VINTAGE RADIO

By JOHN HILL

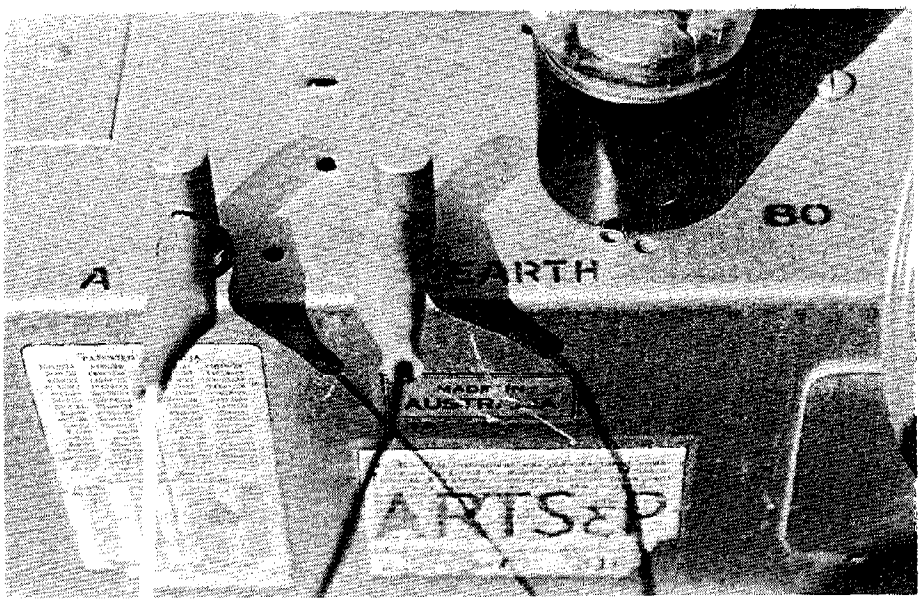
The basics of receiver alignment; Pt.3

Last month, we started to align our hypothetical superhet receiver and had progressed as far as the intermediate frequency transformers. We can now proceed with the rest of the job & that is to align the aerial and oscillator circuits so that they track accurately.

We shall start with a typical receiver from the mid 1930s; one with a compression type padder capacitor and two trimmers – aerial and oscillator. Receivers that have a fixed padder and an adjustable iron core in the oscillator coil require a different approach.

Due to the fact that most, if not all, radio stations on the broadcast AM band are no longer transmitting on their original frequencies, exact dial calibration is not really possible. It is therefore quite reasonable to ignore the station positions as marked on old dials and set the dial pointer to correspond to the kilohertz calibrations (naturally, the dial will be marked in kilocycles). Most old dials have a frequency scale on them somewhere.

However, as I live in Victoria and most of the Melbourne stations are still quite close to their original frequencies, I set up my receivers to tie in with the Melbourne stations and, accordingly, zero in on 3AR at the low frequency end of the dial and 3XY at the high frequency end.



An RF signal generator is an invaluable aid when aligning old radio sets. The RF signal from the generator is injected into the receiver via the aerial and earth terminals.

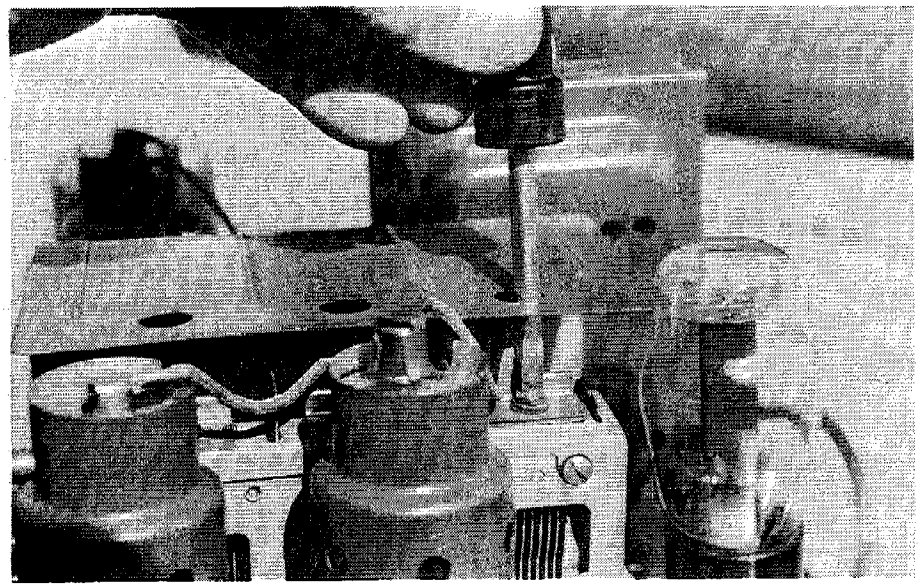
These settings correspond fairly closely to the 600kHz and 1400kHz frequencies that many radio manufacturers suggest as alignment points. Aligning a set in such a manner works in fairly well with some other stations and 5AN and 2SM are two that come to mind. In any case, the alignment frequencies should not be too close to the ends of the band, otherwise tracking may be degraded in the centre of the band.

To carry out the next stage of our receiver alignment, the radio frequency (RF) generator is connected to the aerial and earth terminals and the frequency set to whatever has been decided as a reference point at the low frequency end of the dial. In my case, this is 621kHz which is 3AR's frequency.

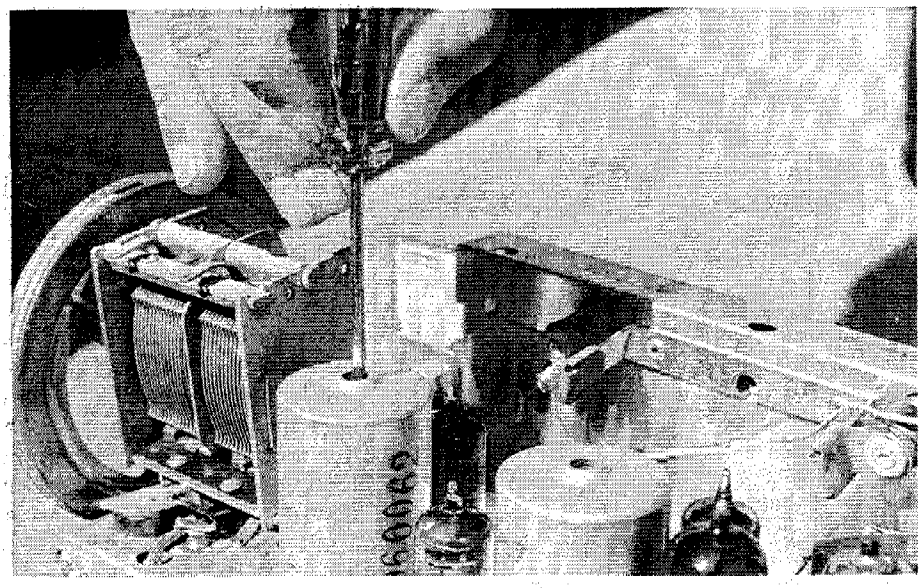
The next step is to tune the receiver to the RF signal with the receiver volume control set to maximum and the generator output adjusted to give a low scale reading on the output meter (see last month's article). The output meter is simply connected between the output valve anode and chassis.

Tracking adjustment using a variable padder capacitor – and without the advantage of an iron core in the aerial coil – is one of the trickier alignment jobs. The problem is that, without any means to adjust the aerial circuit at the low frequency end of the band, the position at which it resonates for a given frequency is completely beyond the operator's control; we have to accept it "as it comes".

More importantly, we have to make the oscillator circuit tune the frequency at this same spot. But, because the oscillator circuit has virtually total control, we have no simple way of knowing where the aerial circuit is resonating; we have to search for it on a trial and error basis.



An RF (radio frequency) stage should be adjusted only after the aerial and oscillator circuits have been aligned. Note that this particular receiver has a dust cover over the tuning capacitor.



If you don't have an RF generator, the IF transformers should be adjusted for maximum volume. However, there is no way of knowing as to whether or not the IF transformers finish up operating at their intended frequency.

Hence the "rocking" technique used on these early sets. The procedure is to first note the reading on the output meter, then make a small adjustment to the padder and retune the gang for maximum output. If the reading increases, you make another adjustment in the same direction. If not, you adjust the padder in the opposite direction.

These small trial and error adjustments are continued until maximum output is achieved.

If dial calibration is required, it can be done after the above adjustment, by adjusting the dial pointer position or the dial drum on the tuning gang shaft.

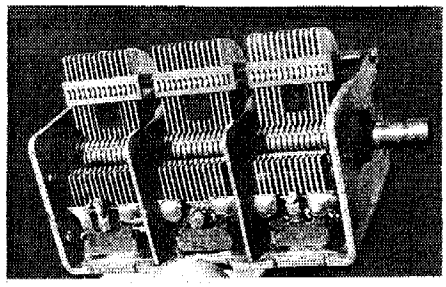
Next, set the RF generator to the chosen frequency at the high end of the dial (in my case, that's 1422kHz, 3XY's frequency). This done, tune the receiver to the signal and check to see if the frequency matches with the dial and dial pointer. If it doesn't, the pointer position can be moved by adjusting the oscillator trimmer one way or the other.

Note that only the oscillator trimmer will shift the signal position. If the signal doesn't move, then the wrong trimmer is being adjusted.

Having done this, adjust the aerial trimmer for maximum output on the output meter. The above procedure should now be continuously repeated at both ends of the dial until no further improvement is possible.

If the receiver has a stage of radio frequency amplification, then the section of the gang that is connected to the RF stage must also be tuned. It is best to adjust this trimmer after the aerial and oscillator trimmers have been set.

And that's it; the receiver is aligned!



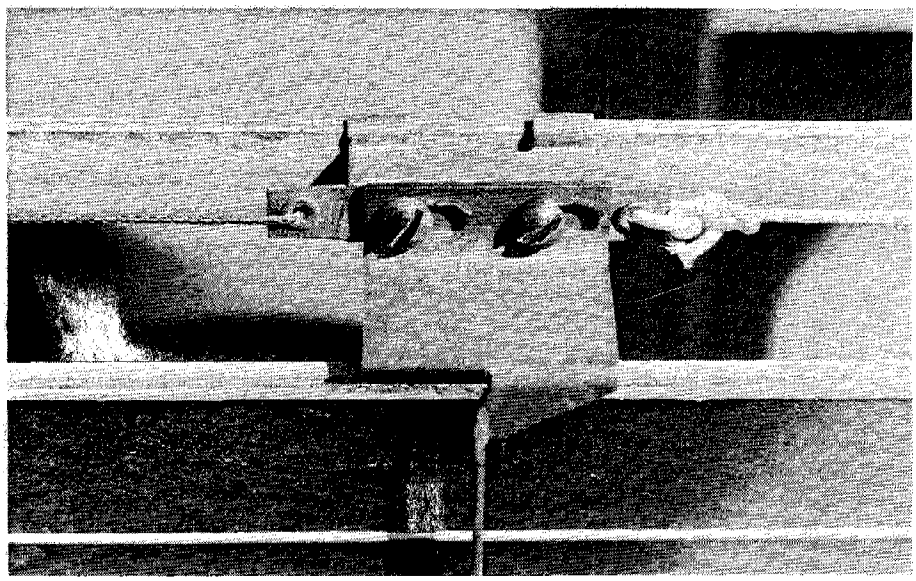
If a superhet radio has a 3-gang tuning capacitor, it usually also has a stage of radio frequency amplification. The more tuned circuits there are, the more important accurate alignment becomes if the set is to perform correctly.

Iron-core slugs

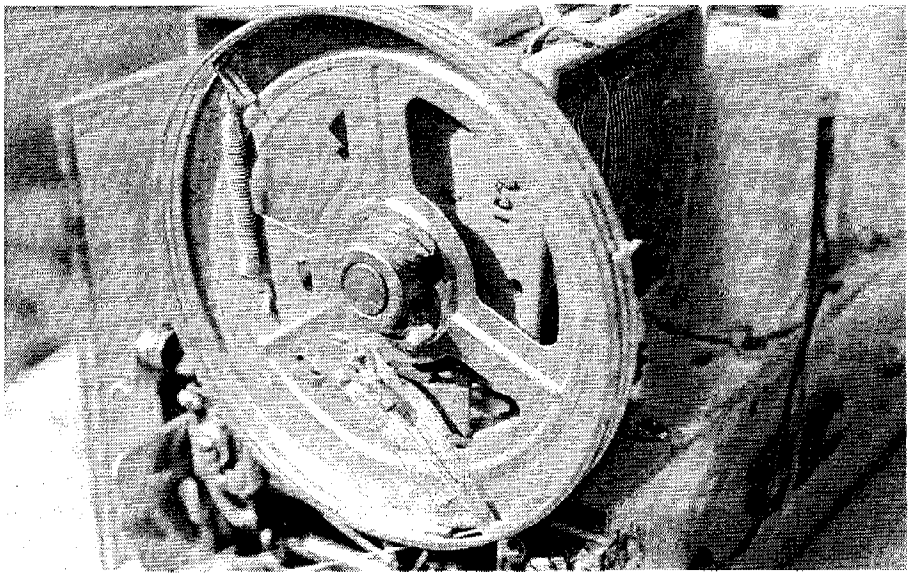
For a superhet with iron cores or slugs in both the aerial and the oscillator coils, the procedure is a little different. In fact, the development of coils with adjustable iron cores was a major breakthrough in its day, making possible simpler, more precise, and more stable adjustments.

These sets have no adjustable padder capacitor – instead, they use a fixed capacitor. The tracking is adjusted using the iron cores. The first step is to set the dial pointer to the extreme low frequency end of the dial scale – or to a "pointer" mark if there is one – with the gang fully in mesh. This done, set the station calibration at the low frequency end of the dial by adjusting the oscillator coil.

The station position at the high frequency end of the dial is now adjusted using the oscillator trimmer. Repeat these two steps until no further improvement is possible, then go back to the low frequency end again and tune for maximum output by adjusting the aerial coil slug.



Small dial pointer adjustments are catered for in this old Radiola by the elongated slots in the pointer bracket. Many pointers can also be slid along the dial cord.



Large dial pointer adjustments can be made by rotating the dial drum a few degrees. The pointer position is set at the low frequency end of the dial.

Finally, adjust the set for maximum output at the high frequency end of the dial using the aerial trimmer. Repeat these last two steps until no further improvements are possible. The job is now complete.

A useful tip – always adjust slugs and/or padder capacitors at the low frequency end of the dial and trimmer capacitors at the high frequency end. Do not confuse the oscillator slug with the IF transformer slugs.

If a receiver has a shortwave band, it should also be re-aligned as there will be trimmer adjustments for the shortwave coils. Usually there is no padder adjustment, the padder capacitor being a fixed one. In some cases, the coils may be fitted with iron slugs.

Alignment instructions for shortwave receivers usually suggest that the RF generator be set to around 12MHz and the trimmers adjusted accordingly. The shortwave oscillator trimmer will move the signal's position on the dial and the shortwave aerial trimmer is then adjusted for maximum output.

Be aware that a strong shortwave signal can produce a double spot condition; ie, the appearance of the same signal at two points on the dial, separated by twice the IF (typically 910kHz). The correct one will be the stronger signal and/or the one closest to the appropriate dial calibration.

However, be aware that there are a few variations with shortwave receivers and multi-band sets can be a bit difficult to work out.

No instruments

It's also quite possible to align a radio receiver without the use of an RF generator or output meter.

The process is similar to the foregoing but with a few minor differences. As previously explained, when aligning with an RF generator, the IF transformers are adjusted before the aerial and oscillator circuits. When aligning without a generator, the procedure is often reversed – not that it really matters much.

Incidentally, the time of day has a lot to do with the success of the operation and a middle of the day tune-up will be much easier than an after-dark job. At night, there are too many distant and often powerful stations jostling for their share of dial space. During daylight hours, only local stations can usually be received and they provide a much steadier signal, although a distant steady signal is what's really required.

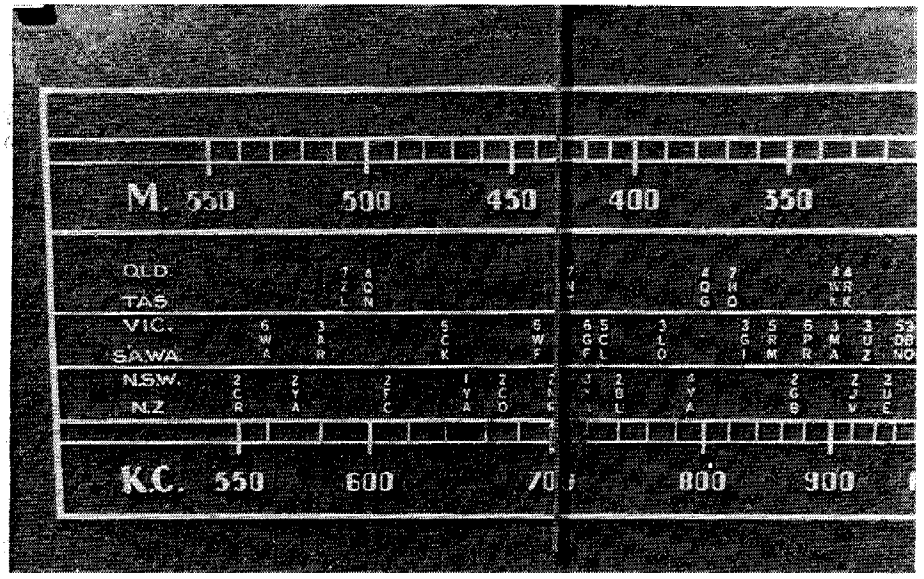
First, tune to a suitable station at the low frequency end of the dial and adjust the oscillator/aerial tracking as already described. Without the benefit of an output meter, this is best done at low volume, as the ear is more sensitive to variations in soft sound than loud sound. Alternatively, you can adapt your multimeter for use as an output meter as described last month.

When the optimum tracking adjustment has been found, shift the dial pointer so that it lines up with the station's frequency if it doesn't already do so.

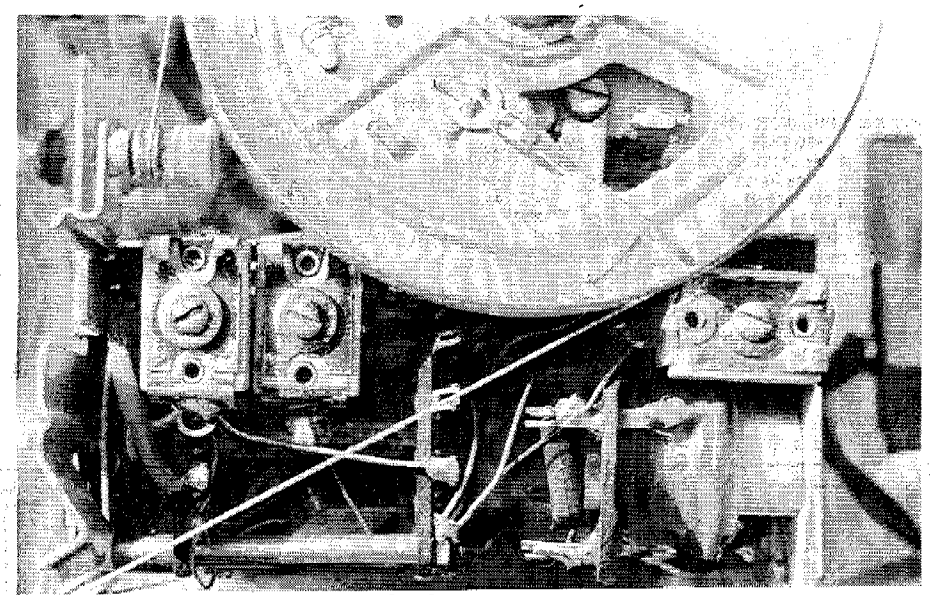
Now move to the high frequency end of the dial and use the oscillator trimmer to move the station to the desired position. This done, adjust the aerial trimmer for maximum volume and the RF trimmer too if the set has a stage of radio frequency amplification. Repeat these steps until no further improvement can be obtained.

IF transformers

When aligning the IF transformers, there is no way of knowing whether or not the transformers are set close to their designated frequency. If the trans-



This old Radiola dial from the mid 1930s is marked in both kHz (K.C.) at the bottom and metres (M.) at the top.



The two trimmers on the lefthand side of this chassis are for the broadcast band, while the trimmer at right and another that's hidden from view are for the shortwave band. Determining which trimmer does what is often a trial and error process and once known, they should be marked for future reference.

formers are as originally adjusted by the radio manufacturer, there is little to worry about. However, if they have had their "screws tightened up", then there could be problems.

Tuning IF transformers without the aid of an RF generator is a bit of a guessing game because they can only be adjusted for maximum volume. Whether or not the transformers end up tuned to their intended operating frequency will remain unknown.

For sets with a shortwave band, all one can do is tune into a reasonable strength signal (somewhere around 12MHz) and adjust the shortwave aerial trimmer for maximum volume. It's not hard to put the dial alignment out if the oscillator trimmer is given a few turns by mistake. It is a good idea to mark the original positions of the adjustment screws in case one gets lost.

Receiver alignment is a very important aspect of vintage radio restoration. The full potential of any superhet radio can never be attained unless the IF transformers are correctly adjusted and the aerial and oscillator circuits are tracking accurately. Basically, that's what receiver alignment is all about. **SC**