VINTAGE RADIO

Tasma 305 'rat radio' from 1936

By Fred Lever

Manufactured by Thorn & Smith (Tasma) in Mascot NSW, the Lawrence 305 is a superhet console radio. It was purchased in a slipshod initial condition, with missing components or oddball replacements. A full rework was needed, of course keeping to the time period.

I purchased a derelict Tasma radio chassis from eBay, shown in Fig.1. The chassis was rusted, missing parts and in sad condition. Over its life, it had acquired replacements such as the odd IF coils, but one nice original item was the Tasma dial (Fig.2). I refurbished the radio using the gang and dial, and as many of the original parts as I sensibly could.

The chassis took some sorting out, with some engineering to fit later-series front-end valves; as part of this process, I needed to fabricate bits and pieces such as coils and shield cans. I arrived at a working chassis and used a 12-inch 1960s Rola permanent magnet speaker fitted with an output transformer and a choke to replace the original electrodynamic type.

The set was then a working radio, just waiting for a cabinet to live in.

The chassis and speaker sat around for ages waiting for me to make my mind up on what cabinet I would make. I sketched some ideas based on photos of a model 305 and other similar Tasma sets. My thinking then swung around to making what someone in the 1950s or 60s might have made if they needed a second or 'shed' radio using a chassis from an old wrecked pre-war console radio.

I considered using distressed timber pieces from the scrap pile with old nail holes, warts and all, just like a "rat rod" vintage car where a modified engine and transmission are fitted to a fresh chassis but with a faded body, showing the patina of 80 years or so of use. Thus, my hotted-up Tasma 1936 model 305 chassis and speaker became a "rat radio".

I have plenty of old scrap timber pieces. Most fit the technical description of firewood, having patina in spades! I set to and made up a small console cabinet. The whole process of chassis refurbishment and cabinet construction stretched over a long period. This article picks out just a few of the essential steps in the journey.

Refurbishing the chassis

The chassis is serial number 305141, ARTS&P rego B52187. The rust had set into the horizontal surfaces with deep pits; I removed the top parts (Fig.3) and discovered some very rough metalwork. Some butcher had chiselled out the original IF cutouts to put in an odd pair of 175kHz coils, one Kingsley KIF4 and one unknown type.

Fig.1: the chassis was in an abysmal state when I received it.

Fig.2: the dial didn't look too bad (besides the discolouration from the lamp's heat at the top), but it was pretty brittle. I added a protective layer to preserve it.

Fig.3: the chassis after removing all the parts but before rust treatment.

Fig.4: with the worst of the rust gone and a coat of primer plus a thick coat of paint, it's now ready to rebuild.

I profiled and drilled the IF cutouts to accept a matched pair of 1950s 455kHz units labelled "24-7" and "24-2". I added a hole in the rear to accept a mains power cord gland. With drilling and cutting completed, I brushed off the loose rust but did not attempt to smooth the chassis out any further.

Then I masked up the parts on the chassis underneath and sprayed one coat of etch primer on the top and, before that set, one thick coat of Mission Brown enamel (Fig.4). The brown then crinkle dried, effectively hiding the pockmarked steel.

Editor's note: if you're going to paint over rust, after removing any loose rust, you should apply a 'rust converter' or a primer that does a similar job, like Rustoleum Stops Rust Rusty Metal Primer. Otherwise, it can continue to rust under the paint.

The electronic parts

I stripped the electronic parts out from under the chassis. The set had a preassembled tagboard (Fig.5) with most of the IF and AF resistors and capacitors on it. The capacitors were hidden underneath (see Fig.6). A wiring loom was laced around the edge of the chassis with all the supplies like the heater wiring, transformer connections and B+ feeder wires. Some bodgy plastic wires had been added at some point.

I pulled the plastic-coated wiring out and used some spare period-correct cloth-covered wire to make up the missing connections. The electronic parts were in terrible condition, with many of the capacitors leaky and the resistors way out of tolerance.

I replaced all the out-of-spec parts with 600V-rated polyester capacitors and 1W resistors from Jaycar, except for the back-bias and voltage droppers, where I used either PW3 or 2W types. I did not need to put any parts under the tag strip. That allowed the strip to be re-mounted lower in the chassis.

The chassis had a four-pin socket for a type 80 rectifier, with the rest being 6-pin valves. I kept the type 80 rectifier and type 42 output valves as in the original but put a fresh set of octal sockets for the first three valves: a 6K8 mixer, 6U7-G IF amplifier and a 6B6-G demodulator/AF amplifier. The last two needed external shields. I fabricated these from soup cans – see Fig.17 for the result.

Fig.7 shows the original circuit

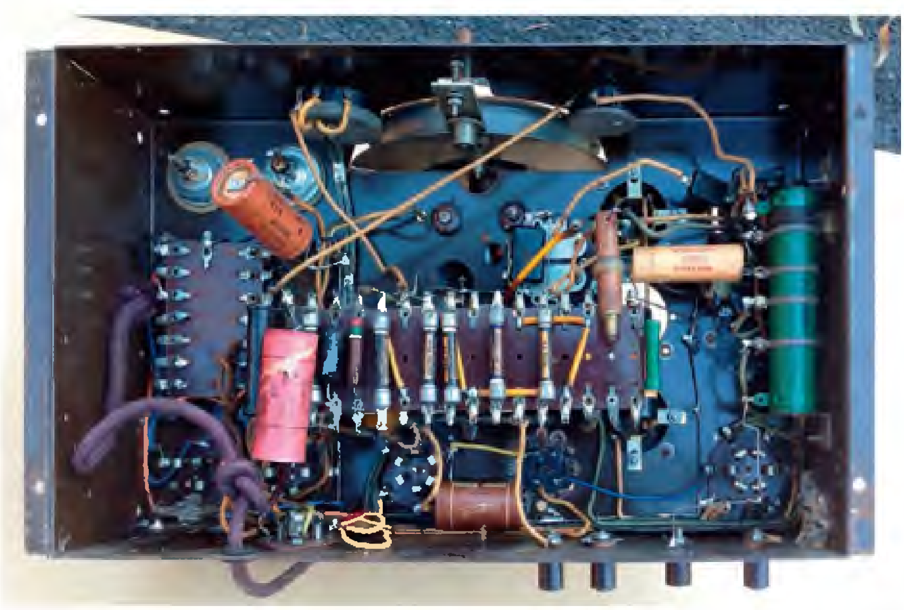

Fig.5: the original wiring; note the tag strips on which pretty much all the smaller parts were mounted.

Fig.6: some of the larger capacitors were hiding under the central tag strip.

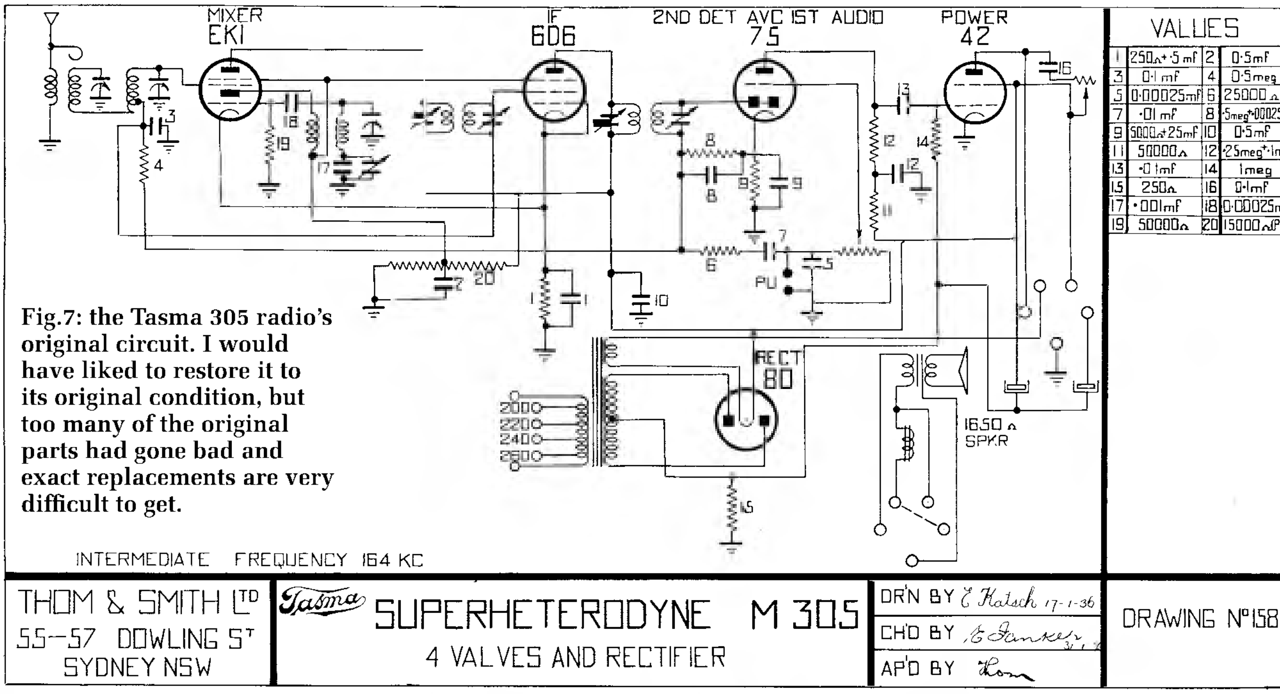

Fig.7: the Tasma 305 radio's original circuit. I would have liked to restore it to its original condition, but too many of the original parts had gone bad and exact replacements are very difficult to get.

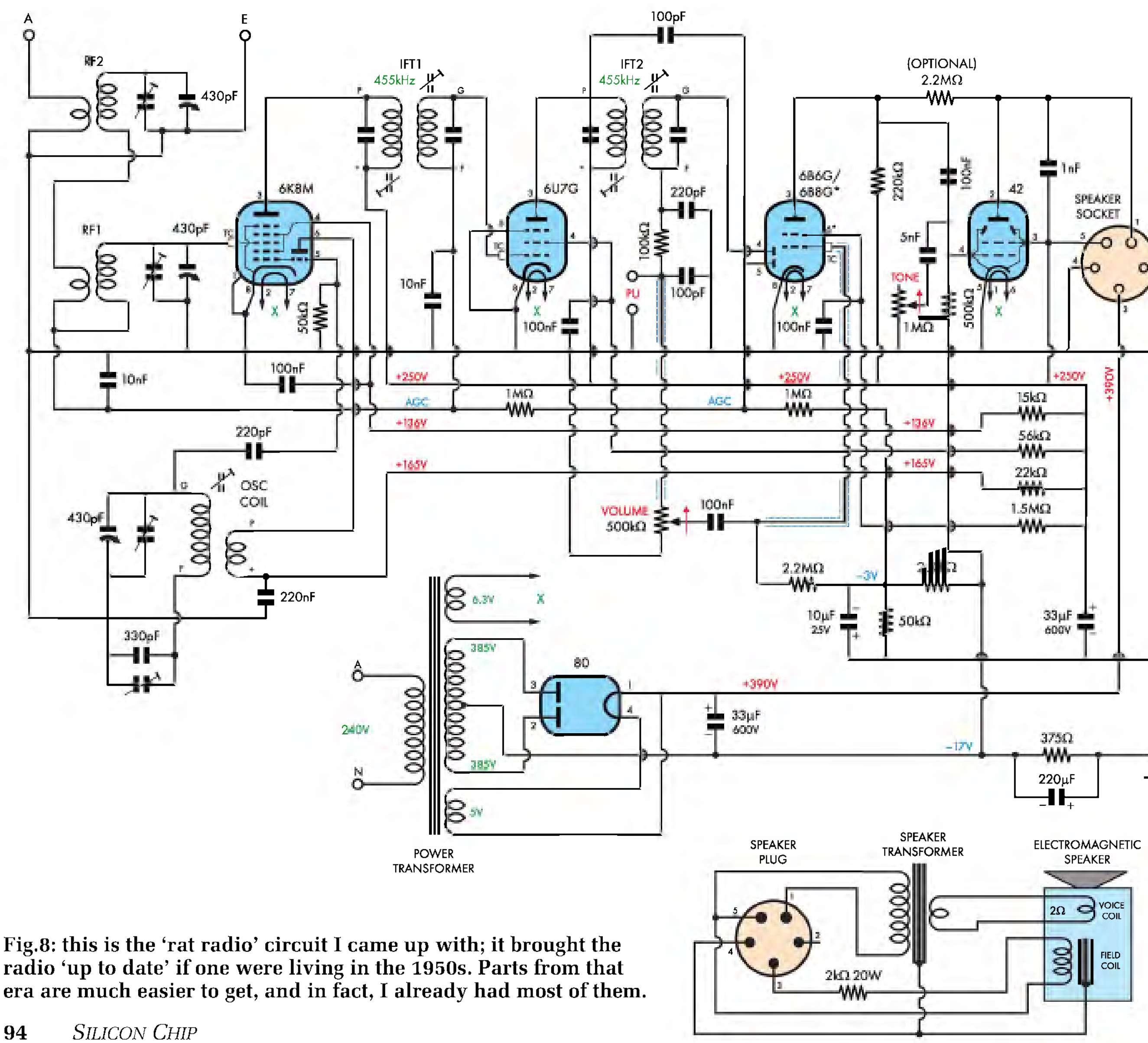

Fig.8: this is the 'rat radio' circuit I came up with; it brought the radio 'up to date' if one were living in the 1950s. Parts from that era are much easier to get, and in fact, I already had most of them.

Fig.9: the two matched 1950s era intermediate frequency transformers I found in my collection that turned out to work pretty well.

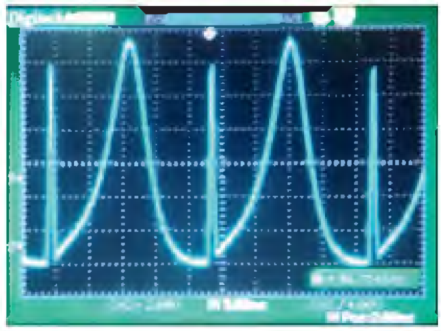

Fig.11: the wobbulator output with the known-good, pre-tuned IFT I used as a reference. I aimed for a similar result when testing the 'new' IFTs.

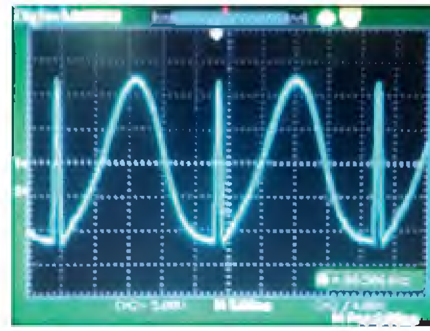

Fig.12: the output using the 24-7 IFT after adjustment. It's more or less as expected.

while Fig.8 is my final 'rat' circuit. The arrangement is a typical superhet of the 1950s with AGC control on the first two valves, to keep a level output for a range of radio stations. The front end covers the broadcast band only, and has a curious twin-coil and three-gang tuning arrangement, like a poor man's RF stage without a valve.

I considered inserting an extra 6U7 RF amplifier and making it a six-valve set but I refrained from that and just wired the 6K8 and 6U7 as usual. The 6B6 has a set of diodes that perform the detection and AGC functions.

I tested and have marked the circuit with the optional part to use a higher-gain 6B8 pentode. However, the lower-gain 6B6 triode was sufficient to drive the type 42 to full output. If a 6B8 were used, the plate-to-plate feedback resistor from the type 42 would help reduce the excess gain and calm any instability.

Testing the IFTs

The intermediate frequency transformers (IFTs) are marked 24-7 455KC and 24-2 455KC (Fig.9). I wanted to test them first, so I dug out the valve IF 'wobbulator' tester I made years ago. This tester puts the IFTs into a valve environment with full HT and circuit capacitances. It quickly shows if a coil is not working correctly.

The tester is virtually a radio, with a local oscillator using a 6SN7 tunable oscillator, a 6SK7 IF stage and a 6H6 detector. Breakout terminals at appropriate circuit points are provided to clip on meters or an oscilloscope. A 6AC7 sawtooth sweep generator and a 6AC7 reactance valve 'wobbles' the 6SN7 tank oscillator to sweep the frequency and thus provide a response curve.

The sweeper was still connected to an IFT I had been tested previously, so I powered the unit up and verified that it still worked. With a bit of fiddling, I obtained a sweep response shown in Fig.11. I set the centre frequency at 455kHz and peaked the cores to get maximum response.

I then swapped in the transformer marked 24-7 and got the result shown in Fig.12 with the slugs adjusted to their centre peaks. That looked good, so I tried the other unit and got the trace shown in Fig.13, then peaked it and got a pretty good-looking response, shown in Fig.14.

When testing unknown IF coils, one puzzle is to determine which is the primary and secondary, and which ends go the plate, B+, grid, and bias. This can make a difference in some cases as the coils may not be symmetrical and will work inefficiently if connected backwards. On most old IFTs, one can find a flying grid top cap wire, allowing you to determine the grid and secondary connections.

I connect the transformers both ways around to my tester to see if the response was better one way or another. With these IFTs, there was a definite 'good' and 'bad' way of connecting the primary, so that defined the P and B+ pins for me.

The oscillator coil

While I had sorted out the IFTs and was using the original air-cored aerial coils, I had no oscillator coil. I needed a coil to produce the tuning range, say 500-1700kHz, plus 455kHz, meaning it needed to operate from about 950kHz to 2150kHz.

Delving into the coil box, I found an air-cored coil the same diameter as the Tasma tuning coils. This was a single three-terminal tapped coil meant for

Fig.13: the output with the 24-2 IFT before adjustment.

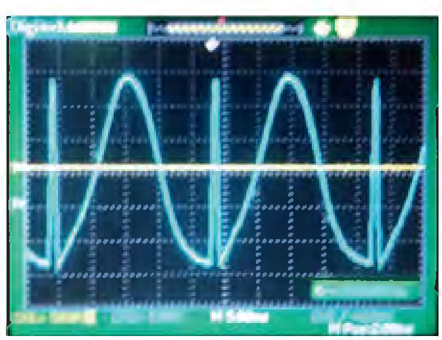

Fig.14: the output with the 24-2 IFT after adjustment. Also fine.

Fig.15: the oscillator coil after I'd finished making my modifications to suit the set under construction.

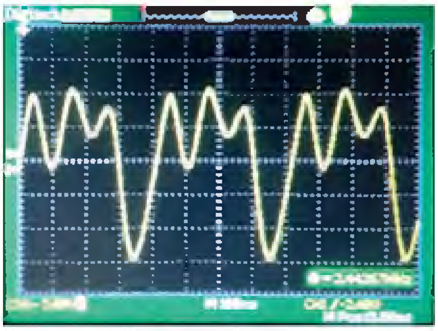

Fig.16: the oscillator plate waveform looks bizarre and mangled.

Fig.17: ahh, much better. The top of the chassis after restoration. The soup can shields are a 'love it or hate it' affair. I happen to think they look pretty decent.

a different type of oscillator circuit. I unwound turns from the main winding and then drilled an extra hole in the former to make the coil a four-terminal unit, suitable for the 6K8 frequency changer.

I reduced the turns until it measured 1.4mH, the inductance I have used in previous 455kHz superhet builds (see Fig.15).

I hooked it up to a tuning gang on the bench and checked the frequency range with a fixed and variable padder capacitor. The best way of testing a coil is to put it in the same electrical surroundings as it would be in the set. I wired up a 6SN7 triode to the gang and coil to form an oscillator and checked the result.

Depending on the gang trimmer and padder settings, I could get frequencies from 900kHz to 2400kHz, which was close enough to try. I also cut up a scrap Philips IF aluminium shield can in the lathe to suit and tested with the coil inside that; the can's presence alters the coil's inductance.

I added a ferrite core so I can vary the inductance a bit in the chassis. That gave me three things to tweak: the core, the padder and the gang trimmer. I fitted the cut-down can with threaded feet pinched from another can to hold it to the chassis.

The coil worked a treat. The oscillator plate wave is a bit mangled (Fig.16), something there is a bit non-linear! However, the tuned tank wave, the one that matters, was clean with regular amplitude all over the tuning range.

Odds and ends

There was a broken mains voltage selector switch on the rear of the chassis. I removed that and fitted the three-core mains lead and gland. That allowed me to provide a solid Earth wire connection to the chassis. I cleaned the dial (shown in Fig.2) by drilling out the rivets, taking it apart and treating each part separately.

The celluloid front piece has a dark blemish at the top from lamp heat, and the painting inside was in a fragile condition. The lettering would flake off if touched. I left the blemish as a 'beauty spot' and sprayed some clear fixative over the surface. Some white paint spruced up the inside of the metal casing.

I fashioned a vintage-looking pointer from a piece of alloy sheet and tapped the spindle so I could use a tiny BA-size screw to hold the pointer on. I cleaned or re-painted other parts to freshen them up.

The final circuit

My final circuit is not all that different from the original. My IF transformers are 455kHz, differing from the original 164kHz, hence the need for a new oscillator coil.

There were some challenges in making the tuning, oscillator and IF coils track in harmony and getting the call sign markings on the dial to match roughly where the stations were. But it was nothing that a spot of trimmer, core and padder setting tweaks could not handle.

I did not use the wire-wound "Candohm" voltage divider resistor shown as item 20 in Fig.7 (and visible in Fig.5) as the end of that was burnt out. I simply used individual dropping resistors to provide the various screen and oscillator voltages needed. Using the smaller modern parts simplified the look of the under-chassis and gave better access to the valve sockets, as shown in Fig.18.

The old electrolytic cans with most of the original transfers still intact looked great. I bolted the dead cans back on the chassis with the decal surfaces sealed with clear spray and fitted some modern replacements on a tag strip mounted onto the ends.

The speaker choke

The speaker was originally an electrodynamic type where the magnet-exciting coil was also the smoothing choke for the HT supply, having a DC resistance of 1650Ω. I had an old Rola 2Ω 12in type 12O permanent magnet speaker spare, so I bolted it to a plywood off-cut, as shown in Fig.19.

I had a 30H choke with 22Ω resistance to replace the function of the magnetising coil. After experimentation, I finished with a 2kΩ 30W wirewound resistor connected in series with this choke. That combination gave me a 250V DC HT with minimal ripple in the working chassis. Then I

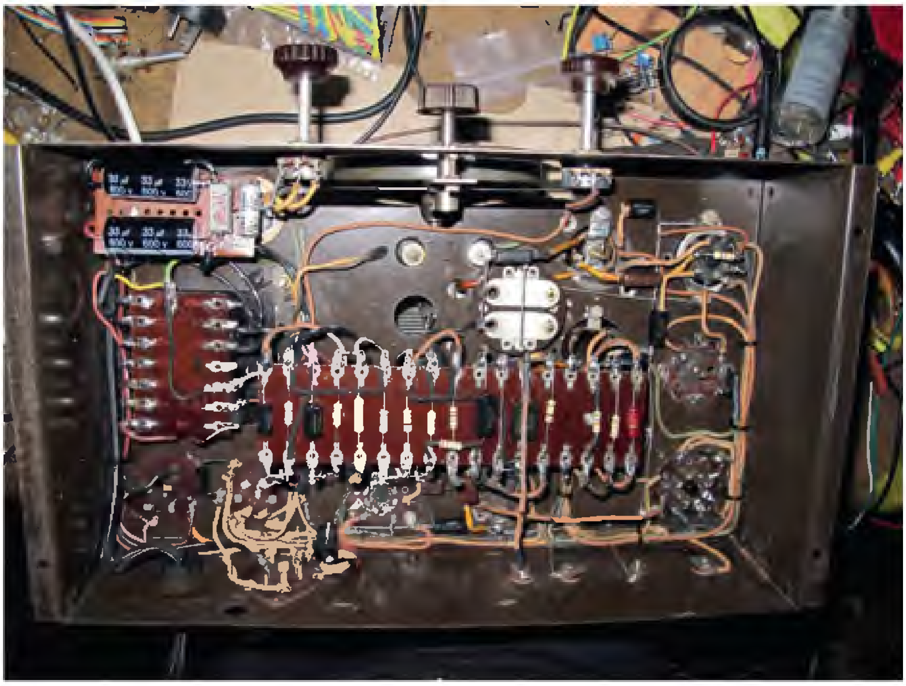

Fig.18: the bottom of the chassis after restoration. The smaller modern components make it look much neater, and it's also considerably easier to work on, especially as there are no more capacitors hidden under the central tag strip.

Fig.19: the Rola 12O loudspeaker I selected for the radio.

rewound a 30VA power transformer to work as an output transformer and fitted both to the panel (Fig.20).

The output transformer

With a 2Ω coil impedance, it's best to keep the transformer adjacent to the speaker so the connecting leads are short. I needed a pretty 'lazy' transformer for 5W audio with plenty of iron, a secondary delivering about 3V and a turns ratio to reflect 7kΩ load to the type 42 plate. I used a Jaycar MM2150 (30VA) with a 60Ω mains primary and a tapped secondary of 6, 9, 12 and 15V.

The primary inductance is 5H, and it uses an interleaved lamination stack. The primary handles at least 30mA of DC plate current, and this will add permanently to the iron magnetisation, so I wanted to air gap the stack. The secondary was wound with just the right size wire for a 2A speaker coil current rating (3V at 4W) and had plenty of taps to play with.

The primary was the problem; its turn count was not high enough to give a reasonable inductance with the air gap, and it was also too low to get a ratio to reflect 7kΩ from 2Ω. The solution was to strip the primary and see how many more turns of a smaller wire I could put back on. I have some eight thou (0.2mm) diameter enamelled wire rated at 80mA, so I used that.

I managed to cram 2150 turns into the former, about twice the original number. With 230V AC applied, that gave me 1.6V, 3.4V, 5.1V and 8.6V at the output. I used the 3.4V tap, a ratio of about 70:1. The reflected impedance would be 9.8kΩ ($70^2 \times 2\Omega$), a tad high for a type 42 valve. I restacked the laminations and now had a primary with 200Ω resistance and 6.1H inductance.

Fig.21 shows the primary coil bobbin with a dreaded thermal fuse and

Fig.20: the rear of the speaker showing how I mounted the output transformer I made by modifying a mains transformer, plus the filter choke and series resistor for the HT supply (replacing the field coil of the original electrodynamic speaker).

Fig.21. I removed the thermal fuse from the transformer while modifying it as it will no longer be a mains transformer.

Fig.22: the modified transformer after reassembly. Note the red tape providing the 'air gap' in the core to prevent saturation from the unavoidable direct current flow.

Fig.23: the Bakelite speaker plug I fabricated from a discarded valve base and a scrap dome.

Fig.24: the simple cradle I made to hold the chassis. It's strong and fits the chassis nicely.

original winding, both of which were removed. I taped the core "I" pieces together with red insulating tape that defined the size of the air gap (Fig.22). I wired the speaker assembly to the chassis using a discarded valve base as a 5-pin plug. A scrap Bakelite dome fitted neatly into the valve base, so I glued that in (Fig.23).

Making the cabinet

For a starting point, I made up a flat bar cradle for the chassis to sit on and bolt to, shown in Fig.24. This cradle sits at an angle in the chassis, sloping backwards so that the dial is tilted more on an eye-line (see Fig.25).

I cut up two five-ply sheets to form the sides, 914mm high and 254mm deep. The cradle sits between these, far enough from the floor to leave room for the speaker plate (Fig.26). This bit of guesswork caused trouble as the dial wound up not being in the centre of the space it occupied and ruined the theory of 'proportions in design' when viewed from the front! The set should have been further up.

Oh well, this was just another challenge to solve later. Then it was a matter of putting enough timber into the structure to make a frame that would take the weight of the set (Fig.27). That structure is the bones of the set and functional as-is. The set could be considered finished at that point, but it looked a bit bare!

A hint to amateurs like me for using timber to build cabinets: build the structure on a level, flat workbench. Shim the bench legs using a bubble level on the top. My bench is a slab of 25mm chipboard sheet sitting on trestles, level to bubble all ways. The sheet itself is flat to about 1mm. Your right-angle square and bubble level are your best friends in keeping the assembly square as you build!

I like to get the corner foot weights as even as possible, so the set sits naturally square on the floor. This basic assembly was a bit back-heavy, mainly from the weight of the power transformer. I also put the speaker transformers at the bottom to get the mass as low down as possible. It is preferable to have the set back heavy for safety, so if wobbled, it favours falling toward the wall.

All of the interior beams are good

Fig.25: you can see how the chassis cradle sits at an angle so that the dial appears straight-on when you look down at it.

Fig.26: I mounted the chassis just high enough so that the speaker board would fit below it. This turned out to be a mistake – I could easily have mounted it higher, but I didn't think of it at the time! By the time I realised this, it was too late...

Fig.27: I added bracing to the frame so it would not fall apart if moved with the chassis inside.

structural timber. The outside timbers are in various stages of aging with random wastage, splits and nail holes.

eBay provided a genuine period round Bakelite dial bezel to frame the dial scale plate hole. I dressed the frame, trying not to have too much of a boxy look by adding some curves here and there.

There was a problem resolving the look of the top of the set with the side shoulders merging with the dial panel sloping back. I used a piece of quad to roll the front to the top, and a skirting board with a rolled edge for the side plates. Then it was a matter of profiling bits of ply to fit around the top and shoulders and glue the whole thing together.

While the glue was drying at the top, I attacked the speaker grille design and made a frame from tomato stakes with the three vertical bars and two sidebars, shown in Fig.28. That gives the speaker some protection and a frame to tack a rectangle of brownish speaker cloth on the inside. I made the frame a push-fit between the shoulders.

I trimmed the rough ply edges on the cabinet with a saw, then sanded them smooth. The inside of the cabinet received a spray job top to bottom with matte black paint, along with the speaker grille. Then I brushed the outside of the cabinet and the grille with clear varnish. Three coats of varnish were enough to seal all the rough bits up and highlight the wood grain, nail holes and all the blemishes.

Control knobs

The set needed three control knobs. These could have been the typical Bakelite types, but while walking down the kitchen aisle at Bunnings, I saw all sorts of cabinet doorknobs. I randomly chose some faceted ball-shaped items and, in my innocence, imagined they were plastic. That would be easy to chuck in the lathe and re-profile to look like radio knobs. Unfortunately, they were glass!

I never have much luck machining glass in my lathe, so I left them ball-shaped, drilled the alloy bases to ¼in to suit the pot shafts, machined the bases to cylinders, then cross-drilled and tapped them for grub screws. Those I made by cutting the heads off 5/32in screws and slotting them with a hacksaw. The resulting knobs (Fig.29) look a bit odd on the set (Fig.30), but you have to try these things.

Fig.28: I added some profiled pieces of timber at the top to resolve the shape. You can also clearly see the frame I made from the speaker grille in this shot.

Fig.29: the original Bunnings (left) and modified (right) knobs. The modified knobs were made using a lathe to better suit a 1950s style.

Fig.30: this shows how the knobs look mounted below the original dial. This isn't quite what I was going for, but I think they turned out OK.

Fig.31: a close-up of the finished chassis mounted in the cabinet.

Fig.32: the rear view of the completed 'rat radio'. I'm pleased with how tidy it is.

Fig.33: I solved the blank space by adding a badge. Once again, it didn't turn out quite the way I intended, but it still looks reasonable.

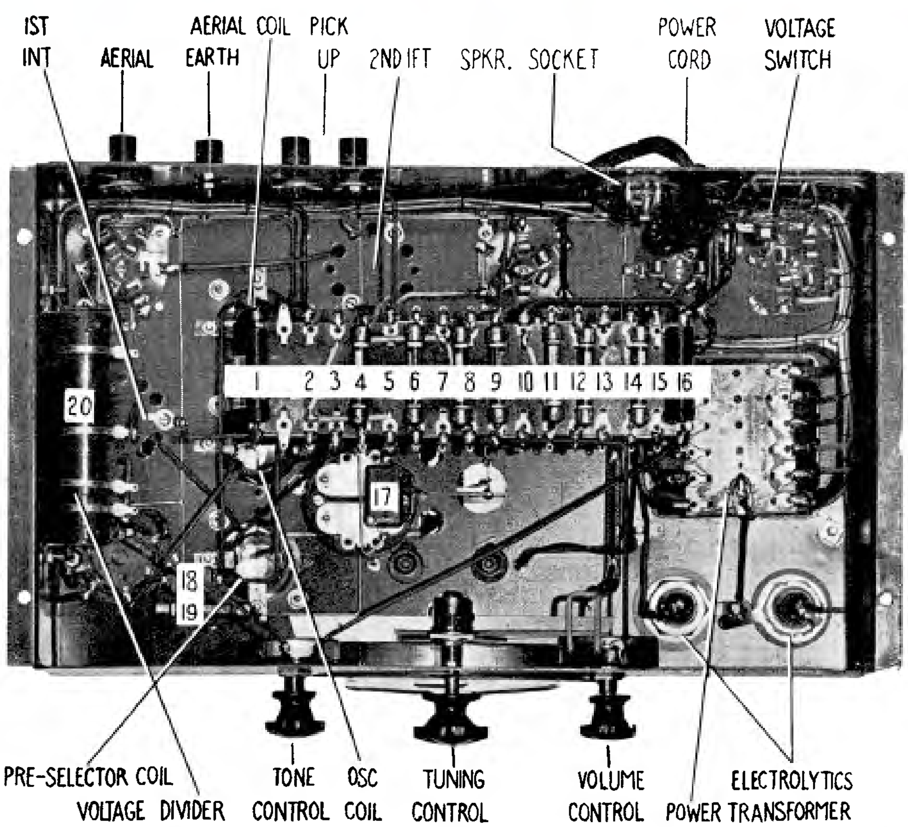

Fig.34: this diagram, taken from the service manual, is used in conjunction with the original circuit diagram. It labels the points of interest on the underside of the Tasma 305 chassis, with the numbers relating to the those shown in Fig.7.

Finishing it

I do not mind rough textures and chunks missing out of surfaces and even odd colours, but I do mind bad proportions. The open area above the dial was just wrong. It needed some optical filling to 'centre' the dial bezel. Concocting a winged "Tasma" logo from ply scrap and mounting this to split the distance between the bezel and the cabinet top achieved that – see Fig.33.

The detail of the logo was a disaster. I had a bright script style "TASMA" centre icon in yellow to match the front panel. When I varnished the surface, the varnish leached the yellow ink out and faded the icon almost to nothing. You win some and you lose some! *[It looks like a purposefully 'distressed' detail – Editor]*

Another detail that I could have done better is that the chassis bolts to the baseboard using Whitworth set screws and wing nuts.

The set has that mellow 40s sound and needs an external antenna wire to pick up any stations. Job done! I decided the project had finally arrived at the destination as a 'rat radio'. Beauty is in the eye of the beholder! SC