

by PETER LANKSHEAR



My favourite 'Dinosaur': the Majestic 90

Someone has aptly referred to American console receivers made from 1928 to late 1930 as 'Dinosaurs'. Reptilian dinosaurs were very successful, some extremely large; but most disappeared over a short period — to be replaced by more compact and advanced animals. The same thing happened when the big TRF receivers gave way to compact superheterodynes...

Fortunately, the era of the big TRF 'Dinosaurs' came before imports of American receivers were restricted. As a result, some good examples of these monsters can be found in Australasian collections.

My personal favourite from this period is the Majestic 90 series, and no receiver was more appropriately named. Majestic they certainly were — massive, and although built using what was already an obsolescent technology, they were nevertheless an outstanding and most successful family of receivers.

Most remarkable was the meteoric history of the manufacturer, Grigsby-Grunow of Chicago. Founded in 1921, the Grigsby-Grunow-Hinds Company as it was originally called, first made celluloid sun visors for cars. In 1924, they entered the rapidly growing radio industry, making horn speakers with celluloid horns. The following year they were ready for a rapidly growing demand for battery eliminators, with the 'Majestic A and B Current Supply'.

During 1926 and 1927 their next model, the 'Super-B' eliminator was so successful that the company became very profitable. But then disaster threatened: AC powered valves became freely available. With battery eliminators out of fashion, a rapid change in product was essential for survival.

Early in 1928, the company reorganised as Grigsby-Grunow, and raised a public share issue of \$800,000. They extended their plant, leased further space and commissioned Radio Frequency Laboratories to design them a receiver. RFL obliged with an eight valve neutralised-triode TRF, with three type 226 directly heated valves as RF amplifiers, a type 227 indirectly heated grid leak detector, and another 226 audio amplifier driving a pair of 171A output triodes. The rectifier was the inevitable

280. A significant feature was a moving-coil loudspeaker.

The initial 60 and 70 series both used this same chassis, the main differences between models being the elaboration of the cabinets.

Mass production

Henry Ford had demonstrated the efficiency of the mass production line — concentrating on one model, with each worker skilled at a few repetitive tasks. Grigsby-Grunow adopted similar methods with equal success, and claimed that less than 15 worker hours were required for each receiver produced.

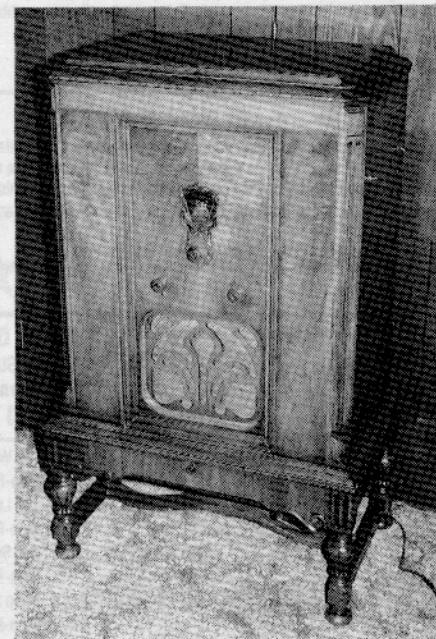
Whereas most radios were still made with moving-iron speakers, even the lower priced Majestic receivers had massive moving-coil units — efficient, and with enough bass and volume to flatten

the competition. The unbeatable combination of dramatic audio quality and competitive price guaranteed Grigsby-Grunow's success.

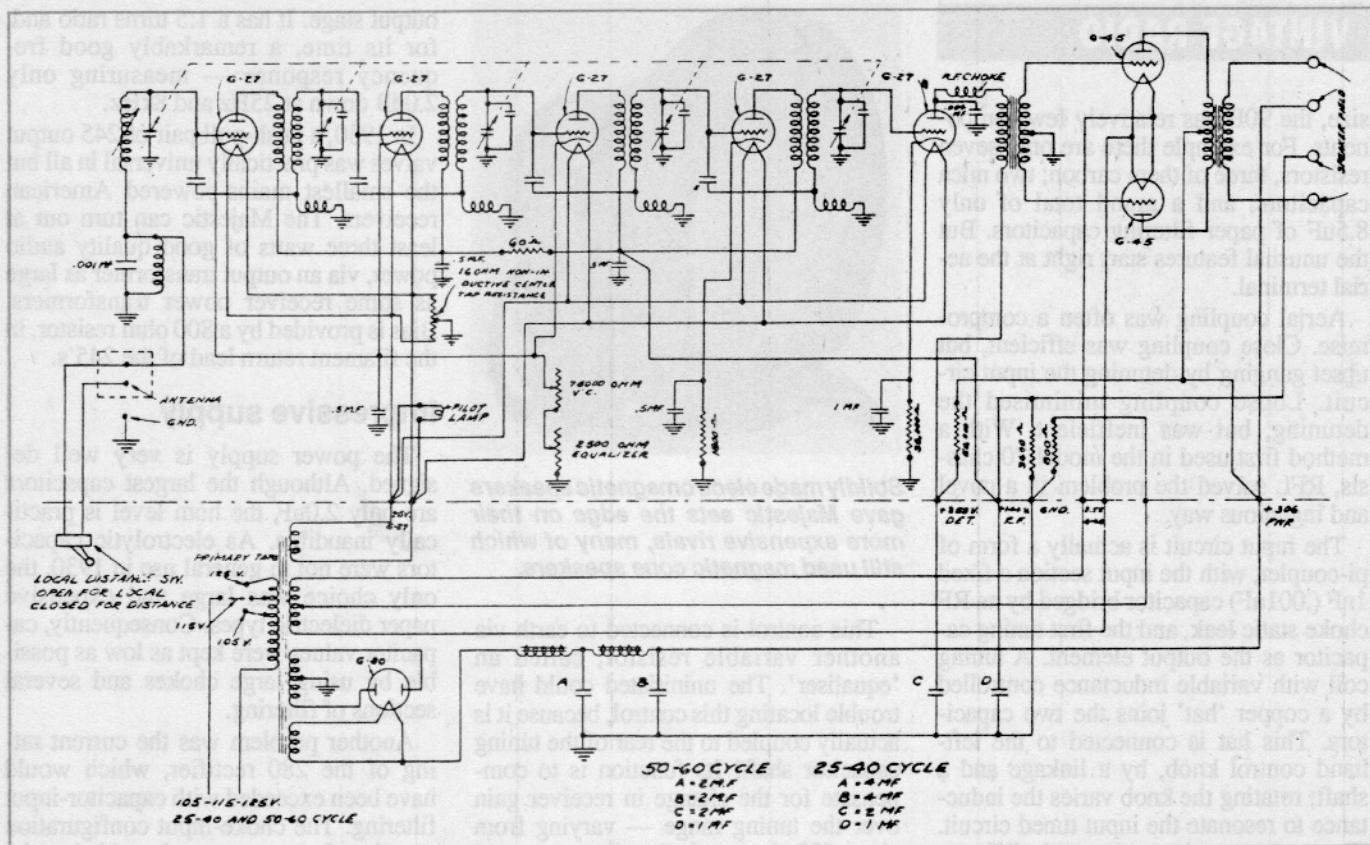
Early in 1929, a new handsome console cabinet known as the 70B was introduced, with the original chassis modified using a separate power supply. At the same time they introduced a deluxe chassis for the up-market model 180 series. The 180 had 227 valves instead of the type 226, and a high power audio amplifier using large type 250 output triodes.

'Mighty Monarch'

By July 1929, when RCA was already selling receivers using the type 224 screen grid valve, RFL had developed for Grigsby-Grunow a third 'all triode' circuit: the unique model 90. This retained a separate power supply and used



The model 90, on the left, was the budget-priced version fitted with the 90B chassis. At right is the more ornate model 102 radio-phonograph combination.



Except for a mains ballast resistor and separate power supply, the circuit for the earlier model 90 was practically identical to that for the 90B, shown here. The model 100 radio-phono chassis had an added changeover switch.

a pair of the newly introduced type 245 output valves, following a string of 227 indirectly heated triodes.

Sales were phenomenal, and by August 1929, 11,000 employees were making 5000 receivers a day! With a turnover for the year ending 31 May 1930 of \$61,000,000 and 25% of national radio production, Majestic were America's No.1 radio manufacturer. They were even making their own valves! Majestic had certainly made remarkable progress in two years.

For the first half of 1930, a modified chassis, the 90B was produced. The 90B retained the model 90 circuit, but with an

integral power supply. As before, the one chassis was used with various cabinet styles. The model 100/100B 'radio-phonograph' chassis had the addition of a changeover switch.

Called 'The Mighty Monarch of the Air', the 90/90B was probably the last major neutralised-triode receiver to be developed, and was unique in several significant ways.

Readers familiar with valve superheterodynes will know that superior models had a stage of tuned RF amplification ahead of the mixer valve. Two tuned stages before the detector were common in TRF receivers, with some larger mod-

els — including the Majestic model 70 — having three tuned amplifiers and a four-gang tuning capacitor.

FIVE gang capacitor

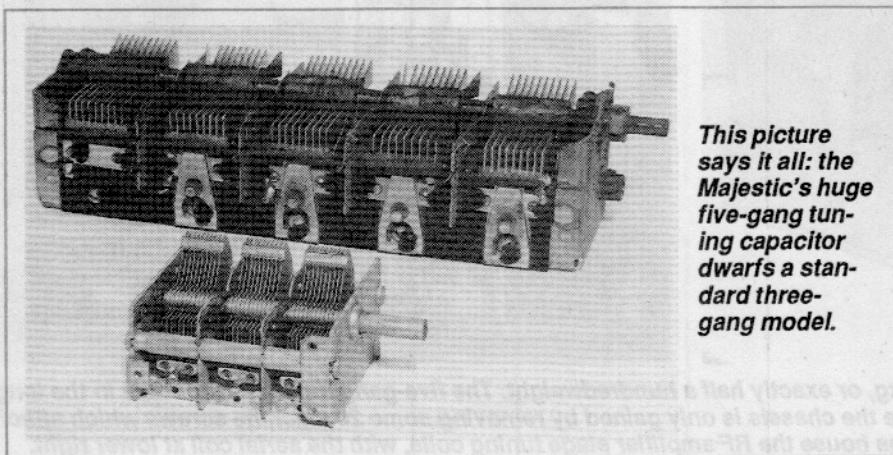
Not so the 90. It had FOUR fully tuned RF stages preceding the detector, requiring a five-gang tuning capacitor! Operating with this enormous gain at one frequency, stability could have been an insurmountable problem; but with short leads and plenty of shielding, RFL achieved a sensitive and stable design.

The grid-leak detector of the model 70 was replaced in the 90 by a more suitable anode-bend detector, driving the output valves through an audio transformer. With no intermediate audio voltage amplifier, the detector had to work hard, for at full output those 245 output triodes required 100 volts of grid to grid drive!

All this was powered by a husky power supply using the usual type 280 rectifier.

One claim made for the Majestic 90 was that it was 'hum free'. With the majority of early mains powered receivers, this statement could have been treated with a large dose of scepticism, but with its good filtering and low audio gain, the 90 series really was quiet.

A detailed study reveals that for all its



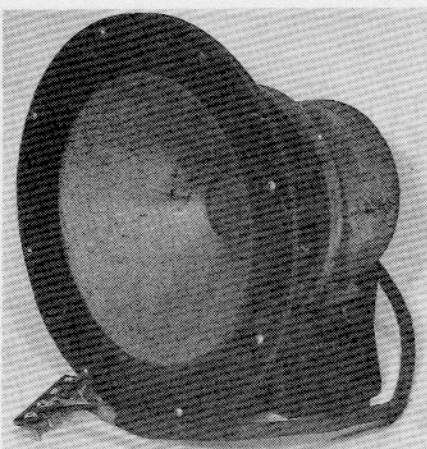
This picture says it all: the Majestic's huge five-gang tuning capacitor dwarfs a standard three-gang model.

size, the 90B has relatively few components. For example there are only seven resistors, three of them carbon; two mica capacitors; and a grand total of only 8.5uF of paper filtering capacitors. But the unusual features start right at the aerial terminal.

Aerial coupling was often a compromise. Close coupling was efficient, but upset ganging by detuning the input circuit. Loose coupling minimised the detuning, but was inefficient. With a method first used in the model 70 chassis, RFL solved the problem in a novel and ingenious way.

The input circuit is actually a form of pi-coupler, with the input section a fixed 1nF (.001uF) capacitor bridged by an RF choke static leak, and the first tuning capacitor as the output element. A tuning coil with variable inductance controlled by a copper 'hat' joins the two capacitors. This hat is connected to the left-hand control knob, by a linkage and a shaft; rotating the knob varies the inductance to resonate the input tuned circuit. The resonant point varies with different aerials and is quite sharp, but needs only minor adjustment over the band. To cope with very strong signals, a local/distance switch adds a capacitor in series with the aerial — actually the capacitance between the two switch leads.

The first three RF stages are identical. Each has a 227 valve neutralised by coupling to its grid, via a neutralising capacitor, a small out of phase voltage from the tuned winding of the following stage. Gain is controlled by varying the bias on these stages, with all three cathodes connected to the 75k ohm volume control.



Solidly made electromagnetic speakers gave Majestic sets the edge on their more expensive rivals, many of which still used magnetic cone speakers.

This control is connected to earth via another variable resistor, called an 'equaliser'. The uninitiated could have trouble locating this control, because it is actually coupled to the rear of the tuning capacitor shaft! Its function is to compensate for the change in receiver gain over the tuning range — varying from about 500 ohms at the low frequency end to 2500 ohms at 1500kHz.

The fourth RF amplifier is similar to the previous stages, again using a 227 valve, but with a fixed cathode bias resistor of 1.8k ohms. This optimises operation to provide plenty of detector drive.

Known as 'anode-bend', 'plate' or 'biased', the detector has a 34k ohm cathode resistor to bias the valve practically to cutoff, and has large signal handling ability with relatively low distortion. A key component is the inter-stage audio transformer, required to provide a very high grid drive voltage to the

output stage. It has a 1:5 turns ratio and, for its time, a remarkably good frequency response — measuring only 2.0dB down at 25Hz and 8kHz.

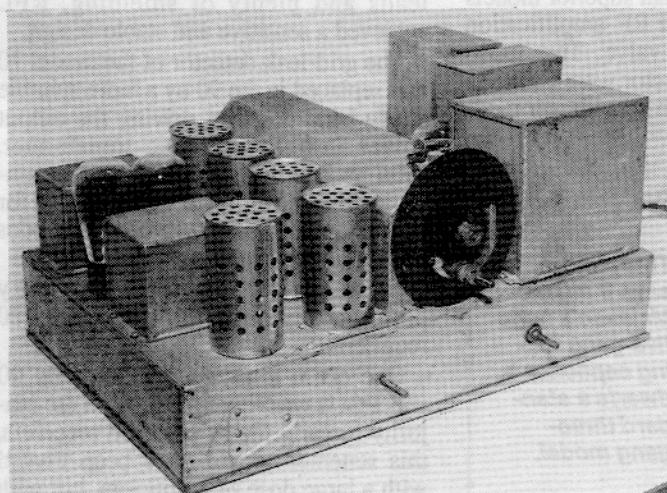
In 1930, a push-pull pair of 245 output valves was practically universal in all but the smallest mains-powered American receivers. The Majestic can turn out at least three watts of good quality audio power, via an output transformer as large as some receiver power transformers. Bias is provided by a 800 ohm resistor, in the filament return lead of the 245's.

Impressive supply

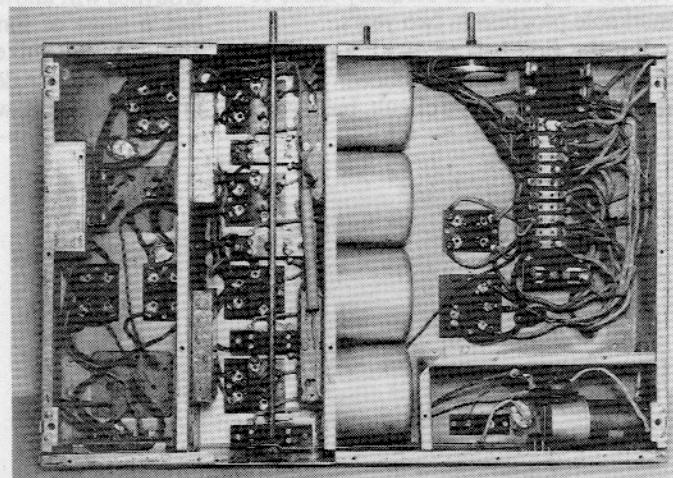
The power supply is very well designed. Although the largest capacitors are only 2.0uF, the hum level is practically inaudible. As electrolytic capacitors were not in general use in 1930, the only choice was large and expensive paper dielectric types. Consequently, capacitor values were kept as low as possible by using large chokes and several sections of filtering.

Another problem was the current rating of the 280 rectifier, which would have been exceeded with capacitor-input filtering. The choke-input configuration was therefore necessary, but this has the disadvantage of needing high power transformer HT voltages. In fact, the rectifier in a Majestic 90 has 1000 volts plate to plate. One works on a live chassis very carefully!

Finally there is the loudspeaker, a major factor in putting the Majestic receivers so far ahead of the competition. Weighing an impressive 6.8kg, the G3 'Colortura' model used in the 90B has a 210mm diameter cone (8"), made from fabric coated with sputtered zinc and with a cloth surround. There is no spider, but the cone is shaped to cover the end of



Left: A massive 90B chassis weighs 25.5kg, or exactly half a hundredweight. The five-gang tuning capacitor is in the long central shield box. Right: Access to inside the chassis is only gained by removing some 20 machine screws which attach the base plate. The four central shield cans house the RF amplifier stage tuning coils, with the aerial coil at lower right.



the centre pole piece and is positioned by a centring screw.

The speaker's field winding forms part of the voltage divider supplying the RF valves, and operates at about 50mA. It is wound with nearly seven kilometres of 36 SWG wire!

Logistics exercise

The smooth production by 11,000 people of 5000 complete radio receivers each working day — or one every 5.76 seconds — required considerable organising ability. William C. Grunow had been a captain in World War 1, and this experience must have been an advantage in controlling Majestic's 'army' of workers. Astronomic quantities of raw materials were required. For example, more than sufficient wire to encircle the Earth was used each day, while valves were needed at the rate of 5000 each hour.

There was no stockpiling. Contractors were expected to deliver a steady supply of materials, at the most only a few hours in advance of consumption — with serious consequences if there were any delays. There was a standing order for 30 railway boxcars each day, to take the finished receivers to the distributors — who had to accept their quotas regardless.

With the ruthless methods and mete-

oric rise in fortunes, the Majestic bubble had to burst. The depression, expensive fixed assets and inroads by firms like Philco put Grigsby-Grunow on the downward slide during 1931. By November 1933, they were in receivership and an asset sale was advertised in October 1934.

How does a 90B measure up today? Very well, although it demands a little

skill in managing the aerial tuning. Reproduction that was impressive in 1930 is still quite acceptable, even if the high RF selectivity makes it sound a bit 'mellow'. The sensitivity is about the same as for the average five-valve superhet, but there is an impressive quietness in the background to weak signals. My 'living fossil', which I bought 15 years ago for only \$25, still gets regular use. ♦

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