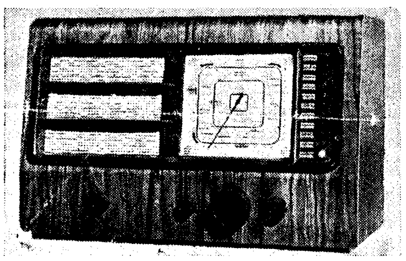
Supplement to The Wireless & Electrical Trader, April 6, 1946

"TRADER" SERVICE SHEET

765

EKCO PB189

Covering C389 CONSOLE and PB189U



The Ekco PB189 and PB189U.

AUTOMATIC frequency correction is used in the Ekco PB189 to ensure accurate tuning with the press-button motor drive.

The receiver is a 6-valve (plus rectifier) 3-band superhet with press-button automatic tuning for ten M.W. and L.W. stations. The S.W. range is 15-50 m.

The console version C389 employs an identical chassis except that the tone control is in a different position and eleven station press-buttons are provided. The PB189U is the PB189 with a Philips vibratory converter for D.C. operation. Details are given overleaf.

Release date, all models, 1938. Original prices: PB189, £13 2s. 6d.; C389, £16 5s. 6d.; PB189U, £15 4s. 6d.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. is via **C1** (M.W.), or **L1** (L.W.), to tappings on the primary coils of a band-pass filter circuit. Primary coils **L2, L3** are tuned by **C42**; secondaries **L6, L7** by **C46**. Coupling by mutual inductance of primary and secondary windings. Image suppression by **C40** on M.W.

On S.W. input is via coupling coil **L4** to single-tuned circuit **L5, C46.**

First valve **(V1, Mullard metallised TH4A)** is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator grid coils **L10** (S.W.), **L11** (M.W.), and **L12** (L.W.), are tuned by **C48.** Parallel trimming by **C49** (S.W.), **C50** (M.W.), and **C51** (L.W.); series tracking by **C10** (M.W.) and **C11** (L.W.). These trackers are fixed, but the coils have adjustable iron-dust cores.

Reaction coupling from anode by coils **L13** (S.W.), **L14** (M.W.) and **L15** (L.W.), the longer-waveband coils being short-circuited by switches **S20, S21** when not in use.

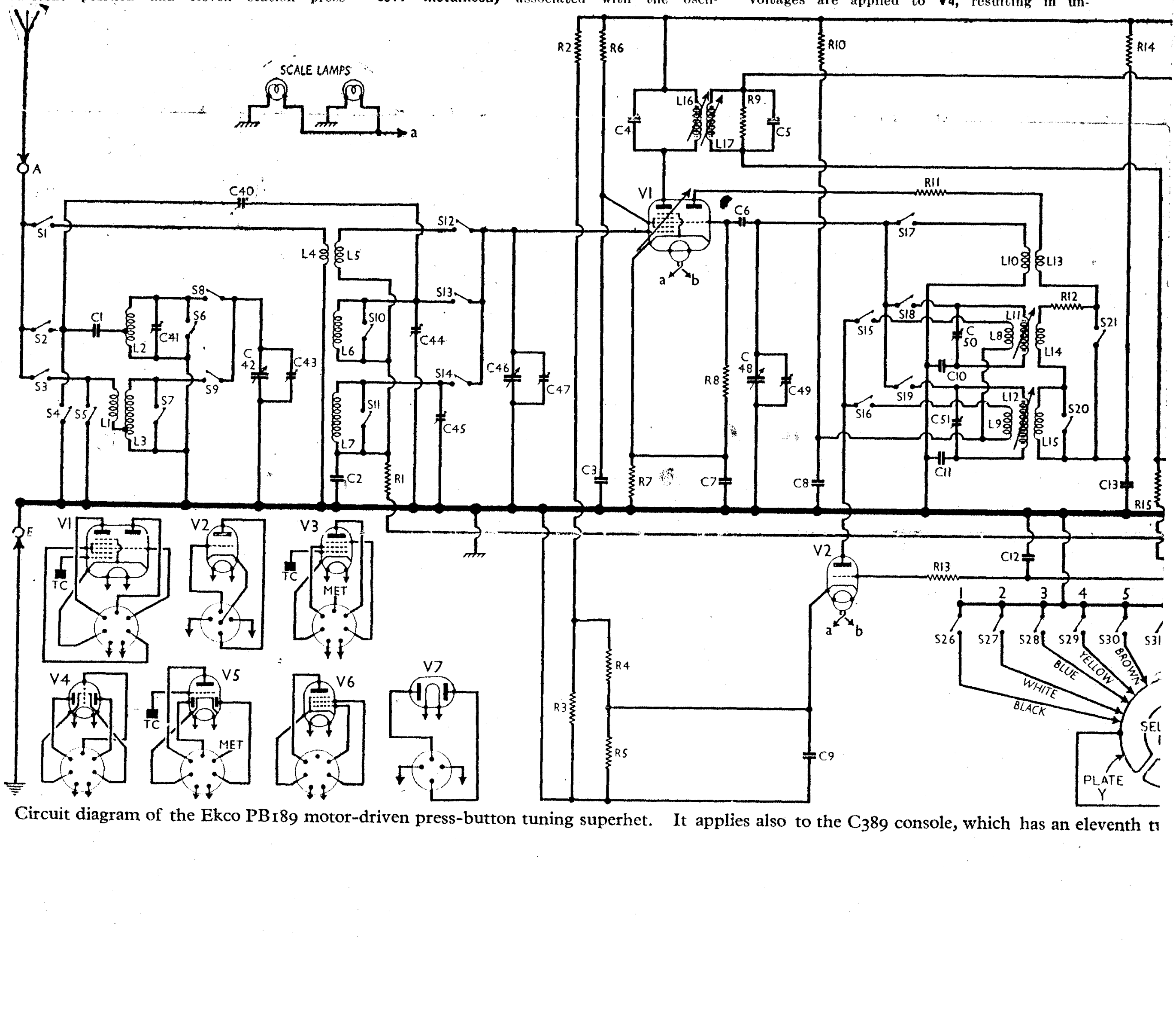
V2 is a triode valve **(V2, Ekco T41** or **Mullard 354V metallised)** associated with the oscillator circuit only in connection with the A.F.C. circuit, and will be dealt with shortly. Third valve **(V3, Ekco VP41** or **Mullard VP4B metallised)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-cored transformer couplings **C4, L16, L17, C5** and **C17, L18, L19, C18.** A further tuned secondary circuit **L21, C22,** remote from its primary but coupled to it by the link coil **L20,** is the radio signal channel to the diode signal detector.

Intermediate frequency 126.5 kc/s.

The output from secondary winding **L19**, which is centre-tapped, is divided virtually into two halves, and the two outputs are applied to the two diodes of the double diode valve **(V4, Ekco 2D41** or **Mullard 2D4B metallised)** which has separate cathodes and acts as the discriminator for automatic frequency correction.

When the intermediate frequency signal is exactly 126.5 kc/s, the voltages applied to the anodes of **V4** from **L19, C19** are equal and of opposite phase, and they produce equal voltage drops along the diode load resistors **R19, R20** in the cathode circuits, but as these are connected in opposition they cancel out, and there is no potential difference between the two cathodes.

If as a result of motor tuning the oscillator circuit is slightly off-tune, the I.F. produced is not exactly 126.5 kc/s, but something above or below it, and under these circumstances unequal voltages are applied to **V4**, resulting in un-



Circuit diagram of the Ekco PB189 motor-driven press-button tuning superhet. It applies also to the C389 console, which has an eleventh tı

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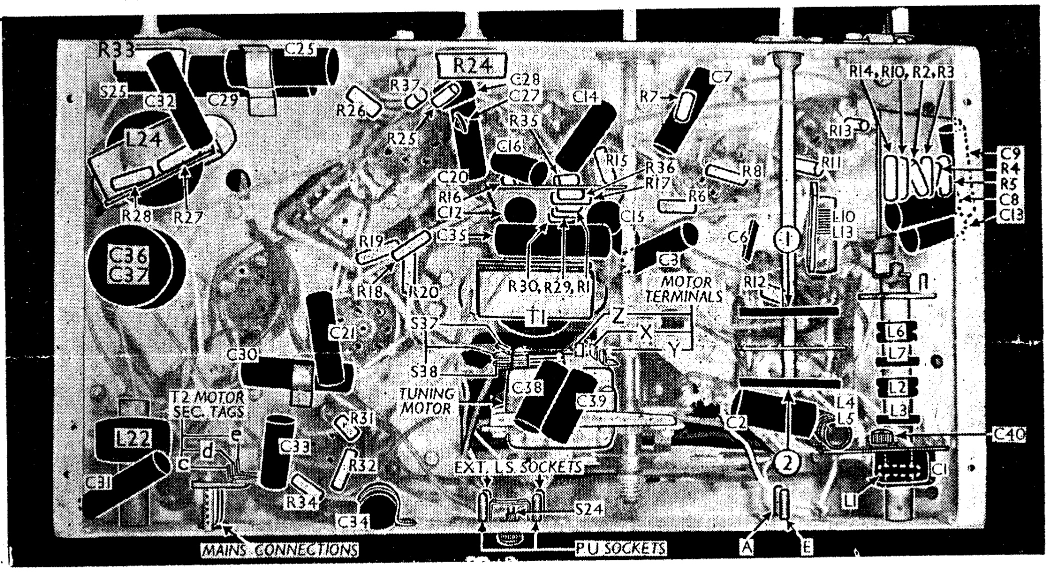
Under - chassis view. The waveband switch numbers are indicated by arrows and numbers 1 and 2 in circles. The two small assemblies have been tilted artificially to show their contents.

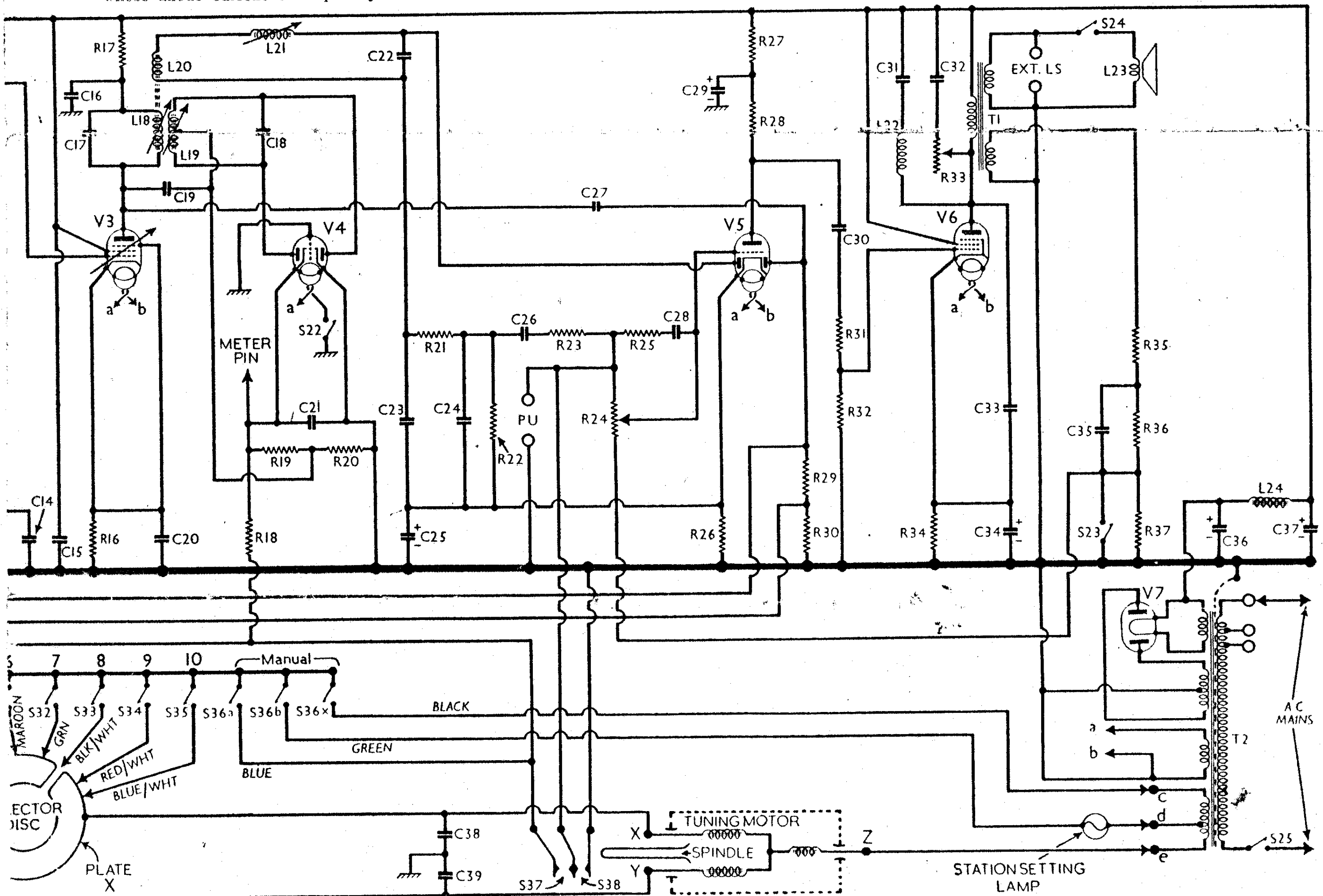


balanced voltages across **R19** and **R20**, so that there is a potential difference between them.

One end **(R20)** is connected to chassis, so the other end (connected to the meter pin) becomes positive or negative with respect to chassis. From it a control line is taken via decoupling circuit **R18, C12, R13** to the control grid of **V2**, whose anode current consequently varies if the intermediate frequency is high or low. Since **V2** anode current flows through **L8** on M.W., or **L9** on L.W., and these coils are coupled to the oscillator circuit tuning coils, the change of current will cause a change in the inductance of the tuning coils in such a direction as to correct the frequency error and produce an intermediate frequency of 126.5 kc/s.

On S.W., **S22** opens and breaks the heater circuit of **V4**, and renders the valve inoperative. On manual operation **S36a** short-circuits the A.F.C. control line, so that A.F.C. operates only with motor tuning.

Diode second detector is part of double diode triode valve **(V5, Ekco DT41** or **Mullard TDD4 metallised)**. Audio frequency component in



tuning button, and to the AC/DC model PB189U, which has a special mains transformer **T2** and a Philips tubular converter for D.C. operation.

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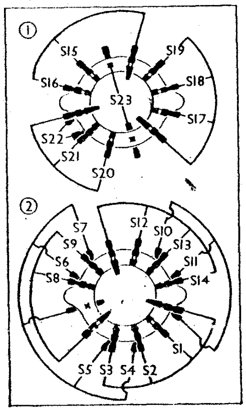
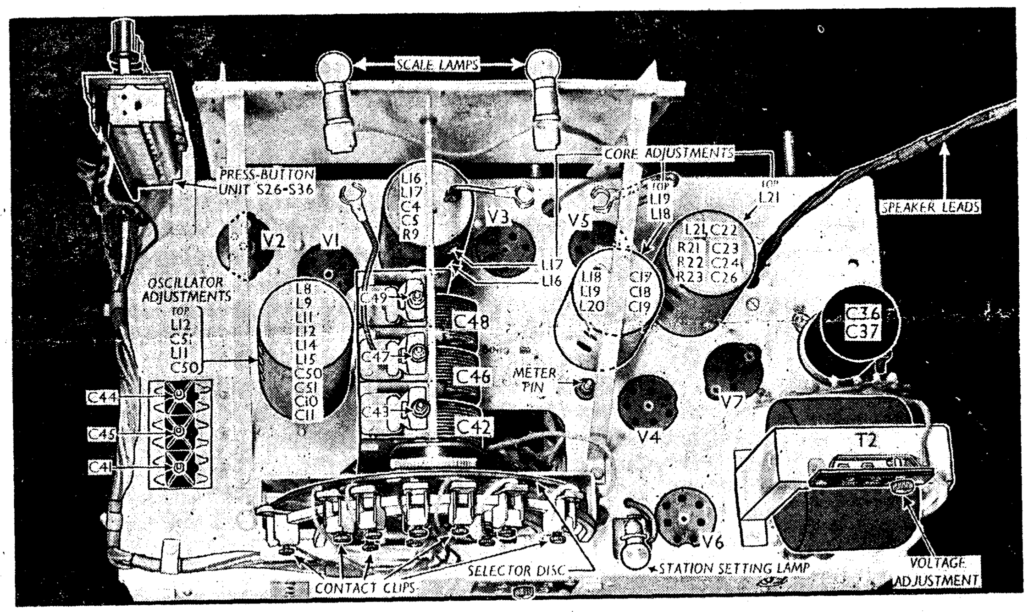




Above : Diagrams of the waveband switch units.

Right : Plan view of the chassis. All four screened coil units have core adjustments as indicated.

when the button is pressed; when it is released, these open, and **S36x** closes.

No diagram is given of the press-button unit switches, as the first ten consist merely of a single fixed contact which "makes" to the frame of the unit, and thus to chassis, via the moving contact when the button is pressed. The three switches numbered **S36** controlled by the manual button are very simple to identify and need no diagram either.

S37, S38 are two muting switches, operated by the tuning motor spindle, which is permitted a certain amount of end-play. When running, the forward thrust of the armature pushes the spindle against the blades of these switches, causing them to close, muting the radio sound channel and also muting the A.F.C. circuit.

Coils.—All the band-pass and aerial circuit coils **L1-L7** are mounted in a single assembly near the aerial socket beneath the chassis. The oscillator circuit coils **L8, L9; L11, L12; L14, L15** are in a screened unit on the chassis deck, the four adjustments being indicated in the order in which they occur in our chassis illustration. The SW coils **L10, L13** are in an unscreened unit beneath the chassis deck.

The two I.F. transformers **L16, L17; L18, L19, L20;** and **L21** are in three screened units on the chassis deck, **L21** having a separate can which it shares with several other components.

Scale and Setting Lamps.—These are all M.E.S. type lamps, with large spherical bulbs, rated at 6.2 V, 0.3 A.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (3-4 Ω) external speaker.

Capacitors C36, C37.—These are two T.C.C. wet electrolytics in a single tubular metal container mounted in a clip through a hole in the chassis deck. The positive connections are brought out to tags on the base of the unit, the 16 μF tag being indicated by a red washer, and the 8 μF tag by a yellow washer. The case forms the common negative connection. The unit is rated at 350 V working.

A.C./D.C. Model PB189U

This receiver is identical with the A.C. version on which this *Service Sheet* was prepared except that it is fitted with the Philips tubular converter type 7880C or 7881C for D.C. operation, and thus has a special mains transformer. This cannot be covered here, but it is fully covered in *Service Sheet* 713.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to L.W., press the white button (manual), turn the gang to maximum, the tone control to high and the volume control to maximum. Clip the signal generator leads via a 0.02 μF capacitor to the insulation on the top-cap lead to **V1** and chassis, connect a 0.5 V A.C. voltmeter to the external speaker sockets, a 100,000 Ω resistor across **L16,** and another across **L18.** Feed in a 126.5 kc/s (2,372 m) signal, and adjust the cores of **L16, L17, L18** and **L21** in that order for maximum output. Very little movement should be necessary, and it is advisable to try half a turn each way to see if any improvement occurs, then continue in the direction that shows an increase. Disconnect output meter and resistors.

Discriminator Stage.—The 0-10 V scale of a voltmeter having an internal resistance of not less than 1,000 ohms per volt (10,000 Ω) must be used as an indicator for this adjustment, and its leads are connected (in either direction) to the Meter Pin (indicated in our plan view of the chassis) and chassis. Connect the "live" signal generator lead clip directly to the top-cap connector of **V1,** feed in 126.5 kc/s signal at about 10 mV, and adjust the discriminator secondary coil **L19** core for maximum reading, and note the value; then readjust core so that reading falls to zero, passes it, and backs off the scale.

Reverse the meter leads, getting a positive reading again, and continue the adjustment until maximum is again reached, but in reverse polarity. The two maximum readings should be compared, and they should be equal; the actual value each time with 10 mV input to **V1** should be about 5 V. If a centre-zero meter is available the lead-reversing process can be avoided.

Should the two readings not be similar, something is wrong with the discriminator circuit, possibly unequal emission of the two sections of **V4** or unequal values for **R19** and **R20.** When it has been established that the readings are equal, readjust **L19** core for zero reading precisely. This adjustment is very critical, and it is important that it should be exact.

R.F. and Oscillator Stages.—Transfer signal generator leads to **A** and **E** sockets via a suitable dummy aerial. With the gang at maximum, the pointer should cover the calibration mark on the outside (S.W.) scale line at the long-wave end of the scale.

S.W.—Switch set to S.W., tune to 18 Mc/s or 16.6 m on scale, feed in an 18 Mc/s signal, and adjust **C49.** Tune to 17 Mc/s or 17.6 m on scale, feed in at 17 Mc/s signal, and adjust **C47** for maximum output. Calibrations should now be checked at 6 Mc/s (50 m) where it should be found to be correct if previous adjustments were effected accurately.

M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C50** for maximum output. Tune to 250 m on scale, feed in a 250 m (1,200 kc/s) signal, and adjust **C44** and **C41** for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust the core of **L11** for maximum sensitivity and accurate calibration, keeping the core-piece on the far side of the coil centre when viewed from the trimming end. Repeat the 200 m and 500 m adjustments until no improvement results.

L.W.—Switch set to L.W., tune to 1,300 m on scale, feed in a 1,300 m (230 kc/s) signal, and adjust **C51** for maximum output, then adjust **C43.** Tune to 1,700 m on scale, feed in a 1,700 m (176.5 kc/s) signal, and adjust the core of **L12** for maximum output, keeping the core-piece on the far side of the coil centre when viewed from the trimming end. Repeat the 1,300 m and 1,700 m adjustments until no improvement results.

Image Rejector.—If image trouble is experienced, the image rejector **C40** may be adjusted on the image until it is at a minimum. This adjustment is always mounted on the **L1-L7** coil assembly, where we show it, but in some cases it may be adjusted from the front, and in others from the rear.

Station Setting.—For setting the contact clips correctly on their carrier rails, the station setting lamp is used as an indicator.

First press the white button, and tune in the required station by hand. Then holding down the white button, press the button whose clip it is desired to set, when the setting lamp will light. Now free the appropriate clip (it bears the same number as its button) by slackening its screw and slide it along the rail to a position where its contact point lies on the gap between the commutator plates, when the light will go out. In this position the clip is correctly set.

If two clips are set to adjacent stations, they may be accommodated on opposite carrier rails. When changing a clip over from one rail to another, the clip must be inverted. Finally, check each newly set button by motor tuning, and fit an appropriate station-name card in the adjoining aperture.

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom cover, upon removal of which (eight countersunk-head wood screws) access may be gained to the under-chassis compartment.

Removing Chassis.—Remove the four control knobs (recessed grub screws);

remove the cheese-head set screw (with lock-washer) holding top of press-button switch unit to front of cabinet;

remove the four cheese-head screws (with flat metal washers) holding the chassis to the bottom of the cabinet.

If the speaker leads are now freed from the fibre cleat (wood screw) on the sub-baffle, the chassis may be withdrawn to the extent of the speaker leads, which is sufficient for most purposes.

To free the chassis entirely, these leads must be unsoldered from the tags on the speaker.

Removing Speaker.—Slacken the nuts on the four clamps holding the speaker to the sub-baffle, and swivel clamps, when speaker may be lifted out.

When replacing, the connecting panel should go at the top.

Printed in England by The Cornwall Press Ltd., Paris Garden, London, S.E.1.

rectified output is developed across load resistors **R21, R22,** and that across **R22** is passed via A.F. coupling capacitor **C26** and manual volume control **R24** to C.G. of triode section, which operates as A.F. amplifier.

Tone compensation for changes in setting of volume control by **R25, C28.** I.F. filtering by **C23, R21** and **C24.** Provision for the connection of a gramophone pick-up across **R24.**

Second diode of **V5,** fed from **V3** anode via **C27,** provides D.C. potentials which are developed across load resistors **R29, R30** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for triode section, is derived from the drop along **R26** in cathode lead to chassis.

Resistance-capacitance coupling by **R28, C30** and **R31, R32,** the two resistors giving a step-down coupling, between **V5** triode and pentode output valve **(V6, Ekco OP42** or **Mullard PenA4).** Whistle suppression by low-pass filter **L22, C31** in anode circuit. Fixed tone correction by **C33,** and variable tone control by **R33, C32,** in anode circuit. Provision for the connection of a low-impedance external speaker across speech coil secondary winding of output transformer **T1,** switch **S24** permitting the internal speaker to be muted if desired.

A second secondary winding on **T1** provides voltages which are fed back through a filter circuit **R35, R36, C35, R37** and applied in negative sense via **R24** to **V5** triode control grid circuit on M.W. and L.W. On S.W. **S23** closes, short-circuiting the coupling resistor **R37** and deleting the feed-back signal, but **R35** prevents the switch from short-circuiting the secondary winding. On gram, negative feed-back is optional, the user being advised that he will obtain greater output upon switching to S.W.

H.T. current is supplied by full-wave rectifying valve **(V7, Ekco R41** or **Mullard DW4/350).** Smoothing by iron-cored choke **L24** and electrolytic capacitors **C36, C37.**

Automatic Tuning

The mains transformer **T2** is equipped with a special secondary winding to drive the tuning motor, and one end of the winding **e** is connected directly to one of the motor terminals **Z.** The other end of the winding **c** goes via switch **S36X** (which is closed when the manual (white) button is out) to the frame of the press-button unit and chassis.

The outer ends of the motor windings, **X** and **Y,** are connected each to one of the semi-circular commutator plates on the selector disc, which is mounted on the spindle of the tuning gang. The motor runs if one of these plates is connected to chassis, the direction of rotation depending upon whether **X** or **Y** is involved.

If button **3** in our circuit diagram is pressed, switch **S28** closes, connecting contact clip **3,** and thus the commutator plate **Y,** to chassis, the motor runs, and as it is geared to the selector disc, this also turns, the direction being such that the upper gap between the two plates travels towards clip **3** until it reaches it, when the motor circuit is broken by the gap and the motor stops. In turning the disc, the motor turns the gang and tunes in the required station, any inaccuracy being corrected by the A.F.C. circuit described earlier.

If the white manual or "Knob Tuning" button is pressed, **S36a** and **S36b** close, and **S36X** opens, disconnecting the chassis end **C** of the motor secondary, so that the motor cannot run. Tuning is then performed in the normal manner by hand.

In order to suppress various noises which may occur in the process of tuning, **S38** closes and short-circuits **R24.** At the same time **S37** closes and suppresses the A.F.C. circuit. Both of these switches are operated by the thrust of the motor spindle, which closes them only while the motor is running.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted in the maker's manual.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH4A	250	2·2	90	5·2
(Oscillator)	130	5·0		
V2 T41	220	2·0	—	—
V3 VP41	240	10	250	4·0
V4 2D41	—	—	—	—
V5 DT41	110	2·4	—	—
V6 OP42	240	32·5	250	5·0
V7 R41	300†	—	—	—

† Each anode, A.C..

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	V1 hept. C. G. decoupling	1,000,000
R2	V2 G.B. potential divider resistors	25,000
R3		25,000
R4		15,000
R5		1,200
R6	V1 S.G. H.T. feed	30,000
R7	V1 fixed G.B. resistor	200
R8	V1 osc. C. G. resistor	100,000
R9	I.F. trans. sec. shunt	500,000
R10	V2 anode H.T. feed	15,000
R11	Oscillator reaction stabilisers	200
R12		3,000
R13	V2 C.G. decoupling	250,000
R14	V1 osc. anode H.T. feed	20,000
R15	V3 C.G. decoupling	1,000,000
R16	V3 fixed G.B. resistor	300
R17	V3 anode H.T. feed	1,000
R18	Discriminator load decoupling	100,000
R19	V4 discriminator load resistors	500,000
R20		500,000
R21	I.F. stopper	100,000
R22	V5 signal diode load	100,000
R23	A.F. feed resistor	50,000
R24	Manual volume control	1,000,000
R25	Part of tone compensator	500,000
R26	V5 triode G.B.; A.V.C. delay.	1,000
R27	V5 triode anode decoupling	10,000
R28	V5 triode anode load	50,000
R29	V5 A.V.C. diode load resistor	500,000
R30		750,000
R31	V6 C.G. potential divider	100,000
R32		250,000
R33	Variable tone control	60,000
R34	V6 G.B. resistor	120
R35	Negative feed-back potential divider	15,000
R36		15,000
R37		500

	CAPACITORS	Values (μF)
C1	Aerial M.W. coupling	0·001
C2	V1 hept. C.G. decoupling	0·1
C3	V1 S.G. decoupling	0·1
C4	1st I.F. transformer tuning capacitors	0·00014
C5		0·00014
C6	V1 osc. C.G. capacitor	0·000025
C7	V1 cathode by-pass	0·1
C8	V2 anode decoupling	0·1
C9	V2 cathode by-pass	0·1
C10	Osc. circ. M.W. tracker	0·00168
C11	Osc. circ. L.W. tracker	0·0008
C12	V2 C.G. decoupling	0·04
C13	V1 osc. anode decoupling	0·1
C14	V3 C.G. decoupling	0·04
C15	H.T. circuit R.F. by-pass	0·1
C16	V3 anode decoupling	0·02
C17	2nd I.F. transformer tuning capacitors	0·00014
C18		0·00014
C19	Phasing capacitor	0·0001
C20	V3 cathode by-pass	0·1
C21	V4 output reservoir	0·1
C22	2nd I.F. trans. signal sec. tuning	0·00014
C23	I.F. by pass capacitors	0·0002
C24		0·0002
C25*	V5 cathode by-pass	25·0
C26	A.F. coupling to V5 triode	0·01
C27	A.V.C. diode coupling	0·000015
C28	Part of tone compensator	0·0001
C29*	V3 triode anode decoupling	2·0
C30	A.F. coupling to V6	0·1
C31	Whistle filter tuning	0·005
C32	Part variable tone control	0·1
C33	Fixed tone corrector	0·0025
C34*	V6 cathode by-pass	50·0
C35	Part of feed-back circuit	0·2
C36*	H.T. smoothing capacitors	8·0
C37*		16·0
C38	Tuning motor shunt capacitors	0·02
C39		0·02
C40‡	Image suppressor	—
C41‡	B.-P. pri. M.W. trimmer	—
C42†	Band-pass pri. tuning	—
C43‡	B.-P. pri. L.W. trimmer	—
C44‡	B.-P. sec. M.W. trimmer	—
C45‡	B.-P. sec. L.W. trimmer	—
C46†	B.-P. sec. and S.W. tuning	—
C47‡	Aerial circ. S.W. trimmer	—
C48‡	Oscillator circuit tuning	—
C49‡	Ocs. circ. S.W. trimmer	—
C50‡	Osc. circ. M.W. trimmer	—
C51‡	Osc. circ. L.W. trimmer	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial L.W. coupling coil	50·0†
L2	Band-pass primary coils	2·5
L3		25·0
L4	Aerial S.W. coupling coil	0·2
L5	Aerial S.W. tuning coil	Very low
L6	Band-pass secondary coils	2·5
L7		25·0
L8	Osc. M.W. A.F.C. coil	19·0
L9	Osc. L.W. A.F.C. coil	90·0
L10	Osc. S.W. tuning coil	Very low
L11	Osc. M.W. tuning coil	2·0
L12	Osc. L.W. tuning coil	9·0
L13	Osc. S.W. reaction coil	Very low
L14	Osc. M.W. reaction coil	1·0
L15	Osc. L.W. reaction coil	2·3
L16	1st I.F. trans. Pri.	45·0
L17	1st I.F. trans. Sec.	45·0
L18	2nd I.F. trans. Pri.	45·0
L19	2nd I.F. trans. Disc. sec., total	45·0
L20	2nd I.F. trans. Coupling coil	2·0
L21	2nd I.F. trans. Signal sec.	45·0
L22	Whistle filter coil	80·0
L23	Speaker speech coil	2·3
L24	H.T. smoothing choke	650·0
T1	Output trans. Pri.	350·0
	Speech sec.	0·5
	F.-B. sec.	38·0
T2	Mains trans. Pri., total	33·0
	Heater, sec.	Very low
	Rect. heat. sec.	Very low
	Motor sec., total	2·5
	H.T. sec., total	460·0
Motor	Tuning motor windings	6·3*
S1-S23	Waveband switches	—
S24	Int. speaker switch	—
S25	Mains switch, ganged R33	—
S26-S36	Press-button switches	—
S37	Tuning motor muting switches	—
S38		—

† Including the lower end of L3.
* Either winding. Measured between X and Z or Y and Z with press-buttons out.

GENERAL NOTES

Switches.—S1-S23 are the waveband switches ganged in two rotary units beneath the chassis. These are indicated in our under-chassis view and shown in detail in the diagram in col. 4, where they are drawn as seen in the directions of the arrows in the chassis illustration. The table below gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C,** closed.

S24 is the screw-type internal speaker switch. It mutes the speaker when unscrewed a few turns. **S25** is the Q.M.B. mains switch, ganged with the tone control **R33.**

S26-S35 are the ten station buttons, and **S36a, b** and **x** are the three switches associated with the manual ("Knob Tuning") button, on the press-button unit which is mounted vertically on the chassis deck beside the tuning scale. **S26** belongs to button No. 1, and the rest of the ten station buttons have one switch each up to No. 10, which controls **S35.**

The eleventh button, which is coloured white and is at the bottom of the assembly, is really a manual-auto change-over button switching to manual when pressed. When another button is pressed it is automatically released, and switches over to auto. It controls three switches **S36a S36b** and **S36x. S36a** and **b** close

Switch	L.W.	M.W.	S.W.
S1	—	—	C
S2	—	C	—
S3	C	—	—
S4	—	—	C
S5	—	C	C
S6	—	—	C
S7	—	C	C
S8	—	C	—
S9	C	—	—
S10	—	—	C
S11	—	C	C
S12	—	—	C
S13	—	C	—
S14	C	—	—
S15	—	C	—
S16	C	—	—
S17	—	—	C
S18	—	C	—
S19	C	—	—
S20	—	C	—
S21	—	—	C
S22	C	C	—
S23	—	—	C

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.

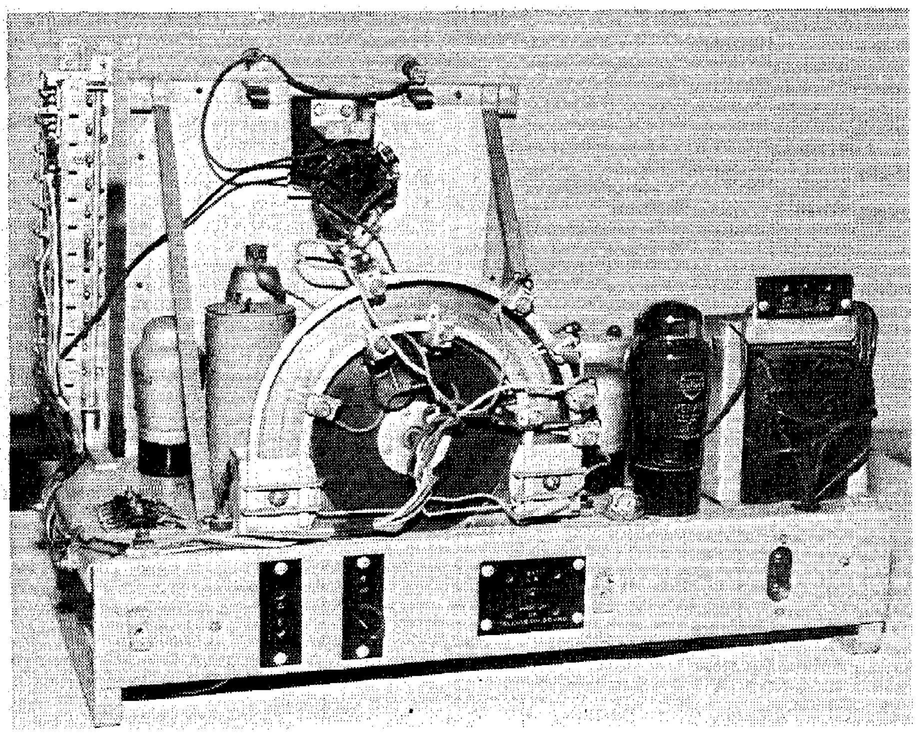
Pushbutton tuning, originally used in car radios, was the fashion feature for 1938 domestic receivers. According to one authority, of the 665 new British models for that year, no fewer than 231 had pushbutton tuning.

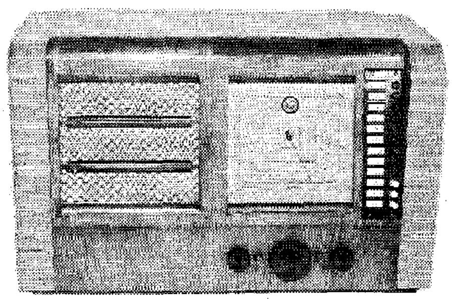
Three major systems were used. Most common were switched preset semi fixed-tuning capacitors or inductors, and telephone-type dials with finger stops linked to the tuning capacitor. More complex and expensive was the motor-driven tuning capacitor used in the PB289.

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

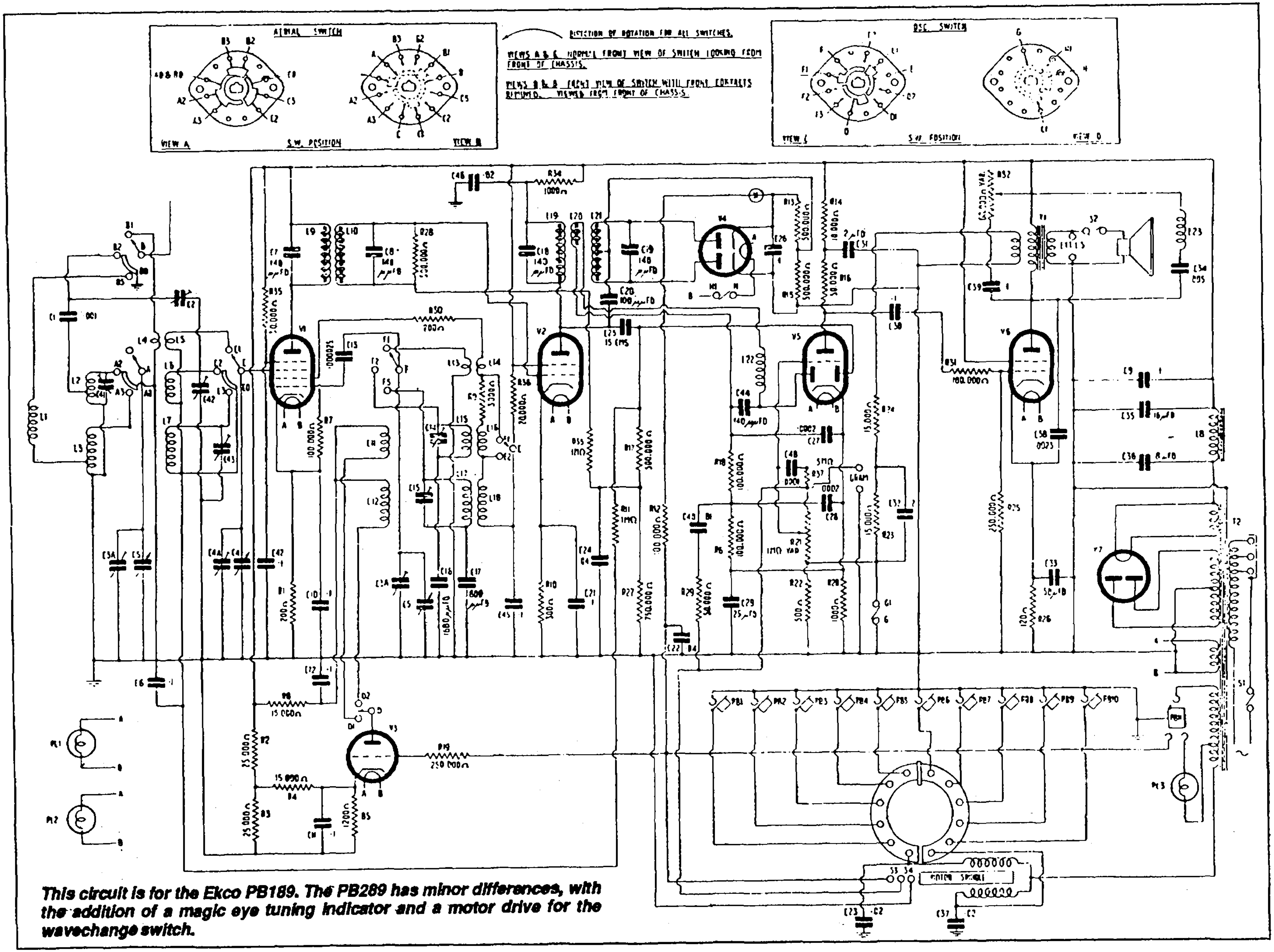
The PB289 incorporates two good features frequently found in European receivers. One was to protect the rear of cabinets with fibre panels, which although of questionable acoustic value, served to prevent contact with live termi-





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.

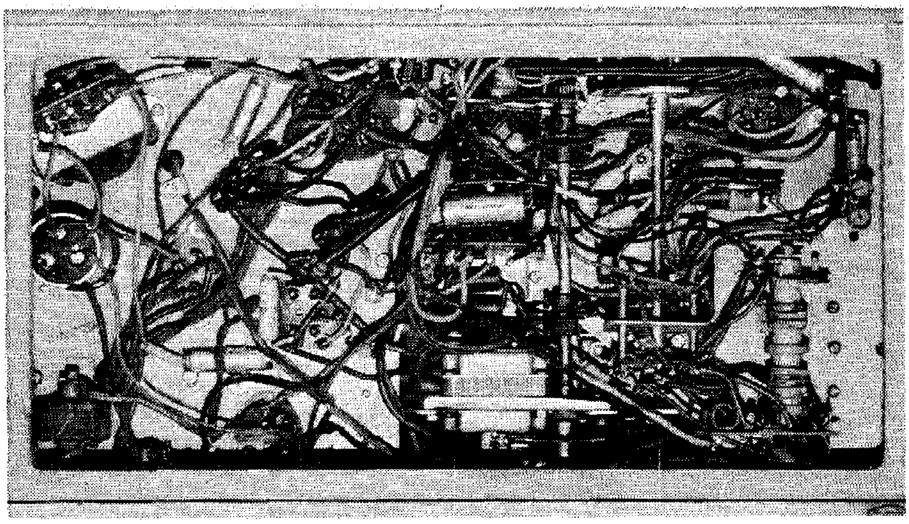
A circuit of the PB289 is not readily available, and the accompanying diagram is of the slightly simpler PB189. Differences are minor, the PB289 having the addition of a magic eye tuning indicator and motor drive for the wavechange switch.

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.

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 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.

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 crosstalk 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.

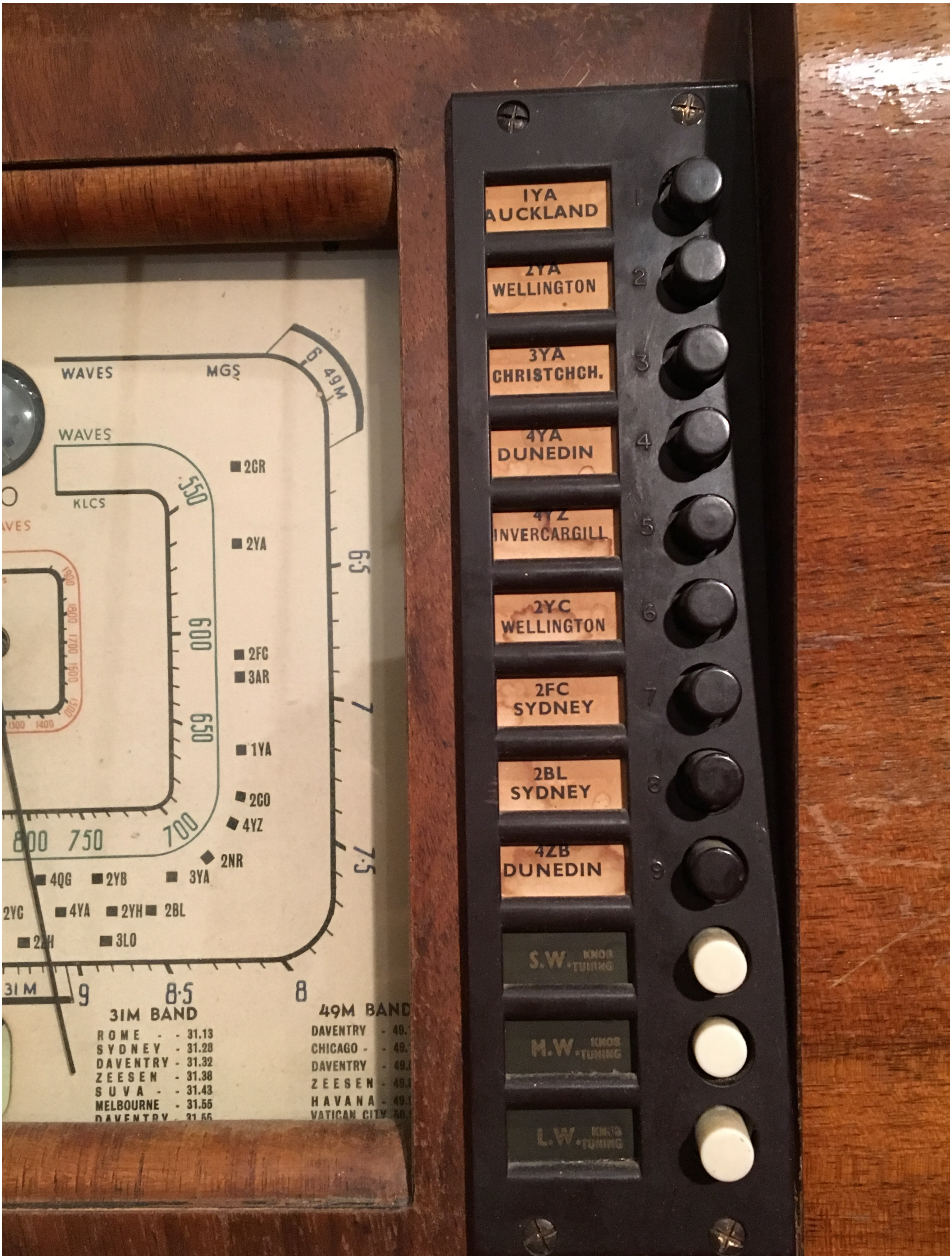
Each finger is in turn connected to its own pushbutton, which when depressed, completes the circuit between a segment and earth, energising the motor which rotates the tuning capacitor and disc towards the gap between the segments. As the finger concerned encounters the gap, the motor is open circuited, 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. ❖

EKCO PB289 SN A9095. Photo: James Davidson



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