BY ROGER JOHNSON

The 'better' short wave sets

Most Australian short wave valve receivers were 4/5 superhets with a broadcast band and a single short wave band covering either from 16 metres to 49 metres, or from 13 metres to 42 metres. However Astor and AWA in particular made fine receivers that performed really well...

THE STANDARD DUAL wave radio of the valve era incorporated a dual-wave facility probably more as a gimmick than as a real attempt to provide an adequate and reliable short wave coverage. In 1946 it was estimated that less than 2% of listening time was allocated to short wave listening; but if you had nothing better to do, then a half an hour here and there trying to pick out some of the more powerful programs no doubt provided some enjoyment.

Short wave facilities on the family console radio began to appear from about 1934, and generally speaking from 1935 most manufacturers had a dual-wave model in their range of electric radios. In the early 1930s battery short wave sets had problems with the converter valve (1A6), and it wasn't until the 1C6 came along that performance was any good. Even so, battery dual-wave receivers were not particularly common until the post war era.

The radios of the octal valve era were remarkably similar. The short wave facility usually covered the 16m, 19m, 25m, 31m and 49m bands with practically no band spread capability. A given station was easily detuned by the slightest turn of the tuning control knob. Separation was sometimes very poor, and performance on the 19 and 16 metre bands often dropped off considerably. Daytime reception was often non-existent.

Not only that but 'double spotting' is also quite a problem. This is the name for the phenomenon where the incoming signal is received at two spots on the dial, due to poor image rejection. The unwanted image is twice the IF away from the normally tuned signal (i.e., the other side of the local oscillator), and is heard because of the broad tuning characteristics of the aerial coil. Double spotting is somewhat eliminated with the inclusion of a tuned RF stage.

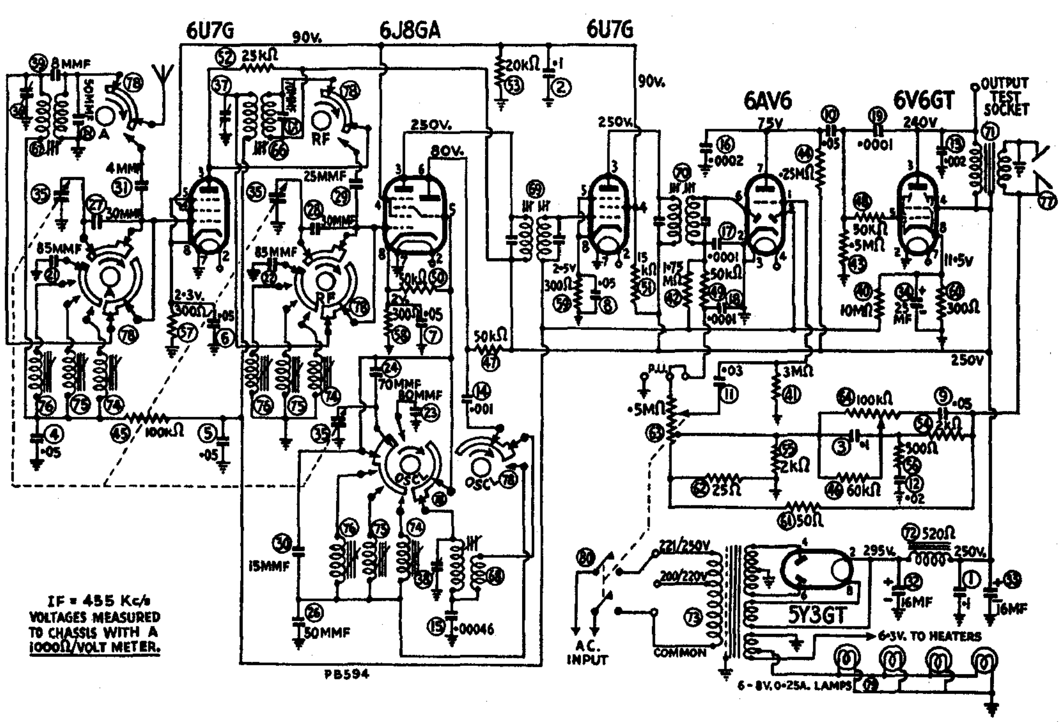

Fig.1: The circuit for the Astor NS, showing complex band switching – and the fairly elaborate audio amp with its negative feedback.

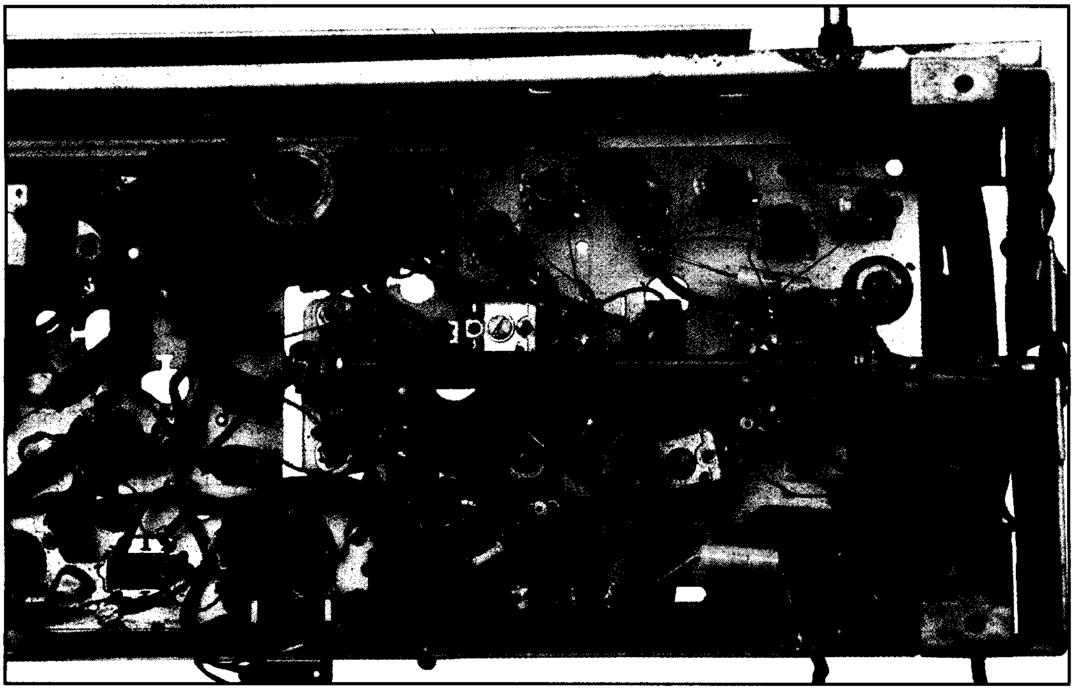

***Fig.2:** Underneath the Astor NS chassis, showing the considerable number of coils in the front end circuitry. The bandswitch is also seen, running horizontally across the centre.*

AWA did try to overcome some of the shortcomings of this type of set with a vernier system incorporated into the tuning control. With particularly high gain overall and well designed coils, these radios were probably the pick of the bunch of the 4/5 superhets up until domestic radio manufacturing was ceased for wartime production.

AWA, Healing and Astor in particular also offered two- and three-band radios with an RF amplifier stage, which considerably improved performance.

Astor's model NS

The Astor model NS radio of 1951 came in the familiar 'harbour bridge' cabinet and left little to chance. It included a tuned RF stage, and specific bandspread tuning for the 19, 25 and 31 metre bands. The actual coverage for one full sweep of the dial was 14.9 to 15.5MHz, 11.6 to 12.5MHz and 9.4 to 9.8MHz respectively. This meant that if the frequency of a given station was known, it could actually be tuned instead of guessed at!

The NS also incorporated audio feedback and a comprehensive treble control to facilitate better audio quality, and although it was a table model it had a reasonable 8" speaker to give quite good audio quality. The circuit is shown in Fig.1.

As you can see it's a good example of the use of switches that do more than the wiper just selecting one contact for each position of its travel. We have the one contact continuously selected for more than one position of the switch, and in other applications, adjacent contacts being connected as the switch passes from one contact to the next.

The band switch is shown in the broadcast (BC) position. The antenna is connected to the BC coil primary. The secondary is then connected to the "6 o'clock" position of the lower bank of (78). This wiper then connects to the grid of the RF amp, and the 30pF capacitor (27) is shorted out. The tuning capacitor (35) is in circuit also, being connected directly from the grid to earth. The 85pF capacitor (21) is switched out.

As the switch is rotated in the direction of the arrow, several things happen in the aerial tuning circuitry. Firstly, the broadcast coils are switched out, and the antenna is coupled via a 4pF capacitor (item 31) to the grid of the 6U7-G, and also to the wiper of the lower switch bank. This disconnects the broadcast aerial tuning coil, and connects the 19m band coil (item 74). In so doing, the 85pF capacitor (21) is connected across the tuning gang, and the shorting link for the 30pF series cap (27) is released, connecting it in series with the tuning gang total capacitance and of course in parallel with the tuning coil, from grid to ground.

Almost identical switching occurs at the output of the RF stage, with items 22, 28 and 29 being brought into the tuning circuit in exactly the same manner.

In the oscillator section, with the switch contacts as shown in the BC position, the BC oscillator coil is in circuit in a conventional manner for Astor sets. The 70pF series capacitor (24) is shorted out. When switched to the 19m band, the osc. coil item 74 is connected to the oscillator grid. The 80pF capacitor (23) shunts the tuning gang, and capacitor 24 is now in series with the tuning gang. The 6J8-G plate is now connected via the 0.001uF capacitor (14) to the other end of the Colpitts oscillator coil.

For the remaining bands, viz. the 25 and 31 metre bands, the switching arrangements are identical apart from switching in the respective coils.

Switching complexity

Why the complicated switching? Well, it's the very essence of a good shortwave receiver that the bands aren't crowded, and for the operator to be able to actu-

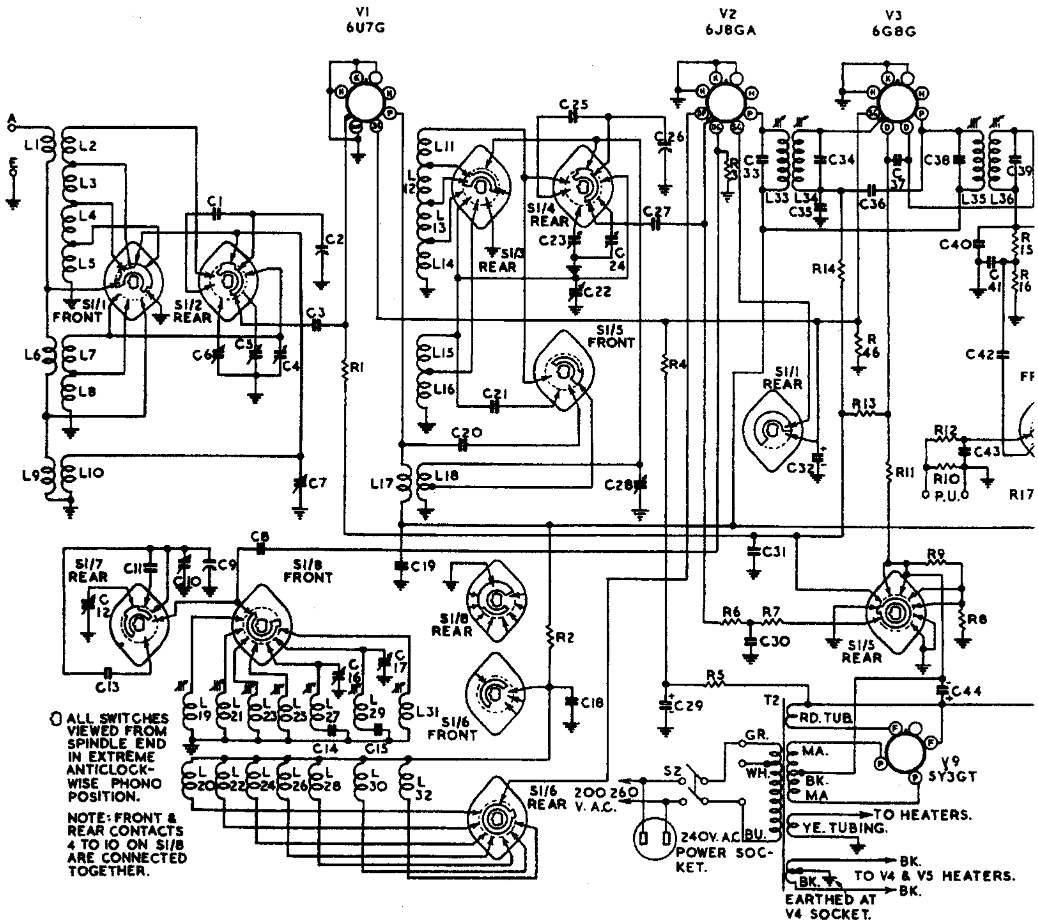

Fig.3: The front end circuitry used in the AWA bandspread receivers released in 1940. V1 is the RF stage, and V2 the oscillator/mixer.

ally select a station on a given frequency calibration of the dial. This will not be achieved with the standard 435pF gang connected directly across the regular short wave coil(s), as in the majority of 4/5 superhets.

To achieve the correct tuning, the range must be severely reduced by reducing the effective range of the tuning capacitor. This has been achieved by the connection of the series capacitors 27, 28 and 24 in the Astor circuit. The capacitance of is also significantly altered by shunt capacitors 21, 22 and 23.

In the aerial and RF tuning circuits, the capacitance range is no longer 20 - 420pF. The shunt capacitor alters that to about 100 - 510pF approximately, while the series capacitor reduces this again to an effective tuning range of about 23 - 28.5pF.

The effective figures for the oscillator range would be similar and slightly higher, at roughly 41 - 62pF. Given this range, it is likely that the oscillator is tuned to the low side of the incoming signals.

One other highly significant factor is that the 'Q' of the tuning circuits are greatly enhanced because of the high-L/low-C circuit configuration. This gives higher selectivity.

No double spotting

Given the short tuning ranges of this receiver, double spotting is eliminated. Take for example the 19m band, with the tuning range 14.9 - 15.5MHz. If the desired signal was at 15.486MHz, say, the image would be at 15.486 minus twice the intermediate frequency of 455kHz or 14.596MHz — which is clearly outside the tuning range.

Fig.2 shows a photo of the underside of the Astor NS chassis, showing both the coils and the wave-change switch with its widely separated wafers.

By the way to align one of these receivers a very accurate signal generator is required, as well as a magnifying glass and the detailed instructions given in the *Official Australian Radio Service Manual* for 1951 (Vol. 10, p50). The coils are slug tuned for even greater efficiency, and great care is needed.

To tackle an alignment using one of the humbler service oscillators is asking for trouble. If no signal generator is available, with an appropriate alignment tool, try listening for Radio Australia on its announced frequency, and *fractionally* adjusting each of the three slugs for the chosen band for maximum output and dial calibration. A fraction of a turn means just that — **no more than a few degrees** each side of the existing position. After that, put your hands in your pockets and go and make a cup of tea! The alignment is complete.

AWA bandspread series

AWA released its bandspread series in 1940, in both battery vibrator and electric models. The essential elements of the front end were essentially the same: viz. a tuned RF amplifier, mixer/oscillator and a single stage of 455kHz IF amplification.

The battery vibrator model used a more elaborate audio system utilising a type 1H4-G transformer coupled to a type 1J6-G class B triode push-pull output.

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Such a configuration could deliver about two watts of audio when really pushed.

The early electric models were available in table and console cabinets. The console jobs that had a very elaborate dial mechanism. A separate drum is illuminated behind the main dial which indicates the chosen band, and was rotated in synchrony with the wave change switch. After WW2, they were released in a table model but with a large flat 'slide rule' dial. The front end circuit was essentially the same, and is reproduced in Fig.3.

The frequency range was divided into seven bands, with the coils being used in the aerial circuit as follows: (1) 13-16m, L2; (2) 16-20m, L2/3; (3) 20-25m, L2/3/4; (4) 25-31m, L2/3/4/5; (5) 31-83m, L7; (6) 75-200m, L8/L9; and (7) L10 the broadcast band. In the diagram, the switches are viewed from the spindle end in the extreme anti-clockwise end and in the phono position.

Bands 1 to 4 are selected by tappings down a common coil sharing the same primary in the aerial and RF stages, as are bands 5 and 6. Band 7, the broadcast band, has its own separate coil. There are separate two-winding oscillator coils for each band, being L19-20 for band 1 and L31-32 for the BC band.

If you trace the wiring, and just looking at S1/1 and S1/2, in the phono position, L10 is earthed to prevent any signal breakthrough. Rotating the switch one step clockwise, and ignoring for the moment the earthing connections to the junctions of L2/3/4/5, we see that C2 the tuning gang is connected to its trimmer C7 and L10 by the thick wiper of S1/2. Similar connections occur in the RF coil by S1/4 and L18/C26/C28.

In the oscillator section, the oscillator grid capacitor is C8 which connects to the osc. grid (pin 5) of the 6J8-G converter (V2) and then to S1/7. In the BC position, the padder C11 is connected in series with the tuning gang C29, and the BC trimmer C12 is connected in shunt. S1/8 then connects the tuning coil L31 to the gang. The oscillator plate connections and switching are quite straightforward.

SW connections

Imagine if you can the switchbanks being rotated an extra step clockwise. This is best done by looking at S1/2. The thick wiper connects the top of L7/8 to the tuning gang. At the same time, the earth to the bottom of L5 is opened, and the aerial and L7/8 are earthed by S1/1. A similar situation happens in the RF stage. As for the oscillator stage, the oscillator tuning coil L29 is switched in with its trimmer by S1/7.

When selecting the next band,, basically the junction of L7/L8 (and L15/L16) is earthed and the tuning gangs operate only over the smaller portion of that coil. It is hard to imagine, but series capacitors C1, C25 and C13 are only switched in when the four higher bands are selected.

The AWA receivers were intended for complete coverage from the broadcast band to the top of the 13m band at around 23MHz, with adequate band spreading for general shortwave listening. They could also tune the 160m, 80m, 40m and 20m amateur bands, back in the days when all amateur transmissions were CW or AM telephony.

Again, as with the Astor, alignment is quite a tricky procedure and more harm than good can be done by someone who is not well versed in the gentle art. Correcting badly aligned receivers of this type can take hours, not to mention the outpouring of foul language in the process.

In summary, if shortwave listening is your pet hobby, try and obtain either of these sets. The Astor may be easier to come by, since the same case housed any one of a dozen different chasses, and there were bandspread models without the RF stage as well. A quick look in the back of the cabinet, and at the dial, should reveal all. **ea**