VINTAGE RADIO

By Associate Professor Graham Parslow

Kriesler Farm Radio model 31-2

At first glance, this radio looks like the common Kriesler model 11-7. But it's actually a 31-2, which (for most of its production run) recycled the same case. This was done to save money and take advantage of its very recognisable shape; thanks to a strong advertising campaign for the 11-7. This radio is powered from a 6V lead-acid battery, and was intended for use on farms.

This Kriesler radio was made for use on a farm, operating from a single 6V battery. The first of the model 31-2 line was released in 1946 with a timber case (not Bakelite).

Anyone familiar with the popular Kriesler "breadbox" radio manufactured from 1947-1952 might suspect that the radio featured here is a model 11-7. Indeed, the bottom of the case has "model 11-7" moulded into the Bakelite, but appearances are deceiving.

The Bakelite breadbox radio was strongly promoted at the time, particularly with the phrase "triple throated". This is because three grilles act as sound sources: the honeycomb front grille and two vents in the top of the case. Catchy as the promotional line is, this conveys no acoustic advantage to the design.

Even so, many collectors regard the sound reproduced by the modestly-baffled 6-inch Rola speaker as better than most contemporaries.

This radio is best categorised as a table model. It is 400mm wide and weighs a hefty 9.7kg. The mains-powered model 11-7 weighs 10.6kg due to the added transformer.

This radio comes at the apex of the Bakelite period, before thermo-mouldable plastics displaced Bakelite through the 1950s. Manufacturing this substantial Bakelite case required expensive high-pressure moulds. The pay-back was a low unit cost when produced in large quantities.

Repurposing the model 11-7 case for a farm radio made good sense because of the economies of scale for Bakelite pressing and the bonus of the advertising associated with the case.

The model 31-2 has five octal valves and this example is firmly dated to 1950 by the date stamped on the filter choke (L3).

Circuit description

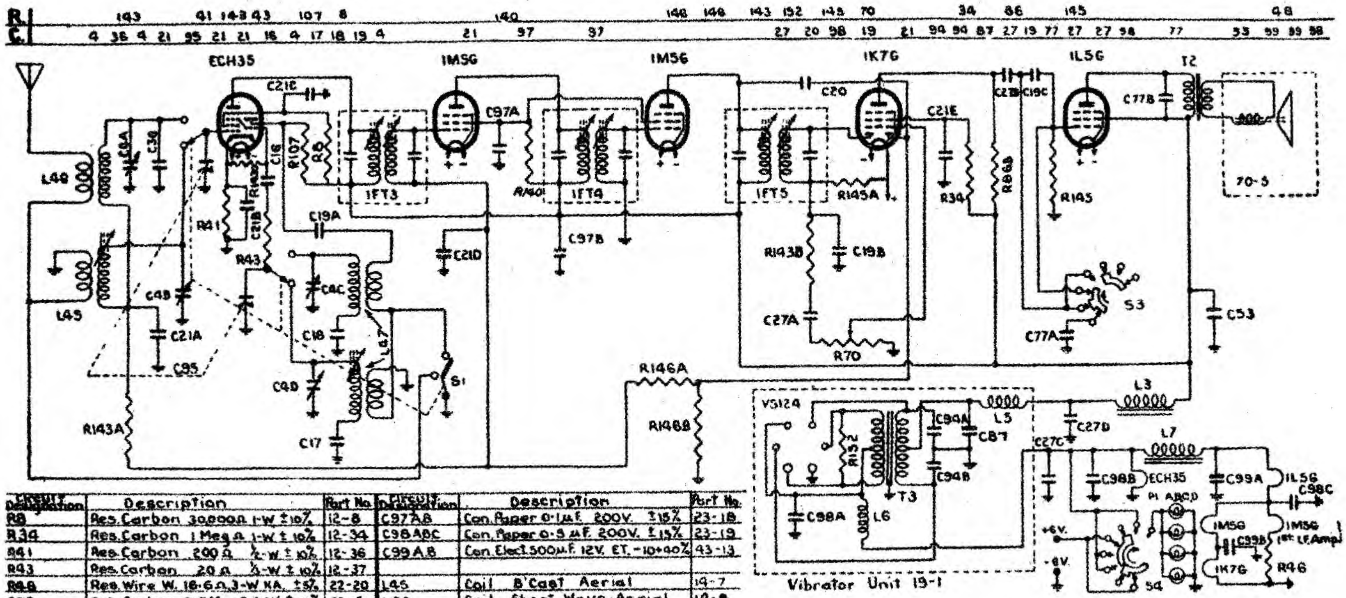
The circuit of the Kriesler model 31-2 is shown in Fig.1. It is a rather standard five-valve superhet, although it has a few interesting features that I shall now describe.

Farm radios were designed to run from various DC voltages, with 6V and 32V being the most common. Many cars of the time had 6V batteries, so maintaining and charging a 6V lead-acid battery was relatively easy.

A vibrator provides the high tension supply. Vibrators use mechanical oscillators, analogous to simple electromagnetic buzzers. Once an interrupted DC supply is created, a transformer can be used to step up the voltage as required.

The V5124 six-pin plug-in vibrator in this radio is the synchronous type, with an extra set of points that take the place of a rectifier valve. The internal circuitry of this module, along with a couple of the external components (to aid in understanding its operation) is shown in Fig.2. Both sets of contacts are mounted on the same vibrating reed, as indicated by the dashed line, and this operates at 100Hz.

Contacts "A" alternately connect each end of the primary to ground; the centre-tap is permanently connected



Circuit Designation	Description	Part No.	Circuit Designation	Description	Part No.
R8	Res. Carbon 30,000Ω 1-W ±10%	12-8	C97A.B	Con. Paper 0·1μF. 200V. ±15%	23-18
R34	Res. Carbon 1 Meg Ω 1-W ±10%	12-34	C98ABC	Con. Paper 0·5 μF. 200V. ±15%	23-19
R41	Res. Carbon 200 Ω ½-W ±10%	12-36	C99A.B	Con. Elect. 500μF. 12V. ET. -10+40%	43-13
R43	Res. Carbon 20 Ω ½-W ±10%	12-37			
R48	Res. Wire W. 16·6Ω, 3-W KA. ±5%	22-20	L45	Coil B'Cast Aerial	19-7
R70	Pot. Carbon 0·5Meg Ω 1-W ±20%	32-4	L46	Coil Short Wave Aerial	14-8
R86 B	Res. Carbon 0·25Meg Ω 1-W ±10%	12-86	L47	Coil B/C & S/W Oscillator	19-9
R107	Res. Carbon 10,000 Ω 1-W ±10%	12-107			
R143A,B,C,	Res. Carbon 50,000Ω ½-W ±10%	12-25	L3	Choke-Filter 14 Henries 60mA.	28-2
R145A,B	Res. Carbon 0·5Meg Ω ½-W ±10%	12-28	L5	Choke-RF. (H.T.) 700m.Henries 20mA	44-3
R146 A,B	Res. Carbon 1 Meg Ω ½-W ±10%	12-29	L6	Choke-RF (LT.)	44-4
R152	Res. Carbon 400 Ω 1-W ±10%	12-38	L7	Choke-Filter 35m.Henries 250mA	28-9
R140	Res. Carbon ·15Meg 1-W ±10%	12-135			
C4 ABCD	Con. Trimmer 3-20 pF	63-5	IFT3	I.F. Transformer 455 K.C	24-3
C16	Con. Mica 100pF. PT ±15%	13-28	IFT4	I.F. Transformer 455 K.C.	24-4
C17	Con. Mica 435pF. SM ±2½%	13-39	IFT5	I.F. Transformer 455 K.C.	24-5
C18	Con. Mica 0·009μF. SM ±5%	13-40			
C19ABC	Con. Mica 250 pF. PT ±15%	13-41	T3	Transformer-Vibrator	18-4
C20	Con. Mica 25 pF SM ±15%	13-42	T2	Trans. Output 15000Ω to 2·3Ω	18-3
C21ABCDE	Con. Paper 0·05μF 200V. ±15%	23-12			
C27ABCD	Con. Paper 0·01 μF 600V. ±15%	23-19	S1	Switch: W/C 2 pos. 3 pole	17-1
C36	Con. Mica 10pF. DS. ±15%	13-43	S3	Switch-Tone Con. 3 pos. 2 pole	17-3
C53	Con. Elect. 8μF. 350V. ET. -10+40%	43-7.	S4	Switch-Battery 3pos. 2 pole	17-4
C77A.B	Con. Mica 0·002 μF. PT ±15%	13-46			
C87.	Con. Elect 8μF 350V. E.E -10+40%	43-14	P1ABCD.	Pilot Light 6·3V. ·3A. M.E.S. Base	47-2
C94 A.B	Con. Paper 0·02μF 600V. ±15%	23-17			
C95	Con. Variable 2Gang	63-6			

Fig.1: the Kriesler model 31-2 circuit, showing the socket for the vibrator (V5124; its circuit is in Fig.2) and the supporting components required to step up and filter the 6V battery supply, inside the dashed box titled "Vibrator Unit 19-1". The vibrator itself is essentially a DPDT relay that self-oscillates at 100Hz. The V5124 pinout starting from the right and going clockwise is: primary, reed & can, primary, secondary, driving coil, secondary.

to the +6V battery terminal. Simultaneously, the second set of contacts at "B" alternately connects each end of the secondary to ground, rectifying the 150V which appears at its centre tap, as this keeps the two halves of the transformer in-phase.

This is equivalent to a full-wave rectifier. The polarity of the input voltage is important. Reversed polarity will cause the rectified output voltage to be negative.

In this radio, the components in the dotted-line box on the circuit diagram are in a canister mounted where a mains transformer would have been in the model 11-7. The canister is designated "Vibrator unit 19-1". The inductors and capacitors packaged with the vibrator ensure a well-filtered high-tension supply of 150V.

In 1950, many farm radios were switching to miniature valve types, yet this radio uses octal valves. It may be that Kriesler had a large stock of octal valves, so the model 31-2 circuit of 1946 remained attractive. Another motive for using octal types was that this meant that they could re-use the same punched chassis from the 11-7; by my reckoning, the chassis used in the 31-2 is identical.

The physical layout of this chassis would not scale well to a three-gang tuning capacitor. This may explain why an RF amplification stage, which would require a third capacitor gang, is not incorporated. It's a pity, as this would improve reception in remote areas.

However, there are punched holes for three IF transformers, so they were able to add another 455kHz IF amplification stage.

The front end has the external aerial switched between two aerial coils via DPDT switch S1; one for MW and the other to cover 6-18 MHz (16-50m). Matching local oscillator coils ensure that the mixer/converter valve (type ECH35) operates with a fixed 455kHz IF.

The 1K7 has two internal diodes. One acts as a detector for the output of IF transformer three (designated IFT5 on the circuit diagram). After passing through C27A (10nF) to block DC, the audio signal goes to the 1K7 grid from the wiper of the 0.5MΩ volume control. The second diode feeds a negative AGC voltage back to the ECH35 and first 1M5 via R146A (1MΩ).

Amplified audio from the anode of

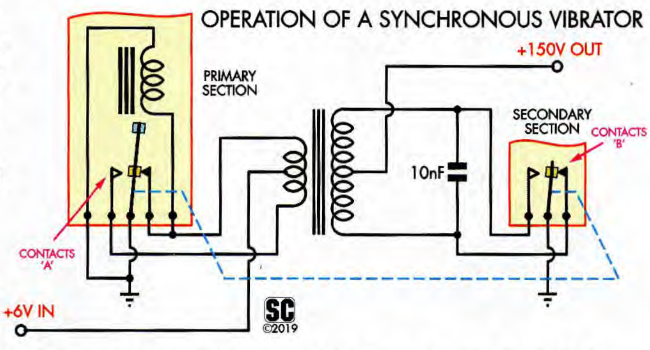
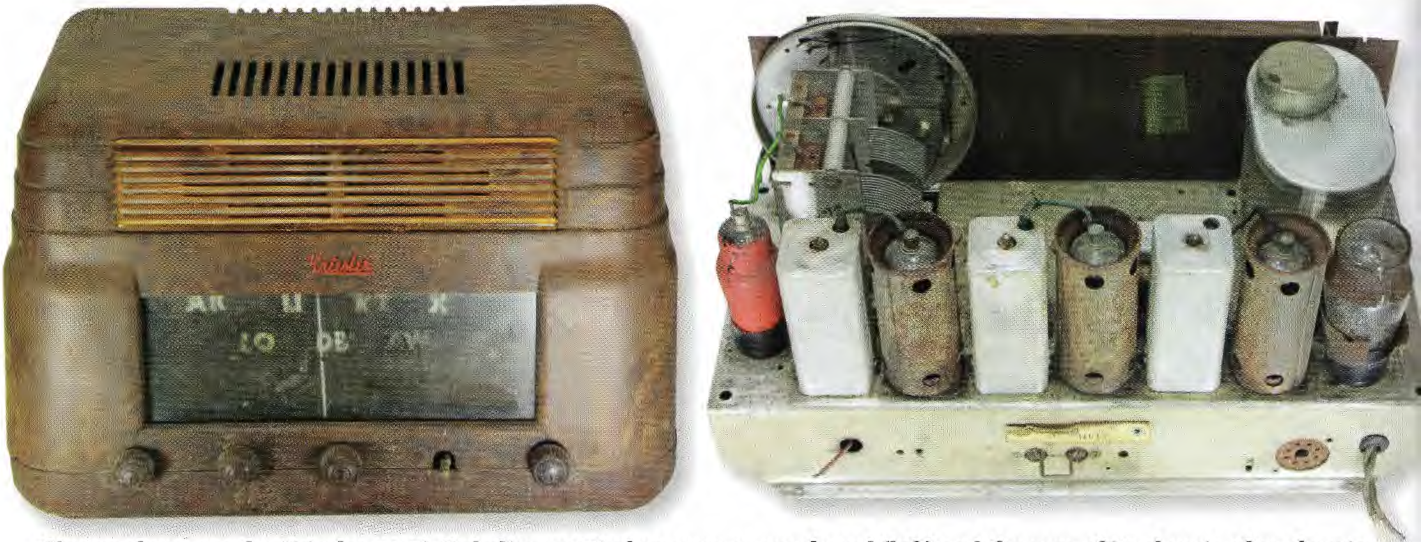


Fig.2: the internals of the vibrator unit. This diagram also includes the transformer and filter capacitor which are external (and shown in Fig.1), to aid in understanding its operation. Contacts "A" alternately ground one end of the primary, driving the coil with alternating polarities to cause oscillation. Contacts "B" alternately ground one end of the secondary, rectifying the transformer's output voltage.



Shown above are the Kriesler 31-2's Bakelite, not timber, case as purchased (left) and the rear of its chassis after cleaning (right), with the V5124 vibrator, shown at the upper right corner in the larger canister. You can clearly see the green wires connecting the top control grids of each valve to the IF transformers and tuning gang.

the 1K7 valve passes to the three-position tone control switch, S3. The three tone choices are (1) straight through after the primary coupling capacitor, (2) bass cut by switching in an extra capacitor in series and (3) top cut by adding a capacitor to Earth.

The circuitry around the 1L5 output valve is minimal. There is no negative feedback from the secondary of output transformer T2. The 1L5 is directly heated with the filament serving as the cathode. The grid bias of the 1L5 is set by the filament chain of connections between the valves. Pin 2 of the filament is at +6V and pin 7 is at +4V, giving an effective grid bias of -5V.

Radios with all directly-heated valves usually turn on and function without significant delay, much like a transistor radio. Although four of the valves are 1-series types with direct heating, this radio has a prolonged warmup period due to the ECH35 converter, which is a 6V indirectly heated valve.

Radio construction

The photo of the chassis shown above is after cleaning, but before full restoration. The vibrator canister can be seen in the upper right corner. The ECH35 (made by Philips) is easy to spot due to the metalised shield coating, painted red, that connects through octal pin 1 to Earth.

That photo also shows the first four valves with top-cap control grids connected by short lengths of wire to their signal sources. This arrangement avoids the potential injection of noise from longer hook-up wiring that would have been required if the grids were terminated via the octal base pins.

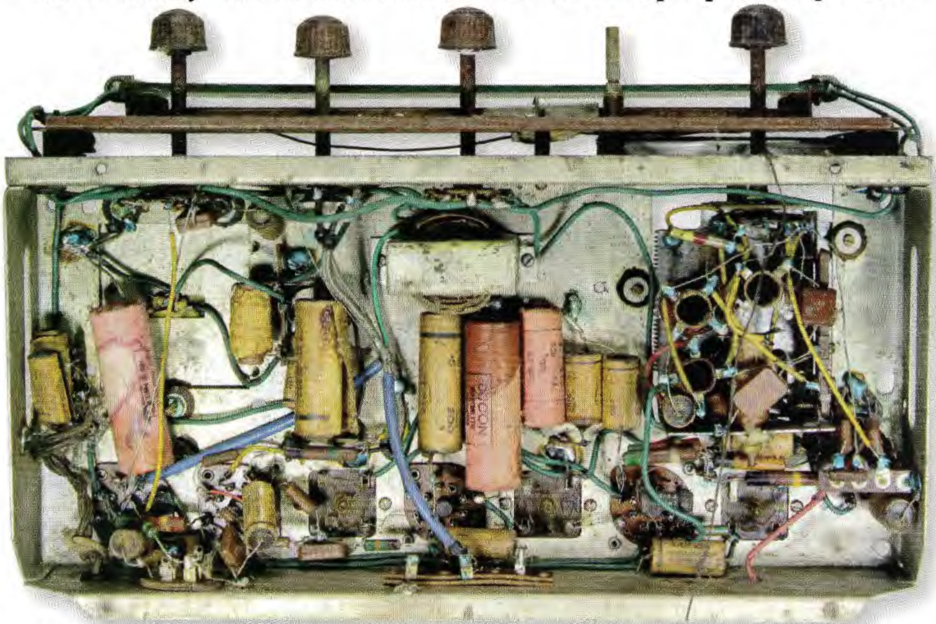
The two IF amplifier valves (type 1M5) are well shielded, and for good measure; the detector preamplifier valve (type 1K7) is also shielded.

Most comparable radios in 1950 used a miniature 3V4 valve for audio output. By contrast, the 1L5G is enormous and its internals are clearly visible. The G (glass) designation in the 1L5G valve specifies the classic envelope shape that was near-universal in the 1930s. The 1L5G valve in this set is a Philips Miniwatt made in Australia.

Few sets made after this date would have an all octal, all type-G valve lineup. The 1L5 presented with two bands of perished rubber as seen in the chassis photo after cleaning. I removed the perished rubber from the 1L5 to improve its appearance.

There is a pleasingly simple linearity to the above chassis arrangement of this radio. Unfortunately, this is not reflected under the chassis. The bulky components, notably the electrolytics and paper capacitors, were installed with little concern for easily locating specific components or making repairs (see photo at left).

The large pink electrolytics are 500µF 12VW types made by Ducon. The marks on them show that the set got wet at some point in its life.



As is the norm with these types of restorations, all electrolytic and high-voltage paper capacitors were replaced.

Restoration

This radio was previously owned

by Rob Coleman, a singular character who enjoyed recounting his times as a technician at Channel Nine in the golden years of the sixties through to the nineties. His best stories were about the behind-the-scenes crises and horse-play in the days of In Melbourne Tonight and Hey Hey, It's Saturday.

Rob was an inveterate acquirer, and this radio was part of a pile in his backyard, largely exposed to the elements. Rob served for many years on the committee of the Historical Radio Society of Australia (HRSA), so it was fitting that the HRSA assisted in the sale of his collected items after his death in 2017. But at the end of the day, no one had taken this orphan home.

Bakelite has never looked duller than on this weather-worn radio. The original dial calibration and one knob were missing and the dial string was broken. That's probably why no one else wanted it. I purchased the radio to clear the table. My tepid enthusiasm to restore it was elevated when I discovered it was not just another model 7-11.

Removing the bottom panel revealed exactly what I expected – spider webs, water marks and worm castings.

Thankfully, there proved to be no faults in the densely-packed shielded box housing the aerial and oscillator coils.

You might notice a yellow stalactite-like intrusion of wax that had melted through from the vibrator canister above. Fascinating! My conclusion was that wax had been used as a noise suppressant to muffle the 100Hz buzz of the vibrator.

Troubleshooting a dead radio

I decided to bypass the vibrator in restoration, and simply use an external 150V DC supply.

Sadly, the speaker coil was jammed hard, so I tossed it in the bin. I fitted a replacement speaker but retained the original output transformer.

The electrical components looked like they might all be serviceable. Ever the optimist, I connected bench supplies of 6V and 150V (ramped up from zero), but got nothing. There was no output from the RF stages at the volume control and injecting a signal at the 1L5 grid also produced no output.

The next step was to replace all electrolytics and high-voltage paper capacitors. Because of the smaller size of the replacements, this has the desirable effect of decluttering the underside of the chassis and making the valve pins more accessible.

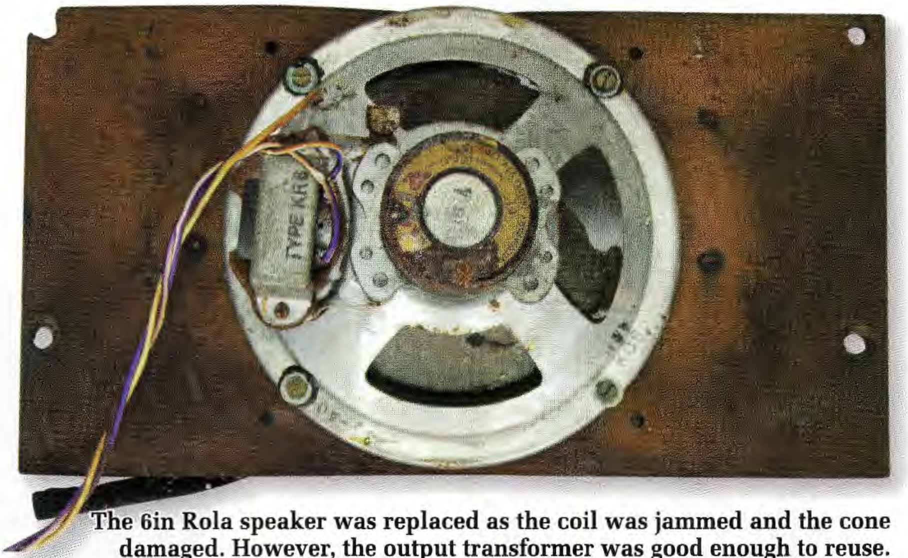
Some fruitless hours passed, with the radio remaining dead and voltages making little sense, until that 'Eureka!' moment when it all made sense.

Corrosion internal to the pin 7 socket of the 1L5 was causing erratic contact between the valve filament and the power supply. Inspection of the filament cascade of series and parallel connections in the circuit diagram will show how an imperfect connection of the 1L5 will cause other valves in the chain to lose function.

Although the 1-series of valves nominally work with 1V across their filament, they need at least 1.5V for good performance. All of the 1-series valves in this radio operate at 2V (6V ÷ 3).

Fixing the pin 7 contact did not completely fix the radio. The RF section remained dead and external audio fed in came out highly distorted. Swapping the 1L5 and replacing the output transformer did not fix this distortion.

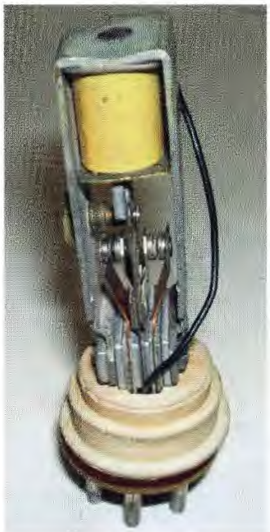
The first replacement speaker I used



The 6in Rola speaker was replaced as the coil was jammed and the cone damaged. However, the output transformer was good enough to reuse.

The internals of the Kriesler 31-2 were in a mess, with loose parts scattered around along with dirt and insects.

An advert for a Kriesler table model radio (likely the 11-7) which shared its case design with the 31-2. Source: ***Australian Women's Weekly, May 1951, Page 51*** **– https://trove.nla.gov.au/newspaper/page/4388702**



The internals of a non-synchronous V4012 vibrator. Oak vibrators were unique in that they had a secondary winding on the driving coil which is short circuited. This helps lower the Q of the coil and thus reduces sparking at the driver contact. (http://members.iinet.net.au/~cool386/msp/msp.html)

looked fine, but substituting another speaker fixed it, so obviously the first substitute was no good. I guess that goes to show that you should test replacement parts before fitting them!

Systematically working through the RF section brought me a relatively quick reward. The ECH35 stage was working fine; injecting a 455kHz signal modulated with 400Hz audio to the second 1M5 produced audible output, but there was no result when a signal was injected to the first 1M5. Finally, I found the last fault – the first 1M5 had only 1V across the filament, so it was effectively dead.

The 1M5 data sheet states that the filament current is 0.12A at 2V. Using Ohm's Law, that tells us the filament should have a resistance of 16.6Ω, precisely the value of series resistor R46 installed by Kriesler to reduce the 4V down to 2V.

Testing the valve from this radio on the bench showed 0.2A of filament current at 2V (ie, 10Ω resistance).

So I paralleled the 16.6Ω series resistor with a 22Ω resistor to restore 2V across the filament. Subsequently, I installed a new 1M5 valve meeting the original specification and then removed the 22Ω resistor.

Finishing it up

The radio now functioned perfectly. I put some parts together to create a dedicated 150V/6V DC mains power supply (shown below). When I started using this, I found that its two-core mains cord was radiating noise into the radio. I replaced it with a three-core lead with the Earth connected through to the radio, which then suppressed this EMI.

The cabinet polished up remarkably well. So, in the end, this ugly duckling became an interesting addition to my collection. SC

The custom 150V/6V DC power supply made for the Kriesler 31-2.