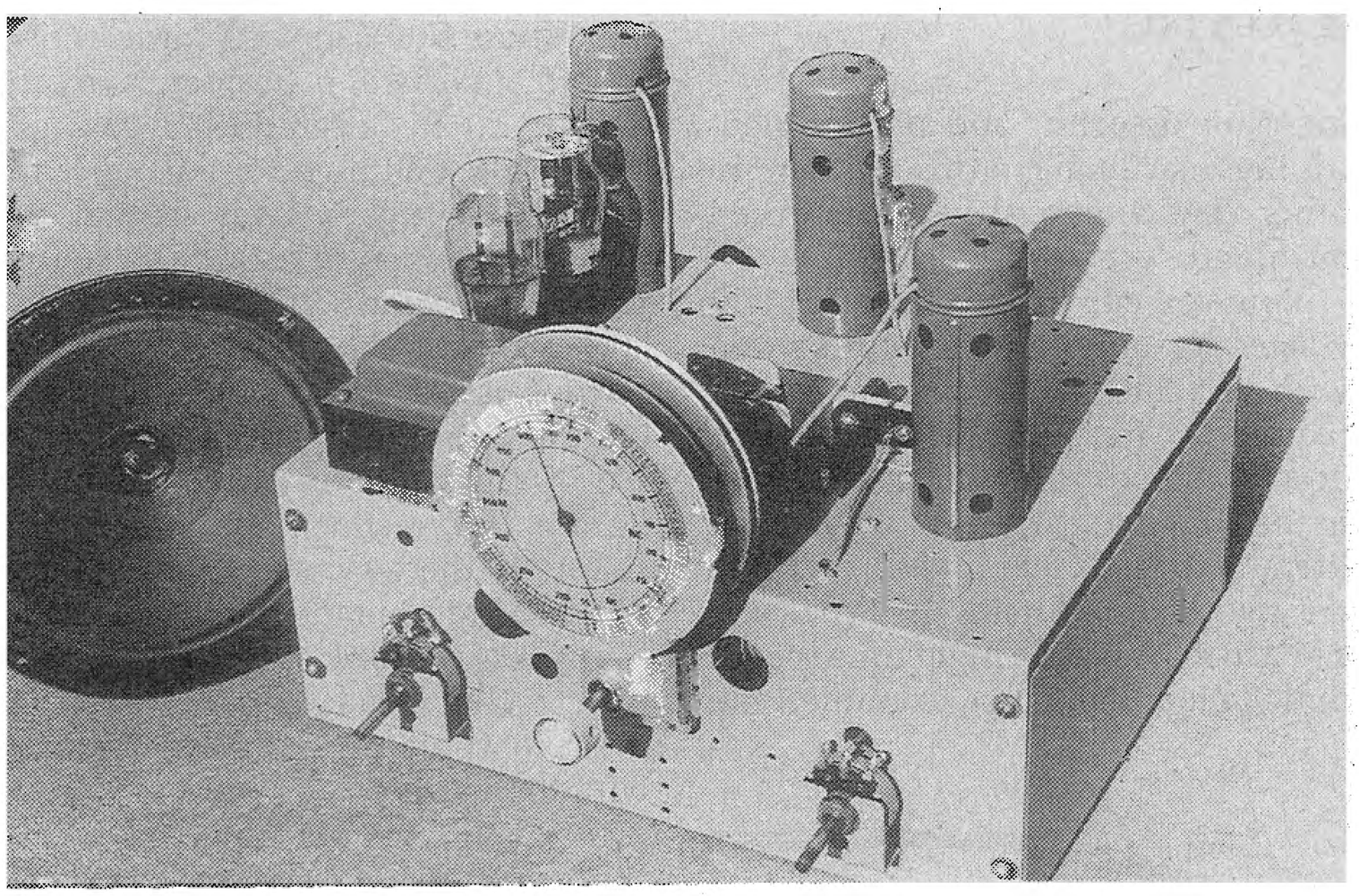
Like many other receivers from the mid 1930s, the old Radiola had a friction drive dial mechanism that was chronically lacking in friction. But although I have repaired many friction drives in the past, this particular design is not an easy one to fix.

For this reason, I tried a different approach and converted the dial mechanism to cord drive. This involved making a new control shaft and fitting a dial drum to the tuning capacitor spindle. There were a few problems (mainly not enough room for the drum) but eventually it all went together and worked OK.

When the time arrived for the big try out, it was a very exciting moment. But optimism soon turned to despair! The best the set could manage was a few squeals on some of the stronger stations. What could I expect



This rear view of the tuning capacitor shows the dial drum that was fitted in place of the original friction drive mechanism. Lack of space between the drum & the front plate of the tuning gang made the conversion difficult.



The finished battery-AC conversion – it's marvellous what a clean-up and a coat of paint can do. The speaker is an 8-inch AWA "permag" from the late 1930s. Note the depth of the chassis.

from such an outfit – part modified original and part Airzone? Time to give it a rest for a while. Tomorrow would be another day!

After tracing through the web-like mess of wiring, it transpired that I had overlooked something very important – there was no bypass capacitor on the IF amplifier's screen grid. Adding this vital component made all the difference and the receiver burst into life.

But although the conversion was actually working, there were problems with harshness and distortion. Incorrect component values were mostly to blame for this and the substitution boxes worked overtime.

The components causing most of the problems were the resistors controlling the converter valve grids, coupling capacitors in the audio stages (0.02µF seems a good all-round figure) and the plate bypass capacitor on the first audio valve. The Airzone circuit I was following used a 500pF mica bypass capacitor on the plate. This needed to be increased and a value of 3300pF really smoothed out the harshness.

When converting a battery set to AC operation, one must expect to encounter a few minor problems, and these must be tracked down and corrected. An additional resistor here and a capacitor there can make the difference between the receiver just working and working really well.

Well that's the interesting part of the project finished. The cabinet work is all that remains to be done. It should be a good cabinet to work on, due to its flat surfaces and small size, as compared to a console cabinet.

Finally, a few words of advice. Battery to AC conversion is not as straightforward as one might think. If contemplating such a task, give it plenty of thought and try to pick a receiver that's more suitable for conversion than the one I chose. If it has octal valves, it will be an advantage in that all the valve sockets will be compatible with whatever AC valves are used. Using a proven circuit is also better than making up your own as you go.

Converting a battery receiver to AC operation can be just as involved as building a receiver from scratch. Unless you are prepared for that, then leave your battery set as you found it and enjoy it for what it is. **SC**