BY ROGER JOHNSON

Oddball Pre-octal Four Valvers

There were so many four-valve receivers produced in the pre-octal era that it's hard to generalise or even give a broad idea of their enormous range and variety. So instead, I've decided to look at four examples of really unorthodox designs — because these will at least illustrate the boundaries.

BEFORE WE START looking at these more unusual circuits, though, a few words about a fairly typical set of this era will hopefully set the scene.

In the April 1940 issue of *Radio and Hobbies*, the late John Moyle describes the 'Little General' receiver, in which he claims that this was 'the first radio of its type ever described...'

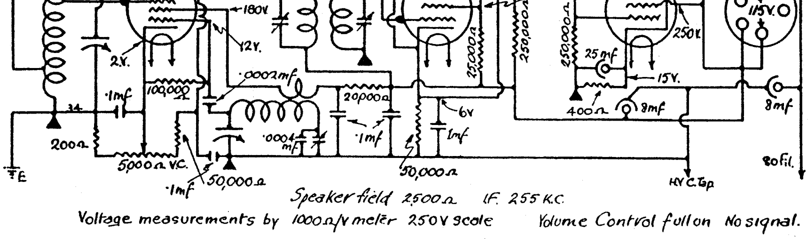
This is a somewhat erroneous claim. Small radios were certainly available commercially, and in any case the November 1, 1935 issue of *Wireless Weekly* carried the '4/35' superhet design — with a circuit almost identical to the Little General. It is built on a larger chassis (12" x 7"), uses valve types 6A7, 6B7S, 42 and 80, with no AGC, and the output is driven directly from the detector load. The only real difference is the volume control, which shunts the antenna to earth as well as increasing the 6B7S cathode voltage. A voltage divider is used for the various voltages instead of fixed resistors, and the text points out that the performance of such a set will depend upon the quality of the coil kit. In the next issue, a reflex version appears.

The Healing model 34

One of the earliest 3/4 valve 'straight' superhets in this country would have to be the Healing model 34 of 1934. This circuit is shown in Fig.1. As you can see it uses a 2A7 converter in which the volume control is a 5k pot in the cathode circuit. So where are the unorthodoxies?

Firstly, note the antenna connection via a tap down the coil. This was more typical in 1924 than in 1934, and is certainly an anachronism. The problem with this type of circuit is that the antenna length capacitively loads the coil, and affects the tuning. The antenna trimmer would have to be peaked for a given antenna length.

Fig.1: The Healing model 34, a superhet with no IF amplifier. The 57 valve is used as an anode-bend detector...



Secondly, the control grid of the 2A7 is also connected to a tapping down the coil. Tappings in this manner were generally to overcome loading effects. One would have thought that the loading effect of the converter would be minimal, to say the least!

The oscillator is conventional, as is the first IF transformer. The next tube, a type 57, is an audio amplifier, not an IF amplifier. The secondary of the IFT goes from grid to earth, and in the cathode of the 57 is a 50k resistor. This valve is operating as an anode bend detector and voltage amplifier.

No other circuits if this type have been seen by the author. If anyone knows of any similar circuits, perhaps they'd ley me know via EA.

The Healing 44B

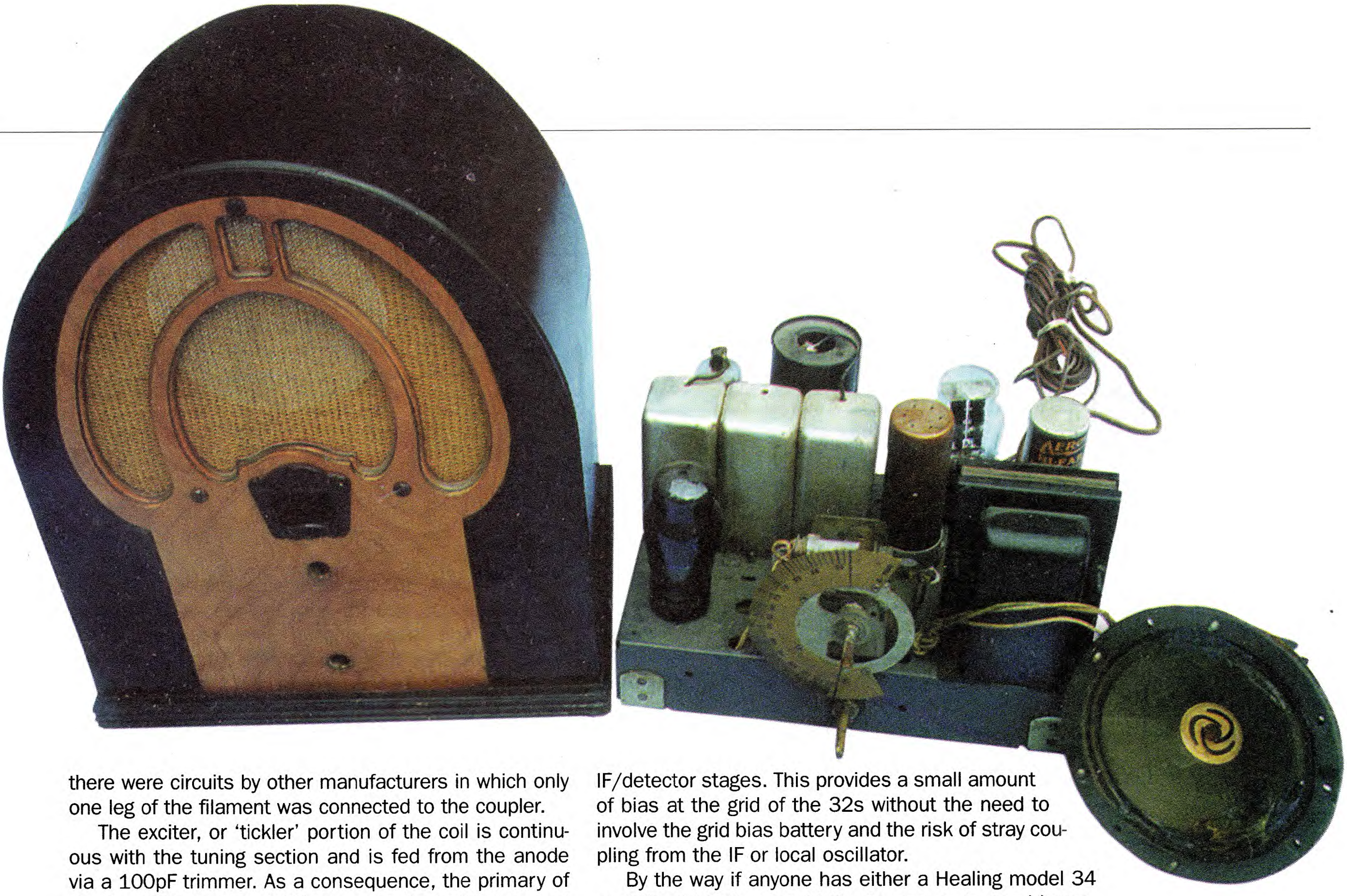
This Healing, again from 1934, is a four-valve battery superhet. The circuit shown in Fig.2 has been redrawn from a poor copy of a very badly drawn original, for clarity.

Generally speaking, when using the older series valves type 30, 32 and 34, using only four valves was considered insufficient for a reliable battery superhet for anything else than a city location. The vast majority of battery superhets had at least an RF stage, and many went on to have push-pull class-B output using either a pair of type 30s, or the new type 19. To ensure reliable oscillator performance, many designers chose a type 30 or similar valve for a separate oscillator. So the minimum tended to be six valves, with many brands having seven or eight.

However, two valves changed all that: the 1A6 converter, and the type 33 output pentode. The 'Pentagrid 4' described in *Wireless Weekly* for May 1934 used those two valves, and could indeed claim to be 'a first of its type'.

So, why the four valve configuration in the Healing 44B? In fairness, if the radio was released in 1934, it was probably designed in 1933, and so hadn't kept up with the rapid pace of change.

This is indeed a four-valve battery superhet, but uses the old type 32 as an autodyne converter. Notice that the oscillator 'coupler' winding is in the filament; in fact there are two coupling windings, one on each side. They are (or should be) bifilar wound, and were done this way to ensure that each of the filament wires were at the same RF potential. This enhanced oscillator stability, but



there were circuits by other manufacturers in which only one leg of the filament was connected to the coupler.

The exciter, or 'tickler' portion of the coil is continuous with the tuning section and is fed from the anode via a 100pF trimmer. As a consequence, the primary of the first IFT is un-tuned. If it were shunted with the usual compression trimmer, the RF voltages would be shunted to earth via the bypass capacitors and/or the battery, and consequently it would not oscillate.

Indeed, the author spent many, many an hour puzzling over a similar oscillator circuit in a badly cannibalised Healing model 73B, in which an IFT had been scrounged from another Healing chassis and had two compression trimmers. It steadfastly refused to oscillate, despite completely re-winding the oscillator coil. When the trimmer was disconnected, *voila*!

The volume is controlled by varying the grid bias on the variable-mu type 34 IF amplifier. An RF choke is between the volume control and the bias battery to prevent stray IF being coupled back through the batteries to HT and causing instability. However why the 0.1uF bypass capacitor is earthed via the antenna coil primary is a mystery.

Next comes another unusual feature for an Australian radio: a regenerative IF amplifier/detector stage. The plate of the type 32 leaky grid detector is connected via a five-plate trimmer to a small tickler winding on the second IFT, as you can see.

Anyone who has tinkered with one- and two-valve regenerative detectors will know the importance of regeneration to receiver performance. Unfortunately, it is a characteristic of regenerative detectors that the amount of regeneration must be altered with each setting of the tuning capacitor. However in a superheterodyne, the intermediate frequency is fixed, so that the setting of the regeneration would be adjusted once during alignment procedure and then left alone. Such a control would inevitably be a chassis control, and not a panel control. Such an arrangement could considerably improve the performance of the IF amplifier — especially when using the older type 34 tube, which has only about half of the gain of the 1C4.

Another feature you may have noticed is 'grid leak detection' in both the converter and regenerative IF/detector stages. This provides a small amount of bias at the grid of the 32s without the need to involve the grid bias battery and the risk of stray coupling from the IF or local oscillator.

By the way if anyone has either a Healing model 34 or 44B which they would like to see go to good home, would they kindly contact the author.

Another regenerative IF

With the onset of the internet (and a corresponding offset of commonsense and money), many American radios are being added to Australian collections after being purchased through 'eBay'. The small Philco cathedral model 80 is a typical example. The cabinet of this set with the chassis removed is shown in Fig.3.

The four valves and the three coil cans are clearly shown. The valve lineup includes types that were not widely used in Australia — for example the first of the 6.3-volt series types 36 and 37.

In the Philco model 80, a type 36 is used as an autodyne mixer, and the oscillator arrangement is much as the Healing model 44B; that is the oscillator coil is energised from a 100pF trimmer directly from the plate of the 36, and the primary of the IFT is again untuned.

There is only one IFT in this receiver and no separate IF amplifier. The IFT with its tuned secondary is the input to the regenerative second detector, which again uses a 36 with grid leak biasing and regeneration feedback from the plate via a series trimmer. The audio output from the detector feeds a type 42 in the output stage.

A bench test of this receiver was very disap-

Fig.3: *The cabinet and chassis of a Philco model 80, a mains powered set with a circuit very similar to that of the Healing 44B. This particular set was purchased from the US via the Internet.*

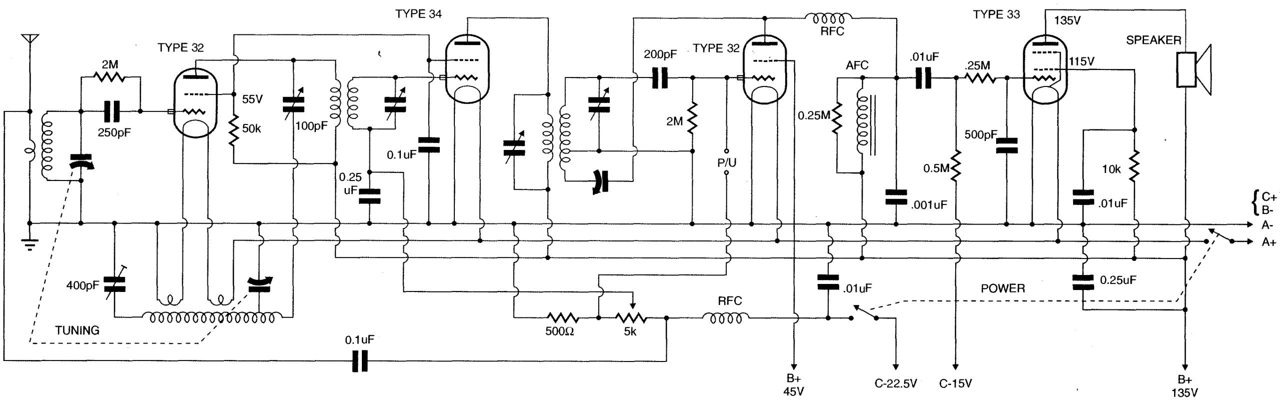


Fig.2: *The Healing model 44B battery set, a somewhat anachronistic 1934 superhet with a regenerative detector.*

pointing. Selectivity was reasonable, but the sensitivity was woeful. This is despite the receiver supposedly having been 'electrically restored'. Perhaps the trimmers were wiggled loose in transit!

The factory notes for this set make interesting reading. To quote:

The schematic diagram will indicate that regeneration is employed in the circuit of the second detector. Regeneration is controlled by the throttle condenser (18) which may be adjusted from the back of the chassis.

It occurs to us that some over-zealous fellows may make this adjustment too critical, instructions to the contrary, with the possibility thereof of calls from owners complaining of birdies in their sets.

If the adjustment of the regeneration is too critical, a change in the weather may be sufficient to cause the second detector to spill over into oscillation.

So if you get any birdie complaints, remember condenser (18) and dive for it. (So there!)

Editor's nightmare

In the April 1, 1932 issue of *Wireless Weekly* there appears the circuit shown in Fig.4, with a caption describing it as 'the technical editor's nightmare'. Whilst it may have been an April Fool's Day gag, it appears not to be, for the discussion was continued for several issues thereafter. Evidently, an after-dinner discussion took place between the magazine's technical editor and one Mr Barry of Philips Lamps, described as 'a theorist in the extreme sense of the word'.

Would it work? It probably would, but to quote the text 'it seems to us that the circuit is quite practical, but the advantages do not warrant the amount of trouble which would have to be expected to get this job in ship shape form'.

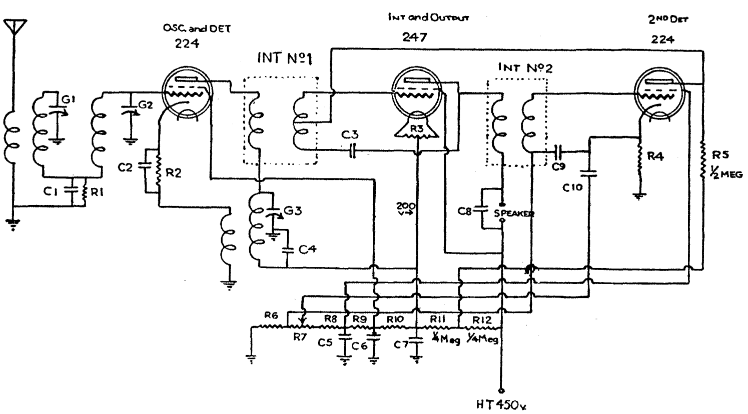


Fig.4: *Was this design the reflex to end all reflexes? Published in Wireless Weekly for April 1, 1932, it's a superhet with IF reflexing around the Loftin-White audio amp stages.*

To start with, the front end is a preselector tuned by G1 and G2. C1 and R1 were the means of providing adequate and stable coupling of the coils, and typical values were about 5nF and 10k. The first stage is a fairly standard autodyne mixer/oscillator, and the padder is not shown in series with G3.

Now the fun begins. As you can see the first IF transformer stage feeds into the type 47 output valve, used here as a reflexed IF amplifier as well. The IFT is centre tapped, so that it can be neutralised 'with the Rice system'. If you follow the phase relationships of the IF signals through the 47 to the 24A, you will see that neutralisation is necessary.

The audio output transformer (connected to the terminals marked 'speaker') is in series with the primary of the second IFT ('INT No2') and bypassed by C8 (approx 10nF). Next the signal is passed to the 24A anode bend detector and audio amp, which is connected with the 47 in the well-known Loftin-White configuration. The text explains that R5 is the *famous half-meg resistor of the Loftin-White, and the resistor bank R6, 7, 8, 9, 10, 11 and 12 is the normal direct-coupled arrangement with the hum-bucker.*

Not shown is the speaker field, which shunts C7. Otherwise there would be no 200V appearing at the 47 cathode. R7 is purely for hum minimisation; as you can see there is no DC connection between the 24A's cathode resistor and R7.

The biggest problem with this circuit would be getting the voltages correct. The type 47 requires about -16 volts grid bias, which is usually obtained by making the cathode positive to the grid. This means that the anode of the 24A would have to be at precisely 184 volts, which would not be easy with 20% tolerance resistors. When using a type 45 triode as the power tube, the bias is something like -50 to -60 volts, which is much easier to obtain by voltage division using a similar circuit.

The 'RF return' for the secondary of IFT1 would be via C3, the primary of IFT2, C8 and the 2 or 4uF paper filter capacitor at the 450V output from the rectifier. C4 to C7, C9 and C10 are all bypass caps of typically 0.5uF, R10 would be about 12k, and R7, R8 and R9 all about 5k, with R6 having a value of 200-300 ohms.

There is no provision for volume control. This would have to be either by varying the screen voltage of the 47, or completely shunting the antenna input, neither of which is particularly satisfactory.

It makes you wonder why they bothered. Then again, to be fair, these were heady days, and how many circuits which proved to be quite satisfactory started out by doodling and throwing around a few ideas? Either that, or neither gentleman was a total abstainer... ea