Restoring An R1155
Part 2

This month Chas. Miller finds the r.f. amplifier inoperative and modifies the output stage.

Whilst the decoupling capacitors were being replaced it was noticed that an extra small capacitor had been soldered between the switches handling the antenna and mixer grid tuning coils. This immediately aroused suspicions that the r.f. amplifier had not been functioning and had been by-passed. It is a curious thing, but the majority of R1155s I have repaired have exhibited this syndrome: invariably it is due to C38 having gone almost dead short and burning out R42, thus removing the anode voltage of the r.f. amplifier V3. R42 is mounted on a small tag panel on the left side of the coil can when viewed from the rear. In this set, evidently made by E.K. Cole Ltd, the resistors used were the type having the carbon element enclosed in a ceramic tube with the ends sealed by cement. It is possible for the carbon to disintegrate completely in these during severe overloading without undue discolouration of the tube, thus deceiving the unwary engineer. Other contractors, e.g. Philips and Mullard, used the ordinary painted carbon resistors which display unmistakable signs of overloading. On the other hand, this Ekco-built set was at least wired with durable rubber insulation on the cables. Some of the contractors' wiring had rubber of such poor quality that it soon hardened and became so brittle that the slightest touch causes it to crumble away; sets with this kind of insulation require virtually complete re-wiring, as many have found to their cost!

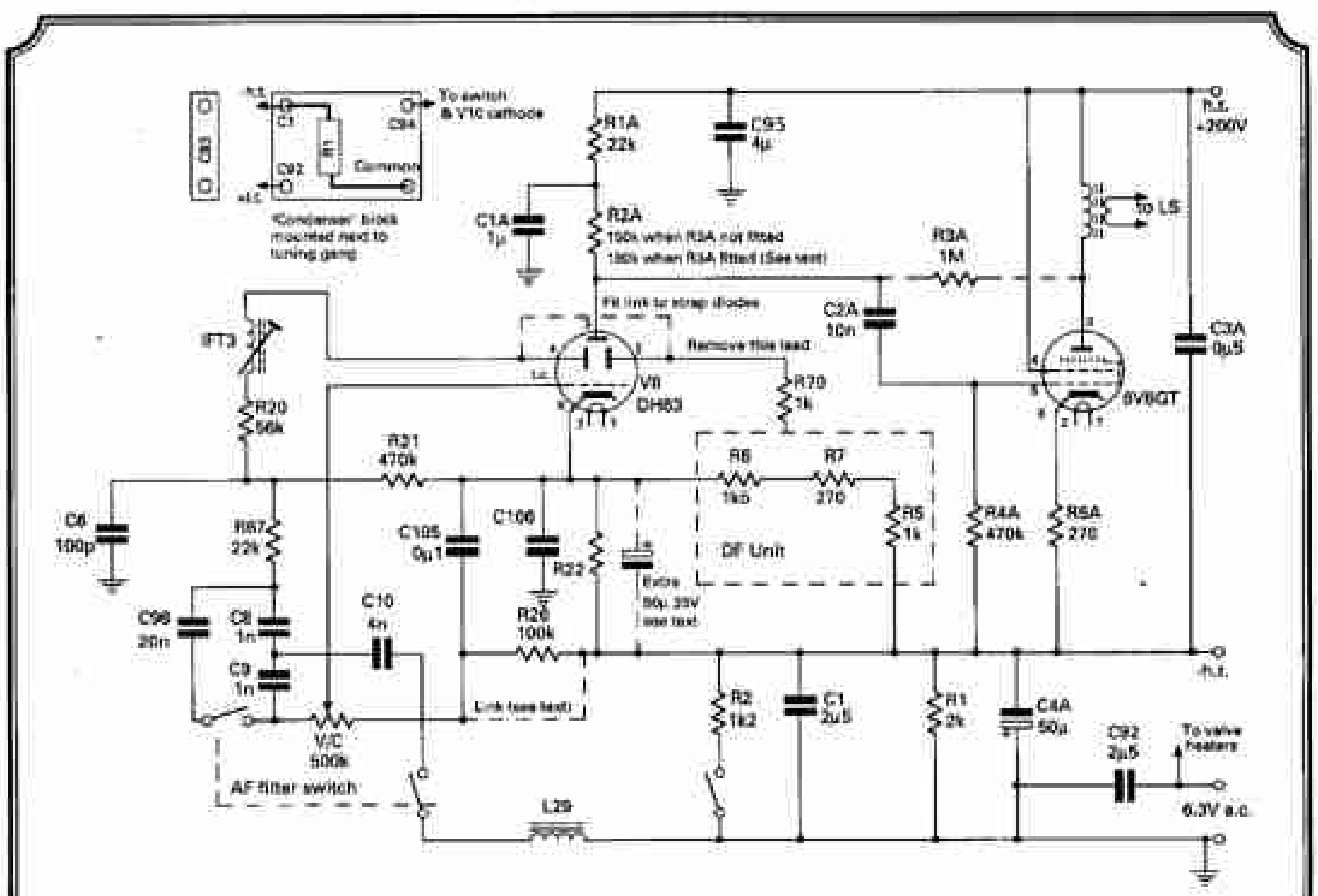


Fig. 2.1: R1155 modified for loudspeaker output. New components are suffixed 'A'.

Modifying the Output Stage

The original output stage used the triode section of V8 to drive headphones via a small matching transformer. Because of its peculiar characteristics there is no exact equivalent to the VR101: anyone desperate might try the least unlikely candidate, which is the American 6R7G. However, when something more than headphone reception is required and a power output stage is added, the problem solves itself since the circuit modifications involved make it possible to use a conventional double-diode-triode, as will be seen.

The removal of the d.f. section had left a blank hole next to V8 which was ideally suited to accommodating the new output valve. The valve chosen for the job was the 6V6GT, which in this application will give an output in excess of 2W with anode and screen currents of only 30mA and 4mA respectively. The heater current is also modest at 0.45A, a useful point when long leads from the p.s.u. are employed and l.t. voltage drop has to be taken into account. A design feature of the 6V6GT is that the third and higher harmonic distortion is kept low by permitting the second harmonic distortion to be rather high. Reduction of the latter may be achieved by introducing negative feedback, obtained here by omitting a bypass capacitor from across the 270Ω cathode bias resistor.

The transformer in the anode of V8 was disconnected but left *in situ* and resistance-capacity coupling used to pass the a.f. signals on to the output valve, see **Fig. 2.1**. It was then possible to replace the VR101 by a DH63 which has a high-impedance triode section more suitable in this role. Note that the value of 470kΩ for the 6V6GT grid resistor should not be exceeded.

Particular care must be taken to ensure that the cathode and grid resistors of the output valve return to h.t.- and not to chassis, to prevent the anode and screen currents from flowing through the bias resistors in the h.t.- circuit referred to earlier.

The output transformer (which should have a ratio of 43:1 for 3Ω speakers and 36:1 for 8Ω types) was mounted just in front of the coil box and under the tuning gang, where there is ample space available.

A 'Monday Morning' Set?

Whilst the new wiring to V8 was being carried out something rather odd was noticed: the cathode pin of the holder was connected to chassis instead of h.t.-. Further investigation produced the interesting discovery that R26 did not go to h.t.- either, as it should have done. It is normally connected to one end of R3 - see **Fig. 2.2** - by a wire on the chassis side and thus hidden from view. This wire was missing, and since it is hardly imaginable that anyone would go to the trouble deliberately to remove it, the only logical explanation is that it was omitted due to a boob at the factory. As the error would have been difficult to detect, presumably a hapless RAF mechanic had resorted to a bodge to get the set working!

First Tests

When the output stage had been fitted it was considered an appropriate time to carry out a test run with the aid of a power pack built especially for R1155 use. Early service manuals specify an h.t. of 200V, later increased to 220V; in practice the lower voltage is perfectly adequate and there appears to be no advantage in increasing it. The h.t. consumption with this input and using the valves mentioned is about 70mA, with the heater current just under 2.9A.

The set produced some kind of loudspeaker signals at once on the three lower frequency bands, but as they consisted of little more than interference noise, increasing at the l.f. end of the dial, it was clear that the local oscillator was not working. This proved to be due solely to dirty contacts on the band switch which were cured by being brushed over with trichlorethylene. Stations were then receivable on all bands and although the performance was fairly good on a very short antenna, comparative tests with a domestic receiver of 1938 vintage soon showed that it left a good deal to be desired. Particularly noticeable was the difference in reception of a distant s.w. station: whereas the domestic set held it at a steady loud volume the R1155 could manage only about half the output with a great deal of fading. Clearly both the sensitivity and the a.g.c. action were in need of attention.

AGC Problems

The first problem was tackled by thorough re-alignment of the i.f., mixer and r.f. stages. The unexpected freedom of the cores in the i.f. transformers suggested that they had been well and truly 'twiddled' by a previous owner who may have been unaware of the rather unusual i.f. of 560kHz. Fortunately the core slots were undamaged and a very significant increase in i.f. gain was rapidly obtained. Even more striking results were achieved in the mixer and r.f. stages, indicating that the specified sensitivity ought to be attainable.

In the next test, although the performance was very much enhanced, there was something not quite right when using the a.g.c. mode. This showed up as a 'squelch' effect that eliminated weaker stations and made the set seem almost dead on certain parts of each band. In the manual gain mode with the control advanced, performance was normal. Back in the a.v.c. mode it was noticeable that the 'magic eye' closed only on very strong stations with a very sudden jump from wide to narrow shadow, which prompted an examination of the a.g.c. circuitry. Since there was nothing visibly wrong - and the various decoupling capacitors had already been replaced - very careful voltage checks were made. Mention has already been made of the minimum bias voltages that occur on the a.g.c. feed resistors R10, R11 and R12: this also sets the delay voltage for the a.g.c. It was found that the negative voltage was completely absent, due to R3 having gone open circuit within its innocent-looking ceramic shell. Replacing this produced just over 1V negative to chassis. A further check showed that R1 had gone low, from 2kΩ to around 1kΩ and when this resistor had been replaced the a.g.c. action and sensitivity was restored to normal. This was confirmed with tests using the signal generator and then with various antennas.

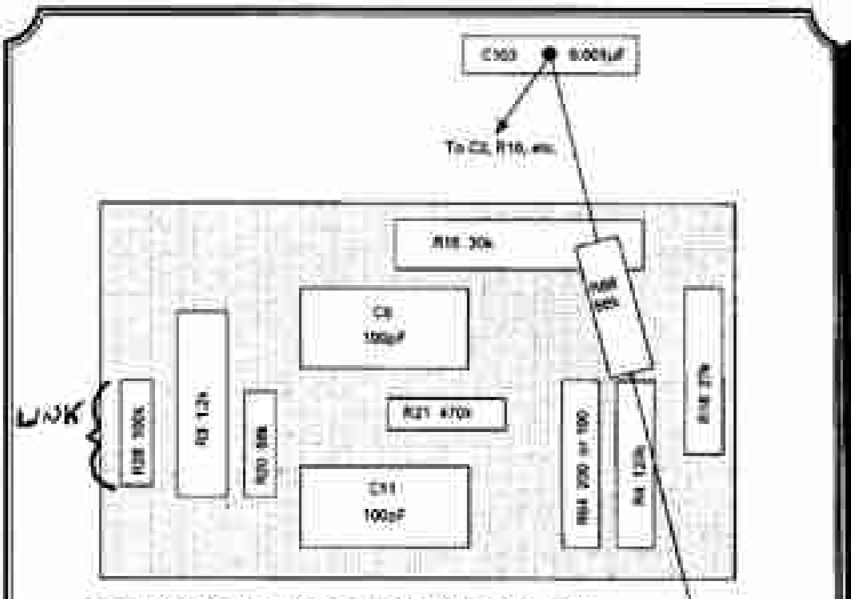


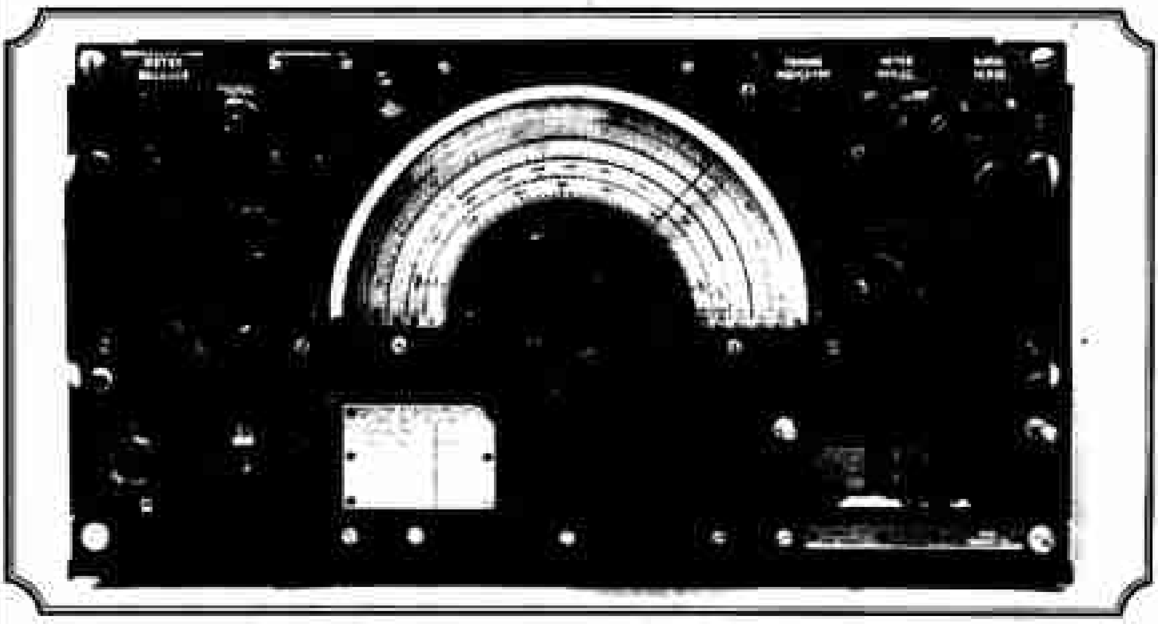
Fig. 2.2: R1155 tag panel with bias, etc. components.

Part 3 describes the final tests and considers the mechanical aspects of the restoration, completing the job.

The photographs for this article were supplied by Paul Allberry.

Abbreviations

A	ampere
a.f.	audio frequency
a.g.c.	automatic gain control
a.v.c.	automatic volume control
h.t.	high tension
h.t.-	high tension negative
i.f.	intermediate frequency
kHz	kilohertz
kΩ	kilohms
l.f.	low frequency
l.t.	low tension
mA	milliampere
p.s.u.	power supply unit
r.f.	radio frequency
s.w.	short wave
V	volt
W	watt
Ω	ohm



Restoring An R1155
Part 3

In this last part, Chas Miller tests the receiver's s.s.b. performance and attends to its physical and mechanical faults.

The final test of the R1155 was of its single-sideband capability using the b.f.o. This, by the way, operates at 280kHz (half the i.f.) and the harmonic used to beat with the i.f. signal. It must be borne in mind that the sole application of the b.f.o. in the R1155, as in most communications sets of its period, was to render c.w. signals audible; to this end the b.f.o. was tuned to around 1kHz off the i.f. The half-frequency method was employed to prevent the b.f.o. from becoming locked to the i.f. signals and thus failing to produce an audible note in the operator's earphones. My standard test for s.s.b. uses the RAF Volmet station on approximately 4.8MHz, which provides a reliable signal at constant signal strength throughout the day. Excellent speech quality could be resolved and since the b.f.o. is injected into the secondary of the i.f.t., after the a.g.c. diode has been fed from the primary, there is no need to change from the a.v.c. to manual control modes. This was tried as a matter of course, but found to be not only unnecessary but undesirable as it introduced some unpleasant background noise. Once the preset adjustment had been made to the b.f.o. it required no further attention.

Mechanical Considerations

The semicircular surround which carries the Cellaloid dial cover was removed to enable a new cover, cut from thin optical quality plastic, to be fitted. This necessitated unscrewing a number of rusty 8BA bolts, which required a dose of penetrating oil well in advance of being tackled with a screwdriver. It is absolutely essential, by the way, that the blade of the latter should fit the screw slot accurately, especially on such small bolts as these: a major cause of failure to remove tight screws is ill-fitting driver blades which simply chew up the screw heads.

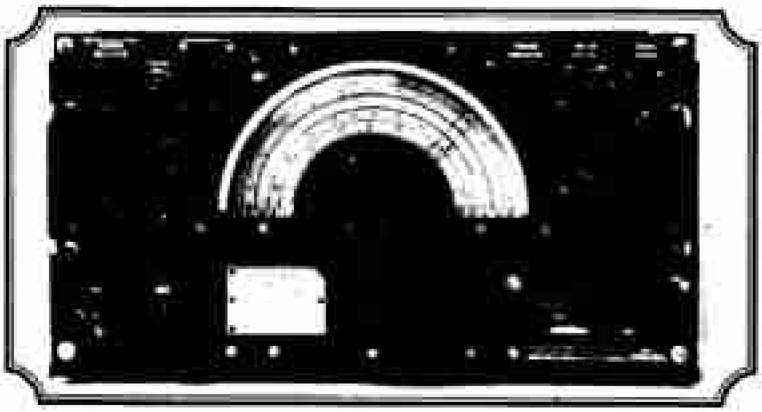
Operation of the epicyclic drive to the tuning gang had become tight and jerky; this was cured by some grease on its moving parts. The bearings on the moving vanes of the gang were given a little light oil, which in addition to making them move freely quietens them electrically.

The dial itself had become severely discoloured and in parts had faded badly, no doubt due to damp. The paint used to print the legends on R1155 dials was on a par with that used on many domestic receivers in the '30s and '40s - in other words, deplorably impermanent! It is hopeless to try to remove dirt by using a cloth having even the slightest amount of dampness, for it will assuredly remove the markings from the dial as though they had never existed. The most that may be tried is a very gentle rubbing with a dry cloth - and even that is chancy. As it happened, thanks to a reader, a spare dial was available, but instead of using it direct experiments were made as to the feasibility of making a photo-copy to be pasted over the old one. The original coloured sections were lost in the process, but this is not a very serious objection since later models of the R1155 were in fact fitted with black-and-white dials.

The various small brass plates giving the functions of the controls responded to light cleaning with a slightly dampened cloth. The same treatment makes the front panel reasonably acceptable, but in due course it will probably be repainted.

The holes left in the front panel by the removal of the d.f.-related controls are a problem with any R1155 which requires careful consideration. Blanking plates, unless very carefully fitted, may not look much better than holes! Filling the latter and then painting them over is tedious but effective, provided that the redundant indicator plates also are removed and their screw holes filled as well. If any reader has suggestions to make in this respect they would be much appreciated.

The bank of Jones plugs used for interconnecting the receiver to the power supplies, indicator units, antenna, headphones and associated T1154 transmitter had all been removed and a small panel carrying a fuseholder and jack socket fitted in their place. This job had been done rather well, tending to confirm my suspicion that the previous owner had been much better at mechanical than electrical work. The fuseholder was retained to protect the h.t. input, whilst the jack was earmarked for the output to the loudspeaker.



A Final Job

The performance of the set from the rubbish dump was as good as any R1155 I have tested, and better than some. Sensitivity was well maintained over the full extent of each band, and between midday and two o'clock on a July afternoon it was particularly noticeable on the 600 to 1500kHz range that dozens of UK 'local' low-power stations could be heard with almost uniform volume, despite the wide variation in signal strengths. On the h.f. ranges the sensitivity was maintained right up to the 18.5MHz limit. Selectivity was excellent with no evidence of sideband 'splash'.

The fact that the set worked so well served to highlight a problem that is common with these receivers. The presence of R26 in series with h.t.- and the lower end of the volume control prevents the latter from reducing the signal to the triode grid to zero when turned to its minimum position. When the set has been modified for loudspeaker use even moderately powerful signals may produce a minimum-volume output that is embarrassingly loud, especially in the quiet of night. In addition the frequency response of the output stage varies noticeably as the control is moved through the first third of its travel, being initially 'bassy' and than rather shrill. To overcome these effects R26 should be replaced by a link to h.t.-, and C105 replaced by a small 50µF/25VW electrolytic (this may be fitted into the same clip). Some extra negative feedback is introduced by changing R2A to 180kΩ and fitting an additional 1MΩ, R3A, taken from V8 anode to the anode of the output valve. The volume control will then be found to operate normally and without affecting the tone. In fact, the output from the set via a good loud speaker will almost certainly surprise the listener by its quality. ■

Abbreviations

A	ampere
a.g.c.	automatic gain control
a.v.c.	automatic volume control
b.f.o.	beat frequency oscillator
BA	British Association (screw-thread standard)
c.w.	continuous wave (Morse)
h.t.-	high tension negative
i.f.	intermediate frequency
i.f.t.	intermediate frequency transformer
kHz	kilohertz
kΩ	kilohm
MHz	megahertz
MΩ	megohm
RAF	Royal Air Force
s.s.b.	single-sideband
Volmet	VOLume METeorological report
VW	volts working
µF	microfarad