Improving the R.208

NOTES ON SOME MAJOR AND MINOR MODIFICATIONS

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The receiver discussed in this article has been available as "surplus" for some time. Though lacking in many of the more desirable features of an amateur-band receiver, it has very good HF coverage, up to 60 mc no less, and is therefore particularly useful for general listening across those frequencies above 30 mc not usually within amateur tuning range. Though a good R.208 may not need much more than re-valving and re-aligning to restore it to normal performance, several desirable modifications are possible, as this article shows. Since the R.208 is strongly built and of generous dimensions, it is more than usually accessible for modification purposes.—Editor.

OVER the past ten or so years various types of receivers have found their way on to the "surplus" market. Amongst these receivers is the R.208, of which little information has been published. The writer has used an R.208 for several years, both in its original form, and later as the "front end" into a BC-348, getting very good results. However, it was felt that refinements and modifications were possible to bring it into line with the more orthodox communication receivers. The frequency range of the R.208 (10-60 mc, in three switched bands, 10-20, 20-40, and 40-60 mc) makes it an ideal receiver for anyone who is interested in the 14, 21, 28 and 50 mc bands, as is the case at G3AIM—though it will be appreciated that it has not got much band-spread, somewhat compensated for by the fact that it is fitted with a good slow motion dial assembly. And it is self-contained for power, six-volt battery or 100-250v. AC mains, with a built-in speaker.

Some Possible Modifications

Due to the fact that it has a fairly high IF of 2 mc, the R.208 has negligible second-channel interference, and the "front-end" is ideal to run in a double-superhet, which was the idea put into practice by the writer. Some time ago, a set of "surplus" CR100 IF coils (complete with crystal and selectivity switch) were purchased, and set aside for future use. It was decided to utilize these components, in converting the R.208 to a double-superhet, and at the same time to fit a noise limiter and modify the AVC circuitry. Another improvement had previously been effected by changing the RF stage from the original EF39 to a

R 257

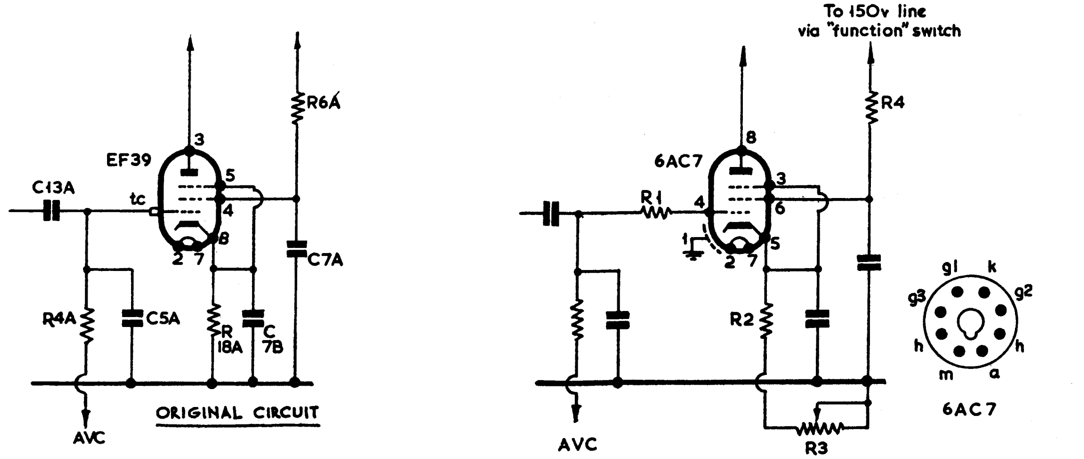

Fig. 1. A worth-while improvement to the R.208 is to change the EF39 RF stage valve to a 6AC7, as explained in the text. The modified circuit is shown on the right, new values being as follows: R1, 10-ohm $\frac{1}{2}$-watt grid stopper; R2, 150 ohms, $\frac{1}{2}$-watt; R3, 3,500 ohms (use R15A from original); R4, 47,000 ohms, $\frac{1}{2}$-watt.

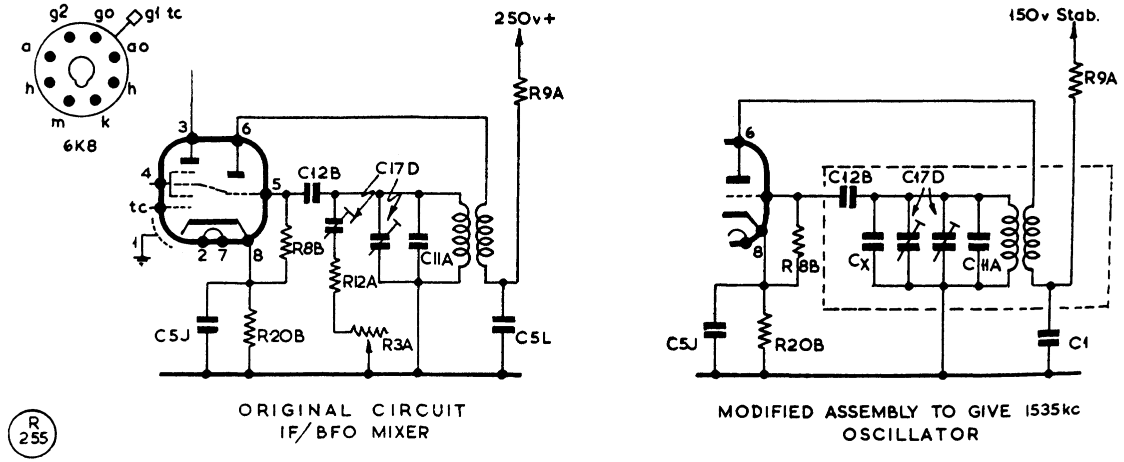

Fig. 2. The R.208 can be converted into a double superhet by modifying the original BFO to work on 1535 kc ; as the first (original) IF is 2 mc, it is a simple matter to run the BFO as the 2nd local oscillator at the lower frequency. The modification details are given in the text, which also explains how a new BFO is fitted later in the chain. In the circuit above, C1 is .01 μF, 350v. working, and Cx is 800 $\mu\mu$F silver-mica.

6AC7, which produced a marked increase in signal strength. For anyone not desirous of drastic changes to the basic R.208, the writer would recommend that only the RF section be modified. This simple operation is covered by " Stage 2 " of the proposed changes set out herewith. To complete the transformation, the receiver is fitted with a standard 9in. panel, which considerably softens the " battleship " appearance of the original, and makes for a neater job.

Stage 1—Wiring Changes

To commence the modifications, first unsolder all wiring and components from the last IF stage to the output stage, leaving only the loudspeaker transformer in position. Remove the loudspeaker from the front panel. Whilst taking out the large tag-strip from under the chassis, it is advisable to check components associated with earlier stages, and re-mount these components in the vicinity of their respective circuits. In an old receiver, some of the condensers and resistors are certain to require replacing. Remove all wiring connected to the test point panel that may still run to the RF, Mixer and IF stages. The 6v. vibrator power supply can be taken off the chassis by unscrewing four bolts, and this could be utilized as an external power supply for portable or field day use. If the chassis extension strips are left *in situ*, it will facilitate handling of the chassis.

Stage 2—RF Stage Modification

Conversion of the RF stage from EF39 to 6AC7 may appear to be difficult, but if the wiring to the coil unit is marked as it is unsoldered, it will be a great help. Remove the dial from the condenser shaft, slacken off the nut locking the wave-change switch to the chassis and panel, then remove the screw from the panel holding the RF/Mixer valve screen. Now, by removing three bolts from the coil unit, the complete assembly can be withdrawn from the chassis.

Unsolder all connections to the RF stage valveholder, and rotate the holder through 180 degrees. The original top-cap connection is removed from the valve-screen and the tag-strip holding R4A and C5A (R.208 circuit notations as given on the cabinet lid) is mounted underneath the coil assembly adjacent to the valveholder. One end of R4A is connected to the grid pin of the valveholder *via* a 10 ohm grid-stopper, and to the other end of R4A is soldered a length of lead sufficient to wire into the AVC system. The cathode bias resistor is changed to a value of 150 ohms and mounted between pin 5 of the valveholder and a tag strip. To the free end of the resistor is attached a lead sufficient to reach to R15A which now becomes a separate RF gain control, and not IF gain as previously used (*see* Fig. 1). The valveholder is now re-wired to suit a 6AC7, utilizing the existing de-coupling condensers, replacing any that need it. The aerial lead to switch wafer S1A is replaced by a length of $\frac{1}{4}$in. coaxial cable which is brought out to the chassis back-drop for termination on a coaxial socket. The coil unit is replaced in the chassis, and the coded leads re-

Table of Values

Fig. 3. The second Mixer and 465 kc IF Stages

C1, C2, C3, C5, C7, C8, C9, C10, C11, C12, C13, C14	= 0.1 μF, 350v.	R10, R14	= 4,700 ohms, ½w.
C4	= .01 μF, 350v.	IF2	= 2nd 2 mc IF (as fitted)
C6	= 7 $\mu\mu$F	IF3	= Mod. 2 mc BFO (*see text*)
R1	= 470,000 ohms, ½w.	IF4	= ex-CR100, IF1
R2	= 20,000 ohms, 2w.	IF5	= ex-CR100, IF2
R3, R9, R13	= 220 ohms, ½w.	IF6	= ex-CR100, IF3
R4, R8, R12	= 47,000 ohms, ½w.	IF7	= ex-CR100, IF5
R5	= 15,000 ohms, 1w.	VR1	= 5,000 ohms, w/wound
R6, R11, R15	= 2,200 ohms, ½w.	V4	= 6K8
R7	= 100,000 ohms, ½w.	V5, V6	= EF39
		V7	= 6SQ7
		S1	= One wafer progressive shorting, and one wafer 1-pole, 5-way

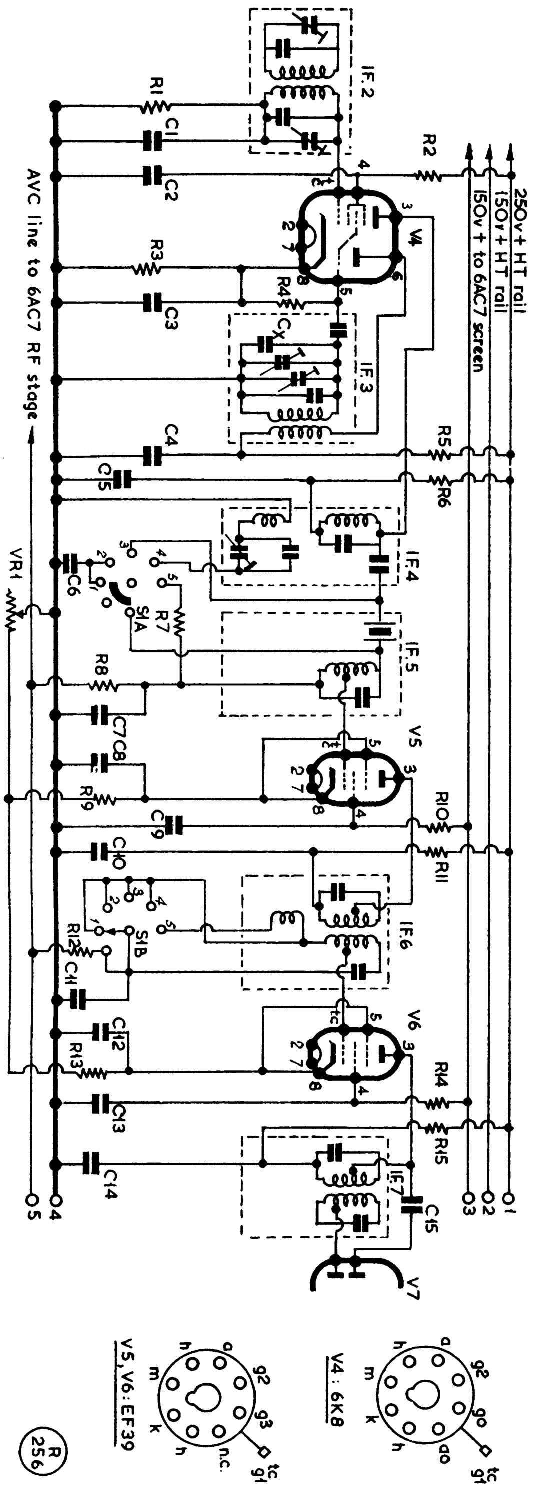

Fig. 3. The second mixer and 465 kc IF stages, using CR-100 coil units, as explained in the text. While standard 465 kc IF transformers could be substituted, the point in having the CR-100 items is that IF5 in the circuit here contains the crystal unit in the 2nd IF stage of the CR-100 assembly. There is ample space on the R.208 chassis for working in the second IF chain.

terminated. The only exception is that the oscillator anode resistor is now taken to the stabilised 150v. HT rail. For anyone interested in "hotting up" the front-end only, these modifications should suffice.

Stage 3—Double Superhet

To convert the R.208 to a double-superhet it is necessary to have a second local oscillator, and this can be provided by using the original 2 mc BFO coil assembly, modified as follows: Connect the two 100 $\mu\mu$F trimmers C17D in parallel and add fixed capacity also in parallel, until the coil assembly resonates at 1535 kc (in the writer's case a 800 $\mu\mu$F silver mica condenser was found to be sufficient). The 20,000-ohm resistor R12A may be left in the coil assembly and used as a support. The modified assembly is mounted in the position previously occupied by the last IF transformer, and the valveholder re-wired (*see* Fig. 2). The oscillator anode resistor R9A is taken to the stabilised 150v. HT rail.

Stage 4—Selectivity

The switched selectivity 465 kc IF amplifier section, shown in Fig. 3, may be wired next, having first mounted the additional IF transformers and valveholders on the chassis. IF2 containing the 465 kc crystal may conveniently be fitted in the position vacated by the 2 mc BFO transformer. When mounting the remaining transformers provision must be made —by holing the chassis—for feeding through the transformer leads and also for the adjustment of the lower iron-dust slugs. Variable IF gain, and IF selectivity controls are brought

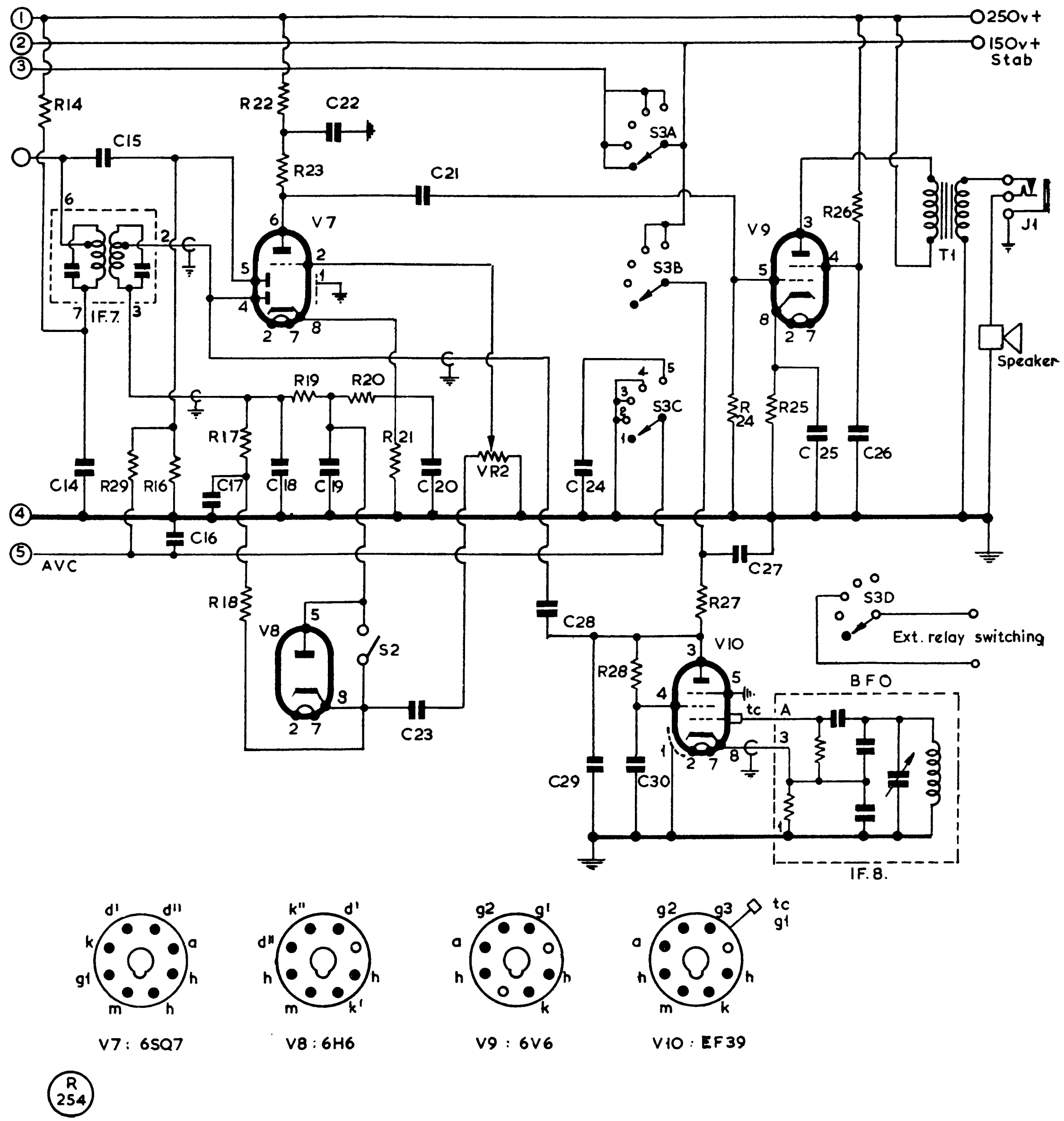

Fig. 4. The second detector, AF output, noise limiter and BFO section of the R.208 as modified by G3AIM. V8, though shown above as a single diode, is actually half a 6H6. The function switch S3 is arranged to give the following positions : Posn. 1, Phone, AVC on ; posn. 2, Phone, AVC off ; posn. 3, Stand-by ; posn. 4, CW/SSB, manual control ; posn. 5, CW/SSB, AVC on. The numbered terminations correspond to those on Fig. 3, p.185.

out to the front panel, as will be seen in the sketch of the 465 kc amplifier-section. The original selectivity switch is too long to mount in the chassis and so must be modified. At G3AIM, this was stripped completely and rebuilt with two wafer sections only. The rear end of the switch assembly is supported by the L-shaped screen around the IF stages. Resistors for anode, screen and AVC circuits are mounted on tagboards fixed to the screen. The AVC line is passed through the screen to the " Function " switch, as also is the 150-volt HT line from the " Function " switch to the screen grids. " Stand-by " is effected by breaking the HT supply to the screen grids.

Stage 5—Output

The output end of the R.208 can be modi-

Table of Values

Fig. 4. The 2nd Detector, Noise Limiter, BFO and AF Output for the Modified R.208

C15, C18, C19	= 100 μμF, mica	R22	= 27,000 ohms, ½w.
C16, C17, C27, C29, C30	= 0.1 μF, 350v.	R23	= 270,000 ohms, ½w.
C20, C25	= 25 μF, 25v.	R25	= 250 ohms, ½w.
C21, C23	= .01 μF, 350v.	R26	= 3,300 ohms, 1w.
C22, C26	= 2 μF, 300v.	VR2	= 0.5 megohm pot'meter
C24	= 1 μF, 150v.	S2	= SPST toggle
C28	= 30 μμF, mica	S3	= Single-pole, 5-way, 4-bank, wafer
R16, R24, R29	= 470,000 ohms, ½w.	T1	= R.208 o/p xformer
R17	= 1 megohm, ½w.	J1	= Close-circuit jack
R18	= 2 megohm, ½w.	IF7	= ex-CR100 IF5
R19, R20, R27, R28	= 100,000 ohms, ½w.	IF8	= ex-CR100 BFO unit
R21	= 3,300 ohms, ½w.	V7	= 6SQ7
		V8	= ½-6H6
		V9	= 6V6
		V10	= EF39

fied to any individual choice, but a circuit is shown as used by the writer. In the interest of stability the BFO takes its HT supply from the 150-volt line, again *via* the "Function" switch. The power supply can be the original unit, mounted in an external case (ideal for Field Day use), or a suitable unit fitted into the receiver itself. This might entail a little hacking out of the chassis, but makes a more compact arrangement for fitting in a cabinet. If it is felt necessary to "winkle-out" the more exotic DX, then a "Selectoject" could be fitted in the space between the BFO valve and the last 465 kc IF transformer. This vacant space could likewise be used to accommodate a switchable product detector for SSB—again, it is a matter of individual choice. AVC is applied to the RF stage (V1), and also to the 465 kc IF amplifiers (*see* Figs. 1 and 3).

Alignment

Alignment of the 465 kc IF amplifier may present some difficulty, unless a Wobbulator and Oscilloscope are available. A rough setting-up can be done by feeding a modulated 465 kc input to the signal grid of the second mixer stage (V4), and peaking the top and bottom sections of the IF's. The selectivity switch must be set to posn. 2 (3000 c/s), reducing the IF gain as the circuits are peaked.

For correct setting up, connect the Wobbulator to the mixer valve (as above), and inject a signal of 465 kc. The selectivity switch is set to posn. 3 (1200 c/s), and the IF gain control near maximum. The Oscilloscope is connected to the detector diode (pin 4) of the 6SQ7, and a resonance curve obtained. This curve may not coincide with the crystal peak (*see* Fig. 5), so it will be necessary to retune the Wobbulator until the two peaks coincide. The neutralising condenser under IF4 is adjusted until any "lump" on either side of the curve is removed and well-balanced skirts remain. Peak the remaining 465 kc transformers, reducing IF gain as necessary.

To adjust the second local oscillator (triode section of V4), connect a Signal Generator to the grid of the valve and tune to 2 mc. The output can be measured on an AC voltmeter connected to J1. Tune the trimmers of IF3, peaking the transformer at approximately 1535 kc, for maximum deflection of the AC voltmeter. With the same setting of the signal generator at 2 mc, peak the trimmers of IF1 and IF2. This completes the setting-up of the two IF channels and the coil unit may now be peaked up on the three ranges.

In conclusion, the only claim the writer makes for the effectiveness of the receiver is to quote the old saying, "If you can't hear them, you can't work them." Using mainly a 20-metre dipole for a number of years, and changing recently to a 20 metre ground-plane, the writer has had confirmed contacts with some 200 countries—which does not seem bad, using a receiver cheaper to buy now than when he got his, and which is easy to get into for modification purposes.

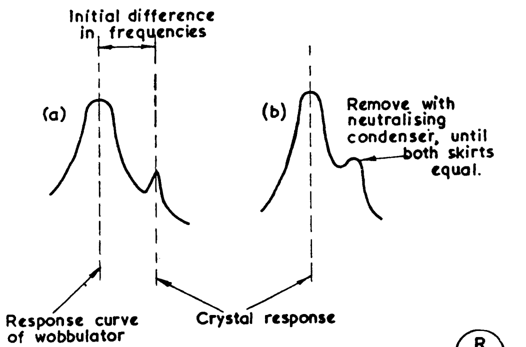

Fig. 5. Shape of the selectivity curves obtained on the R.208 when modified as explained in the article. The final aligning adjustment is done with the wobbulator and crystal filter curves at the same frequency.

THE EXACT VALUE

Among the many fascinating researches being conducted at the National Physical Laboratory — disclosed to those invited on the occasion of the recent official visit — is an investigation into the precise velocity of electro-magnetic waves. This has always been taken as 300,000 kilometres per second. It turns out that the true figure is 299,792·50 ± 0·10 km/s. This does not mean that all our aerial calculations have to be revised, as the percentage difference is negligible. But it does show what is possible in the way of accurate measurement.