Vintage Radio

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Pocket-sized valve portable radios

During the era before transistors took over, manufacturers went to extraordinary lengths to produce portable valve radio receivers. None went further than the Japanese, although their miniature valve portable receivers were never marketed in Australia.

"Portable" radios first started to appear in numbers in the 1930s, although a few innovative portables did appear as early as the mid 1920s. These early sets were quite bulky and heavy and by today's standards, were portable in name only.

Some of those original sets used 2V valves and required a 2V wet cell (A battery) for the filaments. They also required around 135V from a dry battery pack (B battery) for the high-tension (HT) plate and screen voltages. Certainly, people had to be serious about their desire to have radio "wherever they went". Radio stations of the time were fairly low-powered and programming was limited, which restricted the usefulness of early portable sets.

In addition, the battery requirements were quite onerous. The wet cell required regular maintenance and care, including measuring the specific gravity of the electrolyte, keeping the top clean and dry, recharging it at regular intervals and making sure the set was not tipped over.

Tipping the cell (battery) over meant that acid would leak out of the battery and damage the set as well as the battery itself (sulphuric acid is quite corrosive). By contrast, the better designs used dry batteries for the filaments, usually two 1.5V cells in series. The 2V supply for the valve filaments was obtained simply by connecting a resistor in series with this 3V supply.

The dry batteries used for the HT supply required no special maintenance. However, they were heavy and expensive to replace.

This is the view inside the Global miniature portable. The components are tightly packed together.

Portables become portable

In Australia, sets that could truly be classed as "portable" started to appear around 1938. This coincided with the introduction of battery valves which were designed to work from 1.5V and 90V filament and HT voltages. These sets were still quite a struggle to lug around but they were much easier to use than the earlier sets and the battery life was much longer than in sets using valves with 2V filaments.

Although these sets were a big improvement on the original portables, people really wanted something even smaller. As a result, a size of around 350 x 160 x 230mm (W x D x H) became the standard for portable receivers during the late 1940s and the 1950s. Even then, the weight of the sets with an AC power supply and batteries could be as much as 7kg. That said, these sets performed well and had a reasonable battery life of around 300 hours.

Getting smaller

The demand for even smaller sets during this period forced a few compromises. The antenna loop was made smaller by necessity, the sets generally had no RF stage and they used quite small batteries. In fact, the batteries only lasted 30-40 hours before needing replacement.

A typical "miniature" receiver of

this type was the Breville 801, which was featured in the February 2007 issue. This radio measured just 120 x 120 x 160mm – about a fifth the size of the larger sets. These radios enjoyed only a short period of popularity due to their lack of sensitivity and high battery costs.

By contrast, the larger portable sets continued right through until the advent of transistor receivers.

Japanese miniatures

In the years preceding the introduction of transistor receivers, Japanese manufacturers revisited the idea of producing miniature valve sets. As a result, they produced sets that were roughly the same size as the pocket transistor receivers we marvelled at in the late 1950s and early 60s.

These miniature valve sets had four valves in a conventional superheterodyne circuit. This consisted of a 1R5 converter stage, a 1T4 intermediate frequency (IF) amplifier, a 1S5 as a combined detector, AGC diode and pentode audio amplifier, and a 3S4 audio output stage which fed a speaker or headphones/earpiece.

So how well did these little receivers perform? The critical component that affects performance in such small sets is the antenna. In these radios, the ferrite rod antenna varied from quite small to some that ran nearly the length of the case and were from 6-9mm in diameter. Those sets with the larger rod antennas were likely have been better performers – certainly better than the older Australian-manufactured miniature portables of the late 1940s and early 1950s.

Personally, I can not remember seeing any of these miniature Japanese sets on the Australian market. In fact, I had seen only one of these really tiny sets before until the HRSA 25th anniversary celebrations, where I saw several in Laurie Harris's display. Apparently, they were used only in Japan (where they were manufactured) and in the USA. The 10 sets in Laurie's collection came from the estate of another collector.

Small is beautiful

So just how small were the Japanese miniature sets? Well, let's compare the size of the smallest set – the Global – with an AWA 450P miniature portable. The AWA set is 115mm wide x 115mm deep x 240mm high, while the Global is 145mm wide x 50mm deep x 95mm high. This means that the AWA set is 4.6 times the size of the Global, while the standard portable is nearly 19 times the size of the tiny Global.

Inside the Olympic #450 4-valve miniature receiver. The ferrite rod antenna is similar to that used later in transistor radios.

Removing the HT battery gives good access to the under-chassis parts in the Olympic #450. There's some chassis corrosion but the set is otherwise in good condition.

Australian manufacturers such as Astor, AWA and Breville built these small sets for just a few years. They probably stopped making them because the batteries were relatively expensive and didn't last all that long, plus the performance of these radios left quite a bit to be desired.

By contrast, the performance limitations were not such a problem overseas, as AM broadcasting stations were much closer together than in Australia. The battery life would still have been a problem but affluent Americans didn't worry about that and the Japanese liked gimmicky sets, so the battery cost was not a major concern there either.

At the time, we were impressed at the way AWA, Astor and Breville managed to pack the necessary parts into the space available for their portable sets. This initially makes you wonder how the Japanese got all the parts and valves in the cabinet, along with a reasonable loop antenna and a set of batteries.

In fact, the Global is only marginally larger than the ubiquitous No.482, 45V battery of the 1950s and 1960s!

The answer is that most of the parts have been miniaturised to some extent. However, instead of using hearing-aid style valves as you might expect, the

These 10 miniature valve portable radios are all owned by Australian collector Laurie Harris. They were sold only in Japan (where they were manufactured) and in the USA.

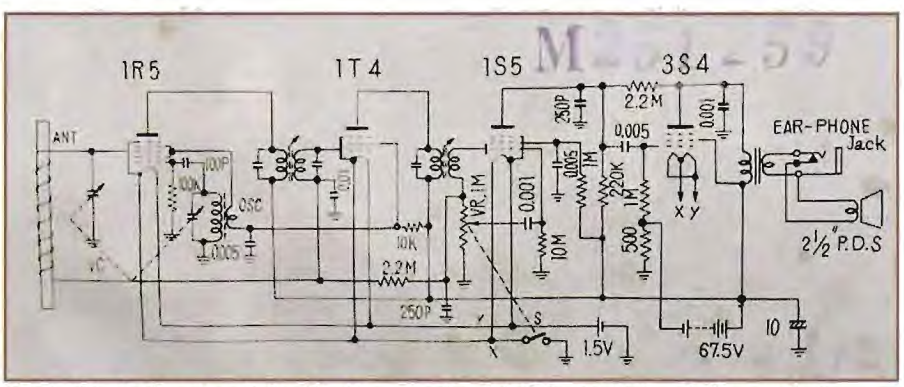


Fig.1: this is the circuit for the Harpers Model GK-501. It is a full superhet circuit with four valves: a 1R5 converter stage, a 1T4 IF amplifier, a 1S5 detector/AGC diode/audio amplifier and a 3S4 audio output stage.

Japanese manufacturers chose to use the normal miniature series valves, as mentioned earlier; ie, 1R5 converter, 1T4 intermediate frequency (IF) amplifier, 1S5 detector and first audio stage, and 3S4 audio output stage. In addition, the ferrite rod loop antennas used in the "larger" miniature receivers were of quite reasonable dimensions.

By contrast, the tuning gangs are miniature air-spaced types rather than the plastic film types used later in transistor receivers. The coils and transformers, although miniature, are not as small as those used later in transistor receivers, while the loudspeakers used were normal 50-75mm round units.

Battery life

Although parts miniaturisation was well done, shrinking the battery sizes meant that the battery life was severely reduced. In the Australian miniature portables, the 1.5V filament "A" battery was usually two D cells (950) in parallel. By contrast, the Japanese miniature sets use either a single 1.5V "D" cell or, in the smallest sets, a "C" cell.

In practice, a single "D" cell would last a little under half the time that two of these cells would working together, while a "C" cell would last perhaps 1/5th of the time that two D cells would. In fact, the life of a "C" cell may have been as little as five hours of continuous operation, while a single "D" cell would probably have lasted about 12 hours.

The 67.5V and 45V high-tension (B) batteries used would have had quite a short life too – probably much the same as the C-size cell. The smallest of these miniature batteries was around the size of three 216 batteries end-to-end.

These batteries were probably more energy dense than the Australian equivalents, the larger miniature batteries probably lasting about 15 hours and the smaller units no more than about five hours. Certainly, the owners of these sets would have soon become rather tired of buying and changing batteries.

The current drain in most units is about 250mA for the filaments and around 9mA for the HT. However, one unit (the Global) has a means of reducing the filament current to 150mA, as described later.

Miniature receivers

The 10 miniature portables owned by Laurie Harris are all shown in an accompanying photograph. The top row, starting at the left, shows the Fleetwood case, then the Fleetwood (one of the larger units) and the Global (the smallest).

In the second row (left to right) are the Olympic #450, the Standard "Muse" SR220E and the Crown PR530. Below these are a Zephyr RN7, a selection of miniature batteries as used in these sets and a Hilton 3672.

The bottom row houses a Continental, a Harpers GK501 and a Harpers GK301 which has the same chassis as the Crown PR530.

These sets all appear to have been predominantly for the American market. How many other makes and models appeared on the market is unknown. It is rather surprising that none (or very few) appear to have been imported into Australia.

The view inside

Several other photographs clearly show what these little receivers were like inside. The small Global would probably have been the worst per-

A selection of miniature valve portable radios and batteries at a recent HRSA display. The radios could easily be mistaken for the portable transistor radios that appeared a few years later.

former, with probably the shortest battery life. Close inspection shows that the components are laid out quite logically, with considerable thought given to keeping everything compact with little waste space between the parts.

The rod antenna for the Global is also quite small, so its performance would not have been outstanding when it came to sensitivity or audio output. It really is a "personal portable".

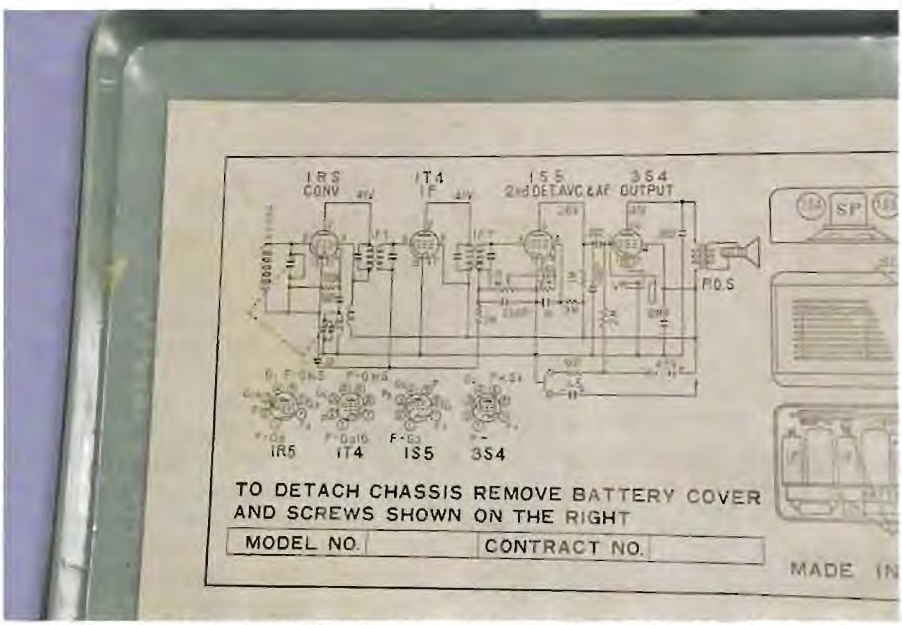
There are a couple of interesting design features in this set which are worth mentioning. The HT comes from a 45V miniature battery which would have a longer life than a similar-sized 67.5V battery. The filament battery is, however, only a "C"-size cell, so its life would be quite short. If the cell were a premium grade item, a life of perhaps 10 hours could be obtained but a generic standard quality item may only last around five hours or so.

However, this little set had one trick up its sleeve when it came to battery life. When an earpiece was connected, the plug open-circuited the filament line to the 3S4 which reduced the filament current drain to 150mA, at the same time removing the HT current drawn by this valve.

This meant that when the set was used with an earpiece, the life of the batteries was probably doubled.

Inside the Harpers GK501 miniature valve portable. The layout is similar to the other sets, with the parts all packed tightly together.

The largest and the smallest compared: the Fleetwood (left) is the largest of the 4-valve miniature portables, while the Global (right) is the smallest.



A label affixed to the inside back of the Global miniature portable shows the circuit diagram and other information. The earpiece disconnects the filament supply to the output valve when it is plugged in, to reduce current drain.

By the way, the earpiece would have been a high-impedance crystal type. Crystal earpieces were common back in the 1960s but can be difficult to source today.

The Fleetwood is the largest of the sets and would probably be the best performer. There is a remarkable amount of room in the set for the valves and other components, along with room for a reasonably-sized 67.5V battery (around half the volume of a No.467 battery). The filament voltage comes from a single premium D cell.

The largish ferrite rod antenna sits behind the HT battery towards the front of the set. Unlike the previous set, the headphone socket is on the output side of the speaker transformer and **all** stages remain in operation when using an earpiece. However, the circuit trick used in the Global to reduce current drain when using an earpiece would have been a good idea in this set and in all the other sets.

Overall, this set would have been a much better performer than the Global and may have even been a better performer than the AWA and Astor 1940s equivalents. However, its battery life would have been much less.

Surprisingly, this receiver also appears to have provision for 110V mains input. However, from what Laurie and I could see, the 110V lead would have had a plug at both ends which would have been quite dangerous, if not potentially lethal, in use.

Another interesting receiver is the Olympic. The views under the chassis and in the back of the set reveal that it is remarkably easy to gain access to important items for servicing. In fact, the underchassis wiring, although tight, is not any harder to access for service than in many larger receivers.

The lack of suitable batteries has forced Laurie to make up batteries to power some of these sets. On the day

of my visit, only one radio had a set of useable batteries. The performance was quite satisfactory and is a tribute to the designers.

Conventional circuits

Some of the receivers have their circuits and other general information pasted inside the back cover. The circuits of all these sets are quite conventional. The only variation is the power consumption savings with the Global when it is used with an earpiece.

The Global receiver was of particular interest to me because of the extent of its miniaturisation and the use of only 45V for the HT. Its audio output would probably be somewhere around 100mW with a new battery.

The component count is also quite low, the set using just seven fixed resistors and eight fixed capacitors. All of the sets appear to have used padderless tuning capacitors.

Summary

These miniature 4-valve portables really are fascinating little receivers. The manufacturers did an excellent job in getting the best out of them, although they would have been mediocre performers in the Australian environment. However, in their intended market – ie, the USA – their performance would have been quite satisfactory.

These little sets really show how far the Japanese manufacturers were prepared to go to miniaturise their sets in the era before transistors took over. They would be a worthwhile addition to a vintage radio enthusiast's collection but being so rare, not many collectors will have the opportunity to own them. SC

Photo Gallery: Philips 1203 3-Valve TRF

RELEASED BY PHILIPS LAMPS (AUSTRALIA) LTD IN 1931, the model 1203 had a selling price of 24 pounds and 10 shillings which was many weeks wages at that time. The adverts described the piano-finished cabinet as representing the ultimate in consoles "at home in any home"

The set was a 3-valve TRF and the valve line-up was as follows: E442S detector, C443 audio output and 506 rectifier. Photo: Historical Radio Society of Australia, Inc.