Vintage Radio

by PETER LANKSHEAR

Something 'different' from the UK

By the late 1930's receiver design was generally standardised and predictable, with a host of locally-made radios dominating the Australasian scene. But during the short period from 1937 to 1940, New Zealand was fortunate in having the Ekco brand receivers imported from England, and one of their 1938 pushbutton models, the PB289, is worth studying as an example of 'up market' British design.

Founded in 1922, the E.K. Cole Company of Southend-on-Sea soon became a major British manufacturer, with extensive facilities including a plastic moulding plant. At one stage they even made their own valves, which, although given their own type numbers, were equivalent to the standard Mullard range.

Having in 1931 pioneered the use of plastic, Ekco's Bakelite cabinets became a major specialty and in 1933 they employed leading industrial designers to create innovative and imaginative styles. Although concentrating on distinctive moulded cabinets, they did use wood for some of their top line receivers, including the model we're going to look at here.

The PB289 has a nicely proportioned cabinet with a very large square dial covering three bands — the European 'long wave' band from 150 to 300kHz, the standard medium wave or broadcast band, and short waves from 6 to 18MHz. To the right of the dial is a row of 12 pushbuttons.

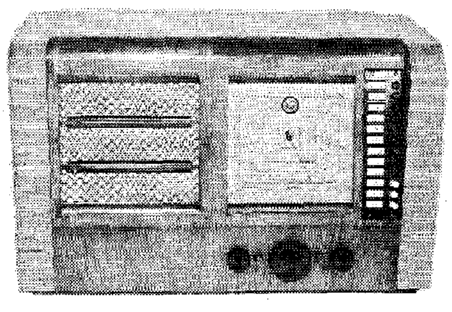
Pushbutton tuning, originally used in car radios, was the fashion feature for 1938 domestic receivers. According to one authority, of the 665 new British models for that year, no fewer than 231 had pushbutton tuning.

Three major systems were used. Most common were switched preset semi fixed-tuning capacitors or inductors, and telephone-type dials with finger stops linked to the tuning capacitor. More complex and expensive was the motor-driven tuning capacitor used in the PB289.

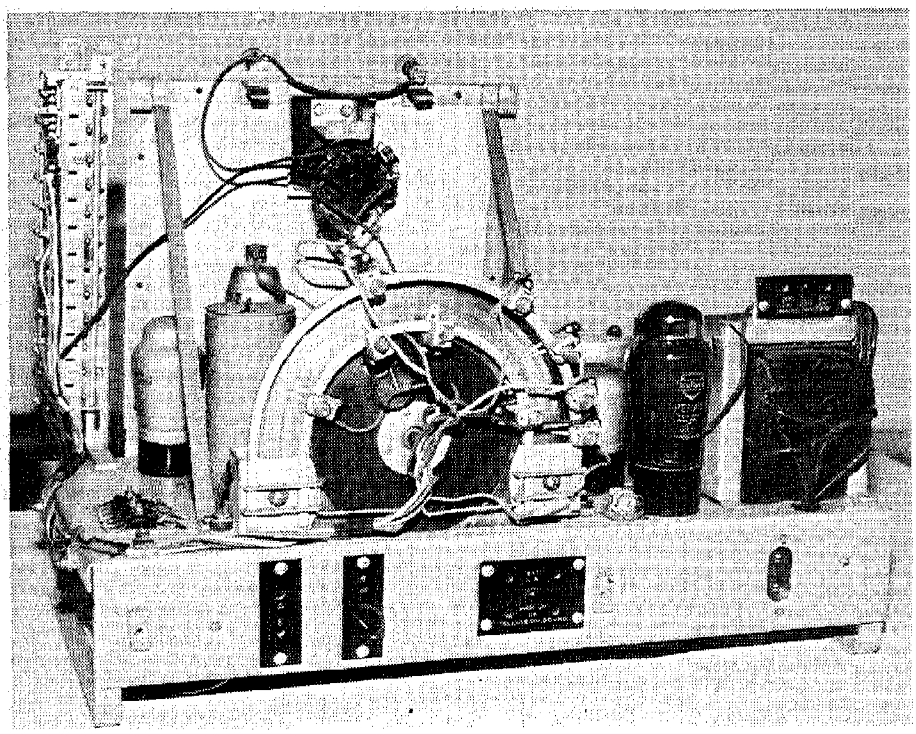
The PB289 motor can be used in the pushbutton mode to select broadcast band stations, and also to assist manual tuning. As it also controls bandswitching, there is no bandswitching knob! Instead, the three lower white pushbuttons are used to select the manually tuned long and shortwave bands as well as broadcast band manual operation.

Enclosed back

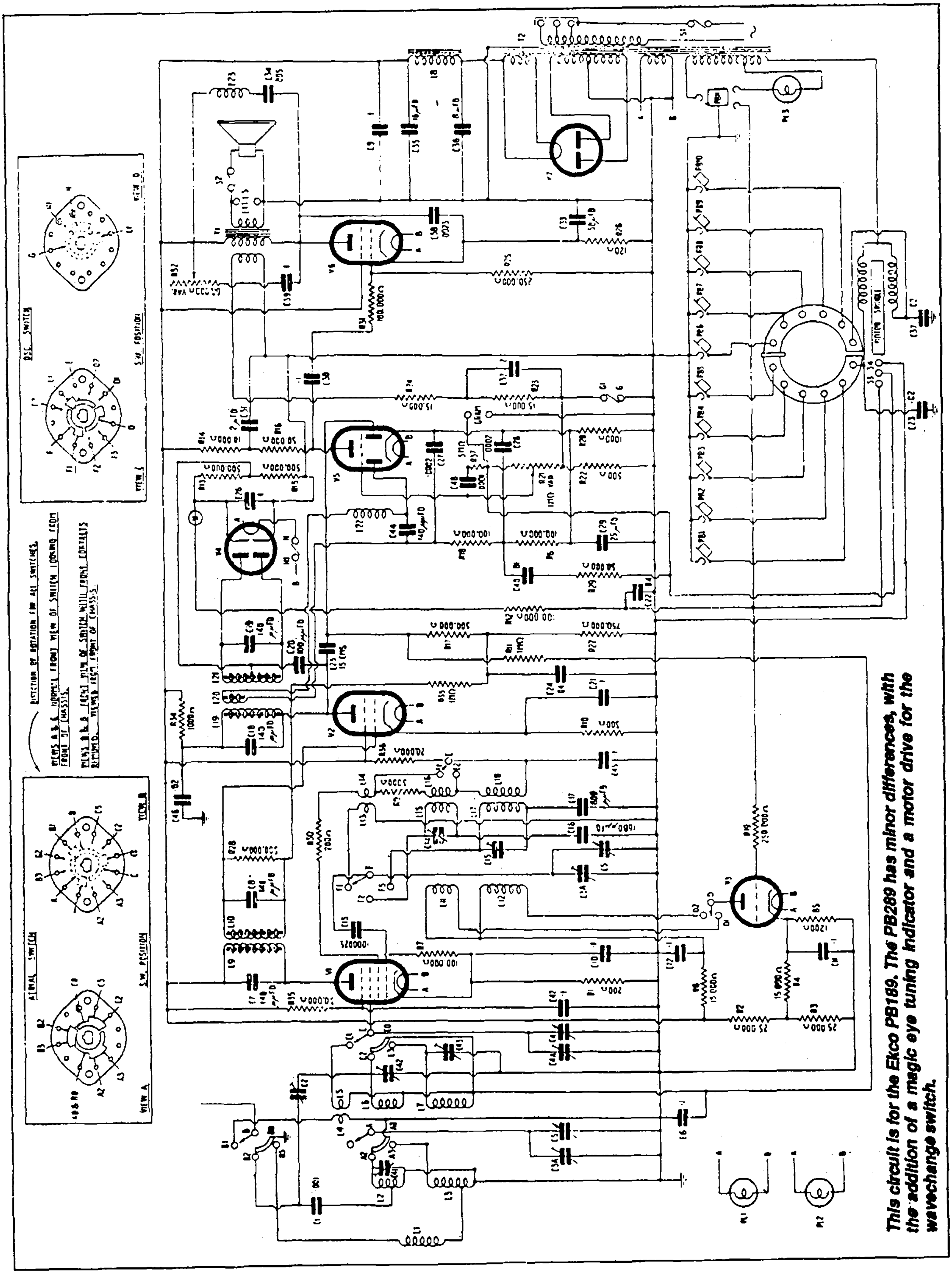
The PB289 incorporates two good features frequently found in European receivers. One was to protect the rear of cabinets with fibre panels, which although of questionable acoustic value, served to prevent contact with live termi-



Most of their receivers had distinctive plastic cabinets, but Ekco chose wood for the 1938 model PB289. At the top centre of the dial is the magic eye tuning indicator. Note the row of tuning selector buttons down the right.



Left: Dominating the rear of the chassis is the motor tuning assembly. Two semicircular rails carry the fingers which contact the commutating segments on the large 'Paxoline' disc.



This circuit is for the Ekco PB189. The PB289 has minor differences, with the addition of a magic eye tuning indicator and a motor drive for the wavechange switch.

nals — and which now provide a bonus for the collector by their having discouraged meddlers, dirt and mice!

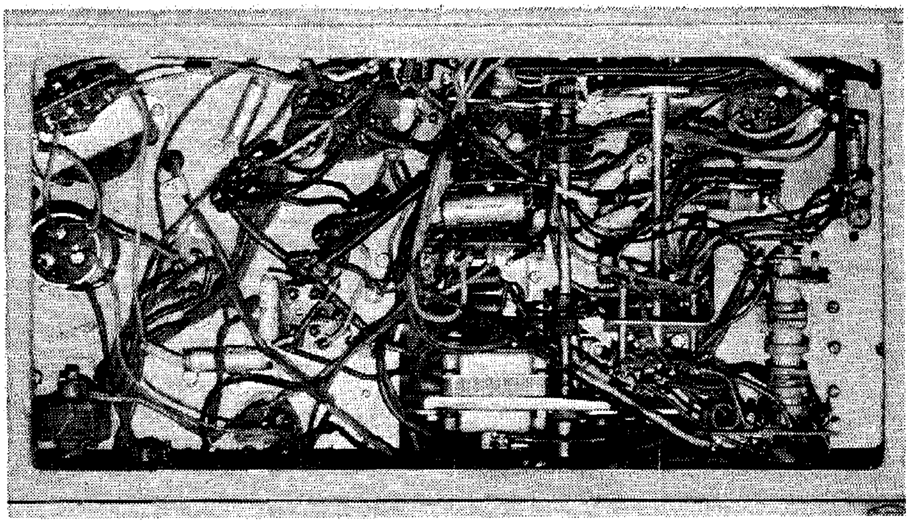
The other feature was a removable panel on the underside of the cabinet, providing access to the wiring without the need to remove the chassis.

With the back removed, the British metal-sprayed valves are immediately apparent. This 4-volt heater series was rarely seen in locally made receivers which, at the time, generally used American pattern valves, with a sprinkling of the Philips side-contact 'P' based series.

Dominating the rear of the chassis is the motor tuning control system disc, with its silver-coated contact plates and a frame fitted with two rows of adjustable contact fingers.

A circuit of the PB289 is not readily available, and the accompanying diagram is of the slightly simpler PB189. Differences are minor, the PB289 having the addition of a magic eye tuning indicator and motor drive for the wavechange switch.

Although the circuit appears to be complex, the PB receivers were basically conventional band-switched superheterodyne receivers comprising a triode-hexode mixer, an IF amplifier, a diode triode detector-audio amplifier and a power amplifier — plus of course, a rectifier. Each stage is significantly different in detail from contemporary local practice, and the component count is greater than for equivalent locally made receivers. Two additional valves, V3 and V4, are the heart of an automatic frequency control system, necessary to compensate for any lack of precision in the pushbutton tuning mode. An eighth valve is a 'P' based type TV1 'magic eye' tuning indicator. The design is conservative, with plenty of bypassing contributing to stability.



The underside of the chassis can be accessed by removing a panel on the cabinet bottom. Although many components are mounted on tag panels, the wiring has the familiar 'rats nest' appearance. Note the motor and drive shaft in the centre.

Image problem

The very low intermediate frequency of 126.5kHz simplifies tracking and provides considerable gain and selectivity, but also creates serious image problems, especially on short wave. Extra tuned circuits, following the aerial, are used to minimise images on the long and medium wave bands.

A different method of aerial coupling is used for each band. L4 is a conventional primary winding for shortwave, and longwave signals are connected through a loading coil L1. Broadcast band coupling is to a tap on L2, an efficient method commonly used for car radios, but ideally must be tuned for individual aerials. C2 is a phasing capacitor for further reduction of broadcast band images.

The oscillator circuit of the triode-hexode mixer V1 is complicated by the automatic frequency control valve V3, a general purpose type 354V triode, connected to HT via extra oscillator coil windings. V3 'pulls' the oscillator frequency, to an extent governed by the polarity and amount of its grid voltage — derived from the discriminator valve V4.

A type VP4B, having a screen grid rating of 250 volts rather than the more familiar 100, is used as the IF amplifier valve V2. The second IF transformer has a centre-tapped winding (L21) to feed V4, a 2D4B double diode discriminator. Similar to those used in FM receivers, the discriminator in this application generates the AFC control voltages. When the receiver is accurately tuned, there is zero voltage at the junction of R13 and R15, but off tune a voltage is generated, with a polarity and magnitude depending on whether the signal is above or below resonance, and the degree of mistuning. By controlling the anode current of V3, this voltage corrects any tuning errors.

Effective AGC

The diode detector configuration is slightly unconventional. Instead of the usual IF secondary winding, a small coil (L20) closely coupled to the primary of the second IF transformer is connected to L22 and C44, the combination being resonant at the intermediate frequency.

As AFC requires an effective automatic gain control system, the PB289 has an effective system with a delay of 2.5 volts, the voltage of the cathode of V5 above earth. C25 (which is rated in centimetres, an obsolete unit equal to 0.9pF) couples the anode of the IF amplifier anode to the second diode of V5, a type TDD4. The negative voltage from the rectified signal is the AGC voltage, and is applied through R11 to the grid of the TH4A mixer.

Only half the available control voltage is fed to the IF amplifier control grid. This is good practice, as the anode current of V2 is not reduced sufficiently with large AGC voltages to limit its signal handling ability.

The usual terminals were provided for a gramophone pickup. However, in the case of the PB289, they are labelled 'Pickup or Television Sound' and could be used in the UK with a low priced add-on TV unit made by Ekco for reception of the recently inaugurated Alexandra Palace television transmissions.

The medium-mu triode section of V5 operates as an audio amplifier resistance coupled to the PenA4 output pentode. The PenA4 was one of a family of European high transconductance pentodes, which had no American designed equivalent. Similar valves, but with 6.3-volt heaters, were the EL3 and EL33 — better known locally. These valves were twice as sensitive as the 6V6G, and in many receivers were successfully driven directly from a diode detector.

Negative feedback

One feature put the Ekco output stage considerably ahead of its time. Negative feedback had been developed by the Bell Telephone Laboratories to reduce cross-talk in multiplexed telephone amplifiers. By 1938, primitive negative feedback was being used around the output valve in some receivers, but usually this was simply a sample from the anode coupled back to the control grid. Although design becomes critical, feedback is more effective if it includes the output transformer, and also is around more than one stage.

Some contemporary Australian HMV receivers did use feedback from the voice coil winding over two stages. Around 1936, the BBC had patented the use of a separate feedback or tertiary output transformer winding for improved stability. Ekco used this method in the PB289, the feedback signal being applied through R24 to the bottom end of the volume control.

It is surprising that the system of connecting the feedback to the volume control was not used more, as it has some good features — the chief being that, due to the shunting of the detector diode, the amount of feedback decreases as the volume control is advanced and consequently, maximum gain is not limited by feedback.

A further uncommon feature is the combination of L25 and C34, connected across the output transformer primary and used as a series-tuned 9kHz whistle filter.

Permag speaker

The power supply is conventional, using choke L8 instead of a speaker field for filtering. Unlike contemporary local and American loudspeakers, which still used electromagnetic field magnets, Ekco loudspeakers had permanent magnet fields. British manufacturers had adopted Alnico alloy in 1936, and were well ahead in permanent magnet development.

Rather than the usual 8" speaker generally found in larger mantel receivers of the period, Ekco managed to fit in a 10" unit, with an improvement in bass response.

Rugged, reliable

The motor-driven tuning mechanism of the PB289 is rugged, simple and well built — reasons for the unit in the receiver illustrated still working flawlessly after more than 50 years.

At the heart of the system are a twin field motor and a fibre disk about 15cm in diameter. Attached to the rear face of the disc are silver-plated commutating segments, in the form of two half circles with a 1mm gap between them.

Surrounding the disk is a frame carrying adjustable clips carrying fingers in contact with the commutating segments, each one being connected to the return of a motor field winding.

Each finger is in turn connected to its own pushbutton, which when depressed, completes the circuit between a segment and earth, energising the motor which rotates the tuning capacitor and disc towards the gap between the segments. As the finger concerned encounters the gap, the motor is open circuited, and the rotation of the tuning capacitor stops at the position of the desired station. As a clutch ensures that the stopping is instantaneous, location accuracy is quite good, with any minor tuning errors corrected by the AFC.

Instead of a wavechange knob, the PB289 has a pushbutton for each of the three bands. Connected to the wavechange switch is a small disc, also with motor control segments. When a wavechange button is depressed, an electromagnetically activated dog clutch couples the motor drive to the wavechange switch, which is rotated to the required position. If the medium wave change pushbutton is left depressed, tuning becomes manual — but with motor assistance if required, controlled by buttons either side of the main tuning knob.

How does the PB289 perform? The pushbutton tuning works well, and there is good sensitivity. Tonal quality is above average. Used as intended, primarily for listening to local stations, it is an excellent receiver. The only real criticism is the image reception, which is apparent to a degree on the broadcast band and is very bad on the 6 to 18MHz band.

Motor tuning was a short lived fashion, but for the historian, is a significant development. The wartime austerity of the 1940's discouraged such non-essential frills, and after the War, switched capacitors or inductors and cam-driven mechanical pushbutton tuning methods proved to be adequate. Motor tuning is unlikely ever to be resurrected, for today non-mechanical remote controls provide pushbutton features that were once only possible in the dreams of science fiction writers. ❖