Vintage Radio

By RODNEY CHAMPNESS, VK3UG

The Healing "Scales" 403E receiver

In the late 1940s, the main household receiver was usually located in the lounge or dining room – and usually controlled by the "man of the house" in line with the rather chauvinistic attitudes of the time. However, small 4-valve mantel receivers designed for use in the kitchen were also becoming quite common.

The Healing 403E – it looked rather like a set of kitchen scales and was often affectionately called the Healing "Scales".

ONE LIMITATION ON the use of multiple sets in a household was the radio receiver licensing regulations. Initially, they required a licence for each individual "wireless" and in fact, back in the sealed receiver era in the 1920s, a separate licence or fee was payable for each station that a person wished to listen to. Fortunately, this idiotic idea was overturned within a rather short time.

However, with one set per licence, there was no incentive to buy more than one set and receivers were expensive anyway. Retailers had to submit a return to the PMG on what sets they sold and to whom, so it was not too hard for the authorities to find out who had unlicensed sets. The mandatory outside aerial was also a dead giveaway. Of course, many home-built sets were never licensed.

Eventually, the licensing regulations were eased and the household licence came into being, allowing several sets to be used. Ultimately, domestic radio and television licensing was abolished on 1st September, 1974. To read more about this subject, go to: http://wireless.iserv.com.au/default.asp?m=main&id=age3

The Healing "Scales"

To meet the need for more than one set in the household, many manufacturers produced small low-performance 4-valve sets. Healing was one of those manufacturers and produced many sets. One that has taken the fancy of many collectors is the Healing 403E or as it is affectionately called by some, the Healing "Scales", supposedly because it looks like a set of kitchen scales.

The set came onto the market around 1950. It would appear that it is designed to be placed on the kitchen bench as the dial scale is on the slop-

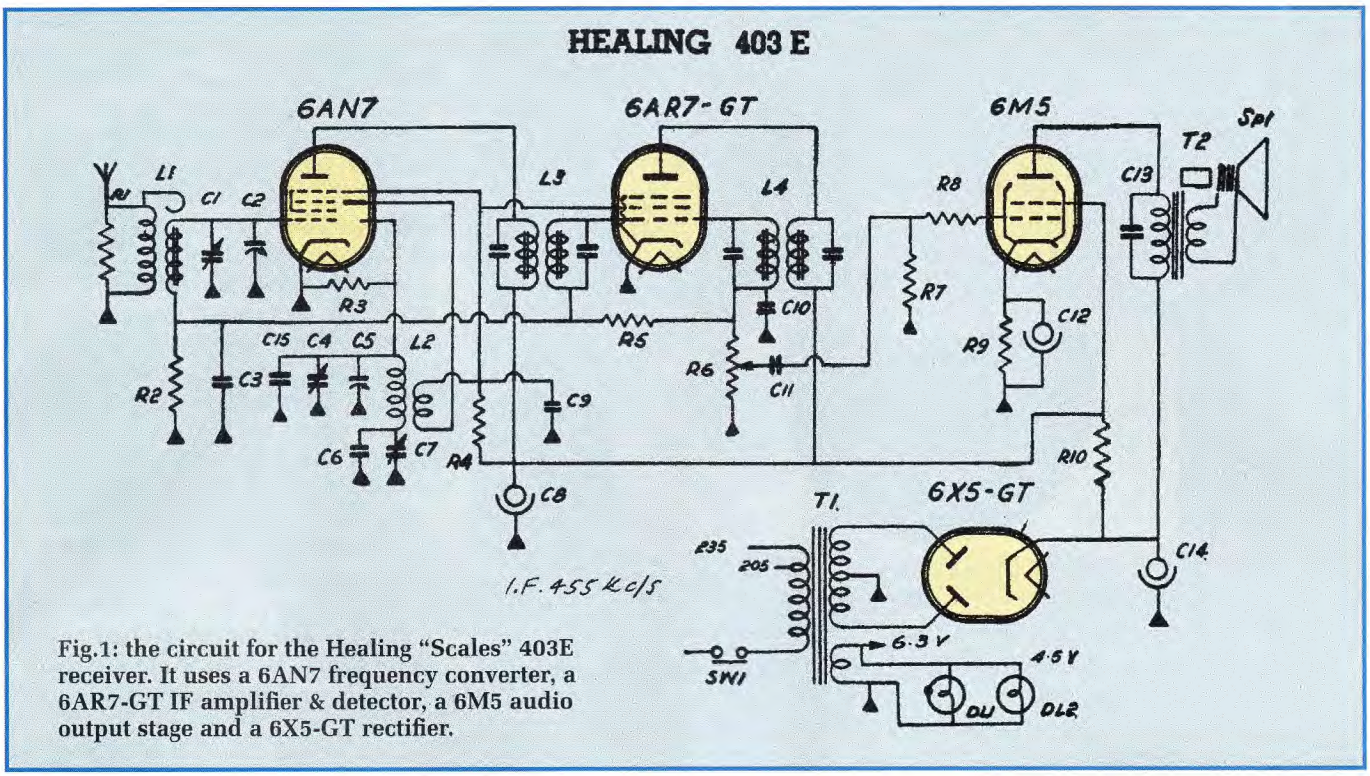


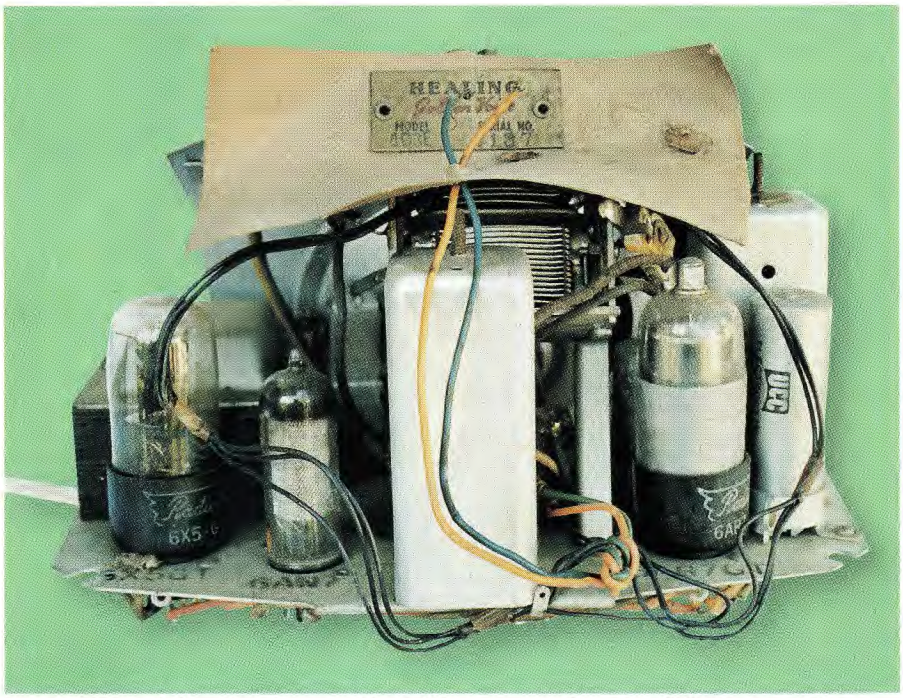
Fig.1: the circuit for the Healing "Scales" 403E receiver. It uses a 6AN7 frequency converter, a 6AR7-GT IF amplifier & detector, a 6M5 audio output stage and a 6X5-GT rectifier.

ing top of the set. It is then really a bench top or table set and not a mantel receiver. It was quite an innovative concept although in the kitchen environment it may have been splashed with water or food. However, despite the potential abuse, the sets survived quite well.

The receiver is separated quite easily from its cabinet, requiring the removal of three screws in the Bakelite base, four screws attaching the chassis and the cabinet top together and the two control knobs.

Warning: once the set is removed from the cabinet, do not tip it upside down onto the dial scale, as it will break. To make sure the dial scale is not damaged, remove it and put it aside until alignment or reassembly is to take place.

This receiver had not been restored at the time of writing. Access under the chassis is quite good and any component there can be adjusted or replaced readily. However, caution is needed when operating this receiver out of its case as the mains terminations are exposed on the bottom of the power transformer. If the set were mine, I would put a protective insulated cover over these terminals. It would be all too easy to touch these exposed terminals while concentrating on other aspects of the restoration process.

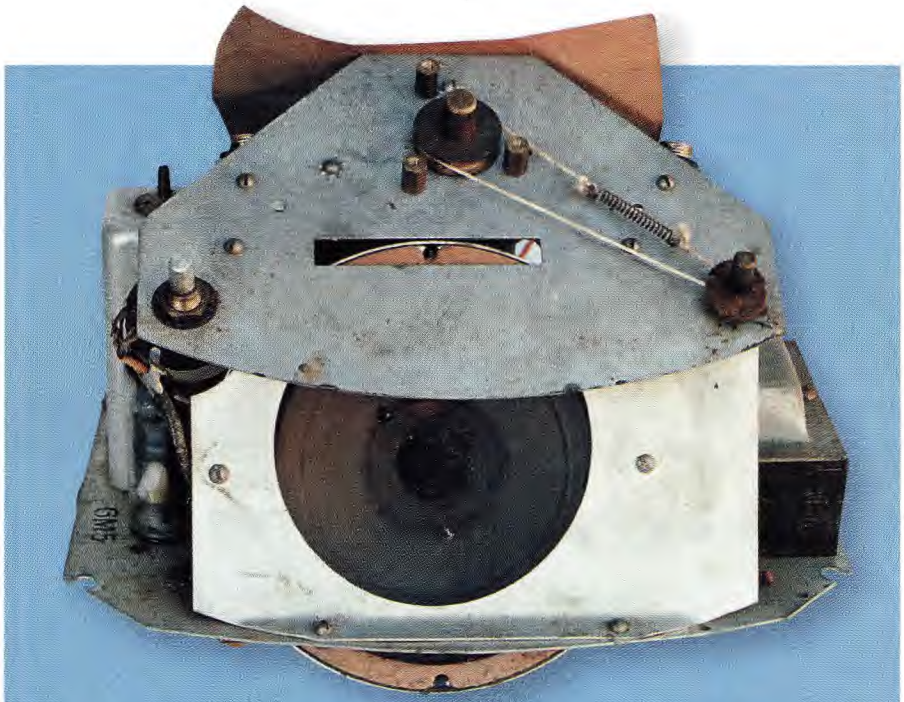


A rear view of the chassis out of its cabinet – note the very tight layout. The receiver uses just four valves.

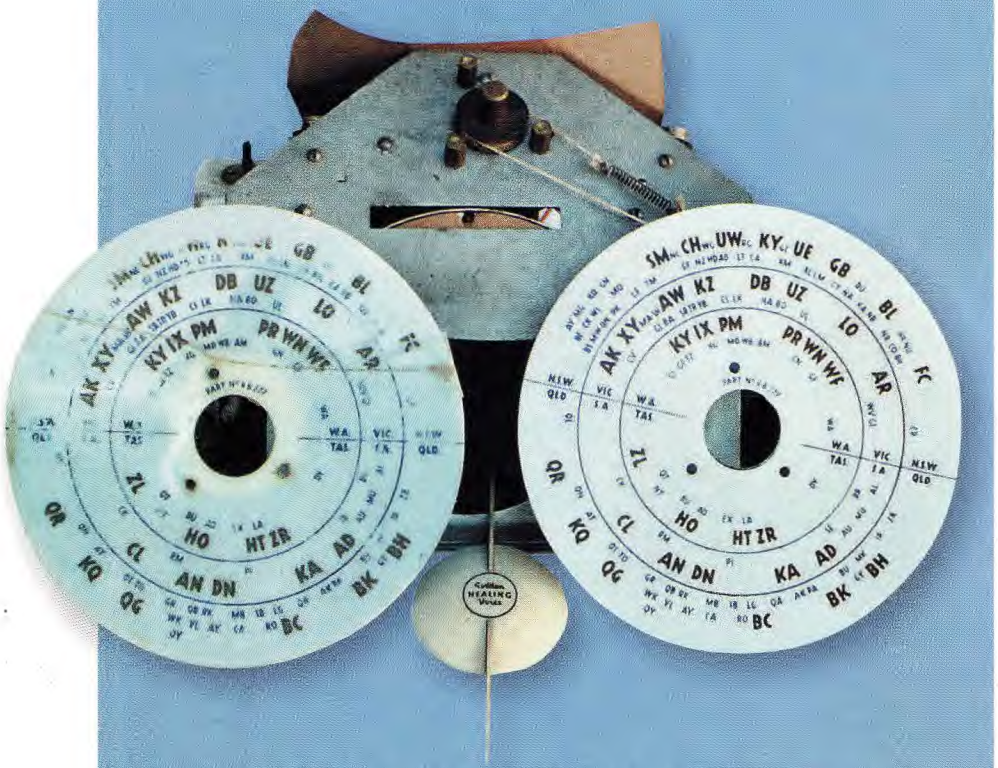
Of course, the twin flex should be replaced with a 3-core mains lead, so that the chassis can be earthed. Suitable replacement power leads are available as extension cables of various lengths at most supermarkets. Just cut off the socket and you will have a lead ready to wire into the chassis.

Better still, you can often salvage perfectly good 3-core power cords during council cleanups, as people often discard computers and other appliances.

Above the chassis, the components are tightly packed in and some dismantling would be required to work



This view shows the chassis from the front. The parts on top of the chassis were rather tightly packed.



Another view of the chassis from the front, this time with repaired (left) and replacement dial scales.

on a few items. Fortunately, work here is not required as often as underneath the chassis.

Circuit highlights

The Healing 403E is really a 3-valve plus rectifier receiver, similar to many sets produced by other manufacturers of the era.

A 6AN7 is used as a frequency changer with an output of 455 kilohertz (kHz) to an IF amplifier using the pentode 6AR7-GT as the amplifier. The two diodes in the 6AR7-GT envelope act as the detector and automatic volume (gain) control (AGC). The AGC is simple and only a third of the AGC voltage is applied to the 6AN7 and the 6AR7-GT via the voltage divider of R2 (1MΩ) and R5 (2MΩ). The audio (and AGC) voltage is applied across R6 which is then applied to the grid of the 6M5 audio output valve.

The converter and IF amplifier are run with no bias on their grids but because their screen voltage is only around 50V, the current drain is not excessive. There will be a small amount of bias provided from the AGC line, even off-station, as any circuit noise and external interference will generate an AGC voltage, small though it may be. Tuned to a station, the bias is significantly higher. By only applying a third of the developed AGC voltage to the two controlled valves, more signal is able to be applied to the 6M5 to achieve a reasonable audio output level.

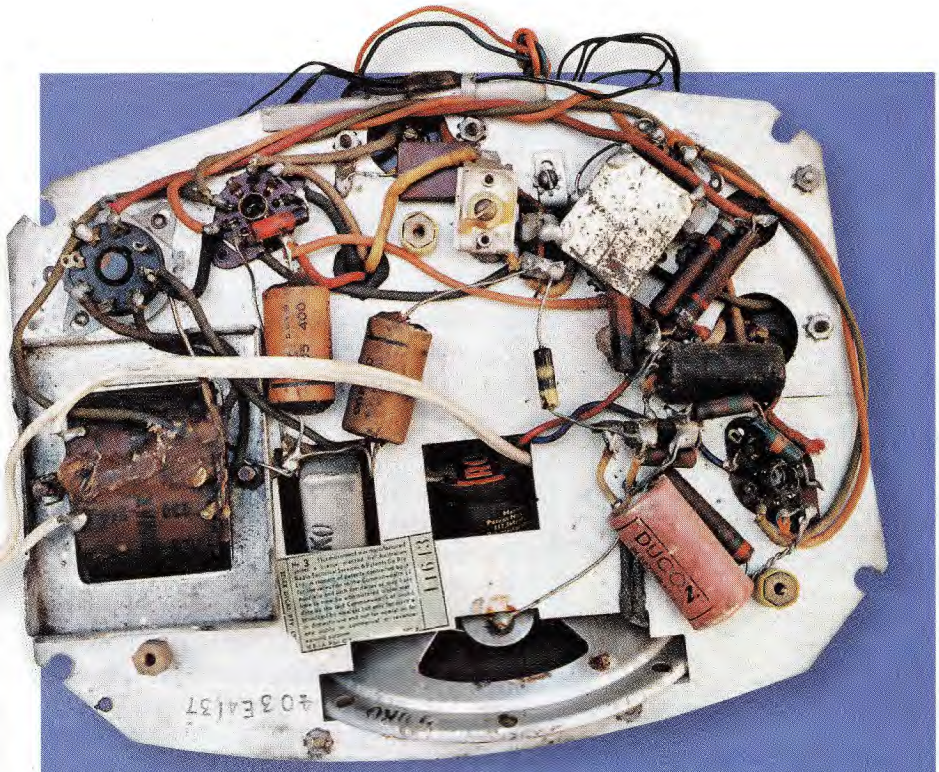
As a purist, I find only applying a third of the available AGC voltage is a poor design feature. However, when it is considered where the set was intended to be used – suburban areas not far from radio stations – it works quite satisfactorily. The 6M5 has the common cathode bias method, which provides around 6V of bias with a current drain of around 25mA in this receiver. The total current drain of the receiver is around 37mA from the 6X5GT rectifier.

Those with a sharp eye will have picked up drafting errors in the published circuit. The secondary winding of L4 (second IF transformer) appears to go to the grid of the 6AR7GT but should connect to a diode or both of the diodes within the 6AR7-GT. The oscillator grid is also not shown connected to the third grid. Labelling the valve pin numbers would also help servicemen and restorers. It is amazing the number of drafting errors that did creep in.

Overhauling the set

Simple receivers like the 403E do not require many paper capacitors to be replaced when compared to more complex 5-valve designs. Most of the paper capacitors in this receiver can be quite leaky and still not cause any noticeable or dangerous problems.

The only critical one is C3, the AGC bypass capacitor, and this should be replaced as a matter of course. The



The is the under-chassis view. Note that the power cord terminations are quite exposed and that only 2-core flex has been used – it should be replaced with a 3-core lead, so that the chassis can be earthed. The mains transformer has also been overheating, as revealed by the congealed wax on the bottom of the windings.

audio coupler (C11) has only a small voltage across it (a maximum of around 20V). If this is leaky, all it will do is place a negative voltage on the grid of the 6M5 and progressively cut it off as the volume control is increased or a stronger station is tuned in. C13, if shorted, would just cause the audio to disappear but no damage would be done to the set.

Electrolytic capacitors C8 and C14 should be reformed if necessary, after being tested with an ohmmeter to ensure there are no short circuits between the high tension (HT) line and the chassis. My rough and ready technique is to place a voltmeter across C14, turn the set on and wait until the voltage across it starts to rise. Once it has risen to 50V or so, I switch off and then, about 30 seconds later, I repeat the procedure, this time letting the voltage rise to around 100V before switching off.

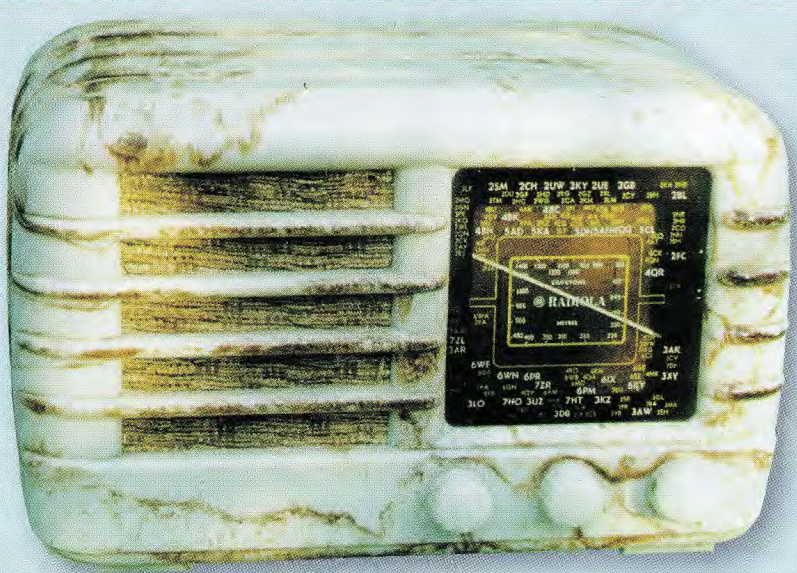
Do this over a period of several minutes and the electrolytic capacitors should be reformed. However, watch the voltmeter and the rectifier when doing this, making sure the rectifier doesn't look as though it is overheating (the plates will go red, if this happens) and that the voltage does increase rapidly once the rectifier starts to conduct. After the preceding tests, check with the power off to see if the electrolytic capacitors are warm to the touch. If they are, they should be replaced, as they are defective. The set should also be run for a while to make sure the power transformer only gets moderately warm.

In this set, it is obvious that the power transformer has dripped some wax, so it has been hotter than it should be. Before doing too much on this set, it would be advisable to do checks on the transformer for shorts and insulation integrity, as well as checking the rectifier and electrolytic capacitors for potential shorts or low resistance to earth (chassis).

Initially, the set should be run with the transformer lightly loaded, by taking out all the valves and leaving just the dial lamps in. If it gets other than slightly warm, the transformer may have a fault. If all is well, the general tests indicated in the previous paragraphs should be undertaken. The problem may have been fixed sometime in the past but it does pay to be very sure that there is no latent fault in the power supply area.

Manufacturers often skimped on

Photo Gallery: AWA 519M (1947)



Manufactured by AWA in 1947, the 519M is another example of a popular 5-valve mantel receiver of that era. It was fitted into a bakelite cabinet, the brown-white mottled unit shown here being one of the less common cabinet colours. The valve line-up was as follows: 6A8-G frequency changer; 6SK7-GT IF amplifier; 6SQ7-GT audio amplifier/detector/AVC rectifier; 6V6-GT audio output; and 6X5-GT rectifier. Photo: Historical Radio Society of Australia, Inc.

fitting some components. In this case, a 100nF (0.1µF) or similar value capacitor has not been put across C8 to effectively bypass any RF energy on the HT line. When first installed, capacitors like C8 are reasonably effective RF bypasses but as time goes by, their effectiveness deteriorates and the receiver will often develop an instability problem.

Although this set has not been restored as yet, I would expect that very little would have to be done for it to function quite satisfactorily. I rarely find that any valves need replacement, providing the critical capacitors are replaced before the set is turned on.

Aligning the set

This is a comparatively easy set to align, with a total of eight adjustments. Basically, the four tuning slugs in IF amplifier transformers L3 and L4 are peaked for best performance on a relatively weak signal at 455kHz. It is not imperative that the frequency be exactly 455kHz as long as it is within about 10kHz of 455kHz.

The front-end alignment is a little more exacting, as several frequencies are involved. The dial scale needs to be attached to the receiver so that the alignment can be done with accuracy. Take note of the warning earlier in the article about how easy it is to damage the dial scale.

The data I have on the receiver is not specific about the spot frequencies used in the front-end alignment. As a general rule, 600kHz and 1500kHz are usually used. If you don't have a signal generator, tuning to stations near to these frequencies is quite adequate, like 621kHz for 3AR (3RN) and 1521kHz (2QN) in my area.

First, tune to around 600kHz and adjust C6 (under the chassis) until the particular station selected appears at the correct spot on the dial. Then adjust the core of L1 for best volume on this station or a weak one nearby.

Now tune to a station near 1500kHz and adjust C4 (on top of the gang) so that the station tuned to appears at the correct spot on the dial, and then peak C1 (on top of the gang) for best performance. Go over the adjustments for 600kHz and 1500kHz several times, as they do interact with one another.

For more information on these procedures, refer to my articles in the December 2002, January 2003 and February 2003 issues of SILICON CHIP.

Summary

This set is a quirky little receiver that doesn't appeal to all, although highly sought after by many collectors. I believe that it would be easily restored. The performance is on a par with sets of a similar design. The design of the AGC system means that it really hasn't enough gain to produce good performance in country areas but it would be quite adequate in suburban locations. I wouldn't say no to having one in my collection. **SC**