

Renovating an RCA Model 20

In last month's column we looked at the model 20, RCA's first conventional TRF receiver, which was sold between November 1925 and the end of 1927. Although it was a relatively expensive model, more than 135,000 were produced and today it is well represented in collections. This month we have some restoration hints for the 20 and similar receivers.

The set I selected for the subject of this month's column is one of the 'single-colour black' models, and when found, it was in a fairly disreputable state. Unfortunately, the cabinet needed more than cosmetic treatment. The lid was distorted and the veneer had long open splits in several places.

Flat-topped radios have always, it seems, been irresistible to owners of pot plants, with the result that years of watering mishaps often do irreparable damage. I suspect that this set was a classic example. Even the layer of veneer on the inside of the lid was damaged, although

fortunately the labels and instruction card remained in good condition.

To compound the problem, the cabinet had been given the all-too-common treatment of a coating of varnish, probably in the vain hope that it would 'freshen up' the appearance. Of course it didn't, but instead now provided real difficulties in restoring the original finish. As the lid would have to be renewed anyway, it seemed that although removal of the original polish should always be a last resort, the most practical approach in this case would be to strip the finish from the panels and sides.

Dismantling

The first step was to withdraw the internals by undoing four screws on the underside of the cabinet, allowing the chassis frame complete with the control panels to be slid out. The removal of eight wood screws released the sloping panel covering the tuning and regeneration controls. The badge and escutcheons were removed and the tiny screws carefully stowed away. Replacements are hard to find!

Component removal from the small vertical panel was more involved. Undoing the machine screws through their dial plates freed the vernier tuning capacitors. Their knobs were removed and their connecting leads were unsoldered from the main tuning capacitors. Similarly, the volume and battery setting controls were released, but as their knobs are moulded onto the shafts, the wiper arms were disconnected. As there seemed to be no way to remove the jacks from the panel, these were disconnected from their leads and masked during spraying.

Next the lid and its length of piano hinge, lid stay and labels were removed. To assist in positioning them on a new lid, a template was made by cutting a piece of paper to size and rubbing the indentations with a pencil, in the same manner as a coin rubbing. A firm of fine furniture restorers successfully made a replacement lid.

Removal of the old finish was simply a matter of very careful scraping, mostly with a wide chisel held vertically. As the interior and back were in good condition, the finish was retained. Difficult spots, especially the routed patterns, were treated with paint stripper. Finally, after some minor damage was repaired the surfaces were prepared by sanding with 220 grit garnet paper, wrapped round a cork sanding block.

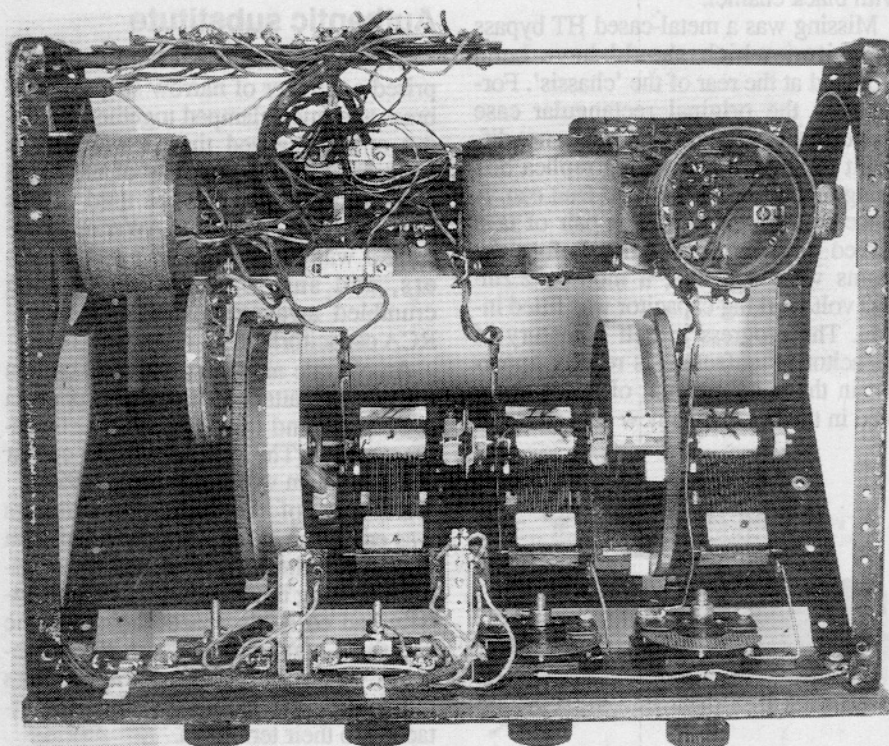


Fig.1: An underneath view of the RCA 20 chassis, before removal of the front panels. Between the detector coil at top left and the RF stage coil are the audio transformer mounts. The RF verniers and filament rheostats are at the bottom.

VINTAGE RADIO

Black wooden radio cabinets were finished in two ways. Although some were coated with black lacquer, many like the RCA 20 were stained and then sprayed with clear nitrocellulose lacquer.

A couple of coats of black spirit stain on the exterior provided sufficient colour. The inside of the new lid was given a coat of mahogany stain. Before spraying, the inside and back, which did not require refinishing, were protected with paper and masking tape. Then a couple of coats of clear lacquer were applied with a spray gun.

Brass polishing

The final job before reassembling the cabinet was polishing the brass escutcheons and dial plates. They too had been coated with varnish, and to avoid any possibility of scratching during its removal, they were given a coat of paint stripper and put in a plastic bag to prevent evaporation. Once the varnish had softened, the metalwork was given a scrubbing with soap and a nail brush before being polished with Brasso and a soft cloth.

The trick with polishing escutcheons is to not be too thorough. Completely burnished surfaces do not look right on old equipment, and indeed were often not so originally. A good rule is to concentrate on the high spots and larger flat surfaces, leaving recessed portions shaded.

After thoroughly removing residual polish, a light coat of clear lacquer was applied from an aerosol container.

Internal inspection

With the cabinet renovated, the condition of the internal components was thoroughly checked. In common with the great majority of receivers of this vintage, the audio transformers had long been replaced, in this case with miniature general purpose types that looked very clearly unoriginal.

Fortunately, one of the original transformers, although open circuited, was still with the set, and by advertising in a vintage radio magazine, a second RCA unit was located. Both were rewound to the original specifications. These are: primary 3000 turns 44 swg (0.08mm); secondary 12,000 turns 44 swg (0.08mm); core size 1/2" square; and window 1" x 5/8".

A problem frequently encountered in restoration is identification of alterations and missing components. Vintage radio societies are often good sources of data, especially of major brands, and members

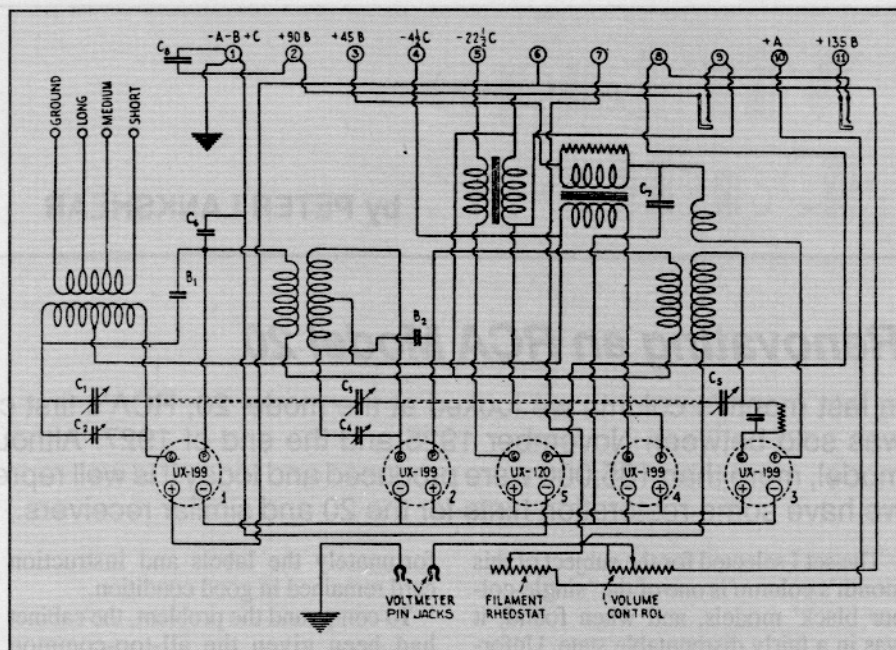


Fig.2: The 'continuity diagram' for the RCA 20 is based on the physical layout, and is useful for tracing the wiring.

will often help with advice and information. In this instance, I was fortunate in having a copy of the original service data and access to a couple of model 20's owned by local collectors.

Immediately apparent were some rust spots on the frame, which were treated with 'rust killer' solution and touched up with black enamel.

Missing was a metal-cased HT bypass capacitor, which should have been mounted at the rear of the 'chassis'. Fortunately the original rectangular case was ordinary tinfoil, and it was not difficult to make a convincing replica box using metal from a flattened fruit can. A piece of fibre fitted with a pair of tags served as a terminal strip. Before the seams were soldered, a modern 2.2uF 200 volt working capacitor was fitted inside. The progress in half a century of capacitor manufacture is readily apparent in the small amount of space occupied in the box by the new capacitor. An

application of black enamel from an aerosol can finished the job.

The detector grid leak and capacitor had been replaced by modern components, and although they were out of sight under the valve shelf, I decided to replace them with some components that would be rather more appropriate.

Authentic substitute

Originally, the capacitor had comprised a number of narrow strips of thin brass and mica clamped together. Studying one, I realised that it was almost identical with the internals of the black composition-covered types used at one time by AWA. A 250pF AWA mica capacitor was squeezed with a pair of pliers, and sure enough the coating crumbled away to reveal a 'genuine' RCA capacitor!

An old one megohm, one watt carbon resistor was attached, the pair dipped in red enamel and I had a very realistic replacement. (The RMA resistor colour coding system was not in use in 1925).

Refitting of the audio transformers was easy. The cases were provided with lugs to bolt them together, and the original mounting brackets, which coincidentally had correctly spaced holes for the substitute transformers, were still in position. With the rewound transformers remounted, the loomed wiring was attached to their terminals.

A new battery cable was needed. An essential part of every battery powered receiver, these were made from coloured textile insulated wire with an overall

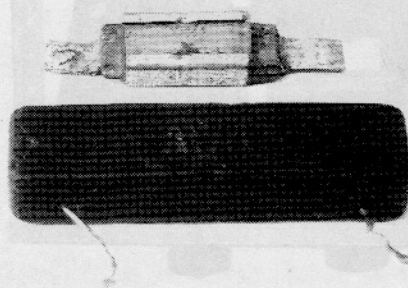


Fig.3: The internals of an old AWA mica capacitor are virtually identical with the early RCA construction.

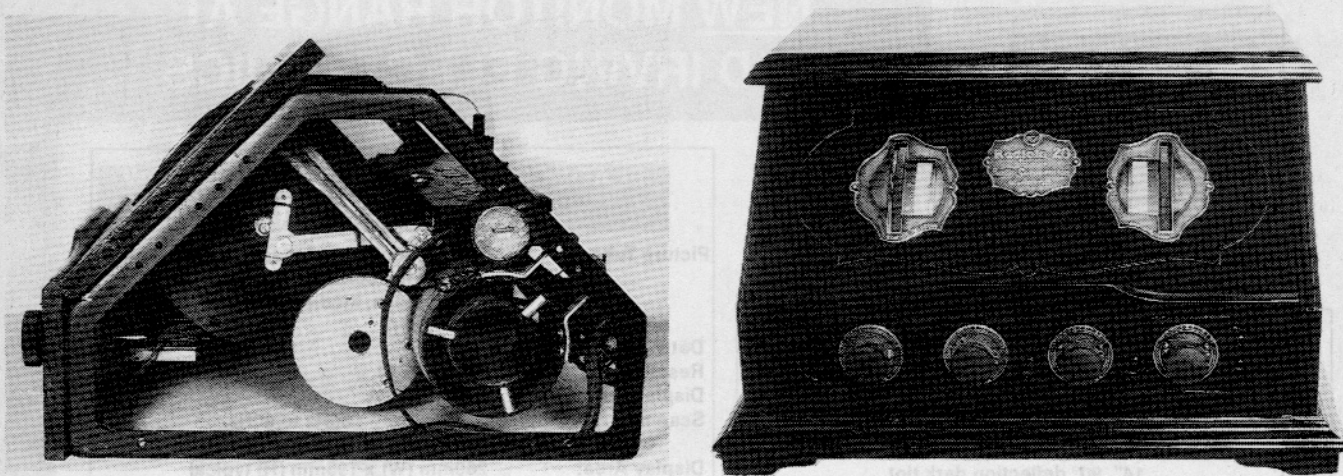


Fig.4 (left): Another view of the RCA 20's unusual construction. At the lower centre is the moveable regeneration coil, with its cranked arm connected to the 'amplification' thumbwheel. Fig.5 (right): Reassembled and with its new lid, the RCA 20 is operational and ready for display.

braided cotton covering. Fortunately, this type of cable is available from specialist suppliers and a two-yard length was obtained and connected. The cotton covering was cut back at each end and protected from fraying by whipping for an inch or so with waxed linen thread.

Substitute valves

Type 199 valves were first in production about 70 years ago and are now scarce, although good used replacements are available at about A\$25 each. Obviously, for initial testing at least, it would be prudent to use some valves that are a little less expensive.

UX-based general purpose triodes with similar filament current ratings will operate satisfactorily in a model 20. A practical choice is the more readily available 2.0 volt type 30, which although having a 40% greater amplification factor than the 199, has similar bias requirements. Similarly, the type 31 is a plug-in replacement for the 120. Of course, the filament voltage should be reduced from 3.3 to a maximum of 2.0.

When using type 30 valves, reducing the detector HT voltage may give a smoother regeneration control. Other suitable valves are the Philips A409 in place of the 199 and the B405 replacing the 120.

With a set of type 30 and 31 valves in the sockets of my receiver, a horn speaker was plugged into the speaker jack. As reversed connections to a horn speaker will reduce the strength of the magnets, a check was made that the positive speaker lead was connected to the jack sleeve. An outside aerial and a good earth were connected. Unlike later practice, the earth terminal in an RCA 20 is

not connected internally but must be connected separately.

The battery eliminator described in *EA* for March 1990, and also in my book *Discovering Vintage Radio* is ideal for this type of receiver. With the eliminator connected and the filament and bias voltages adjusted, the receiver was switched on. It worked, but the RF stages were unstable. It was clear that re-neutralisation would be necessary.

Neutralising

Triode tuned RF amplifiers are inherently unstable due to the internal grid-plate capacitance, and various methods were used to stabilise them. Series grid resistors were popular, but the best method was *neutralisation* as used in the RCA model 20. In effect a bridge circuit is arranged, so that the feedback via the grid-plate capacitance is balanced by an out-of-phase signal fed back to the grid via a small adjustable capacitor.

Although detuning and decreasing the filament voltage may help stabilise the RF amplifier stages in receivers of this type, correct neutralisation is essential for full performance. There are no short cuts, and hit and miss methods will not work. In any event, the basic method is simple enough. With a cold valve in the socket of the stage being balanced, the neutralising capacitor is adjusted to give *minimum* output.

The receiver was carefully tuned to a strong mid-band signal, with the regeneration control set well back. Then a dummy valve was prepared. The time-honoured instruction was to saw off a filament pin of a good valve! No one would do that today, but the same effect can be achieved by temporarily covering

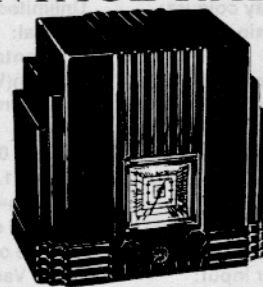
one filament pin with thin cellulose tape, so it is insulated.

With the dummy valve in the first RF socket, there was still some output from the speaker. The neutralising capacitors, similar to the more familiar mica trimmer, are mounted on the rear of the valve shelf. With a non-metallic screwdriver, the end capacitor was adjusted for minimum output. This adjustment is quite sharp and positive — a real 'null'.

The same procedure was then repeated with the second RF stage, using the other neutralising capacitor.

Now the receiver was stable and its performance much improved. All that remained was to fit it back into its case, producing the fine restored set shown in the photo of Fig.5. ♦

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