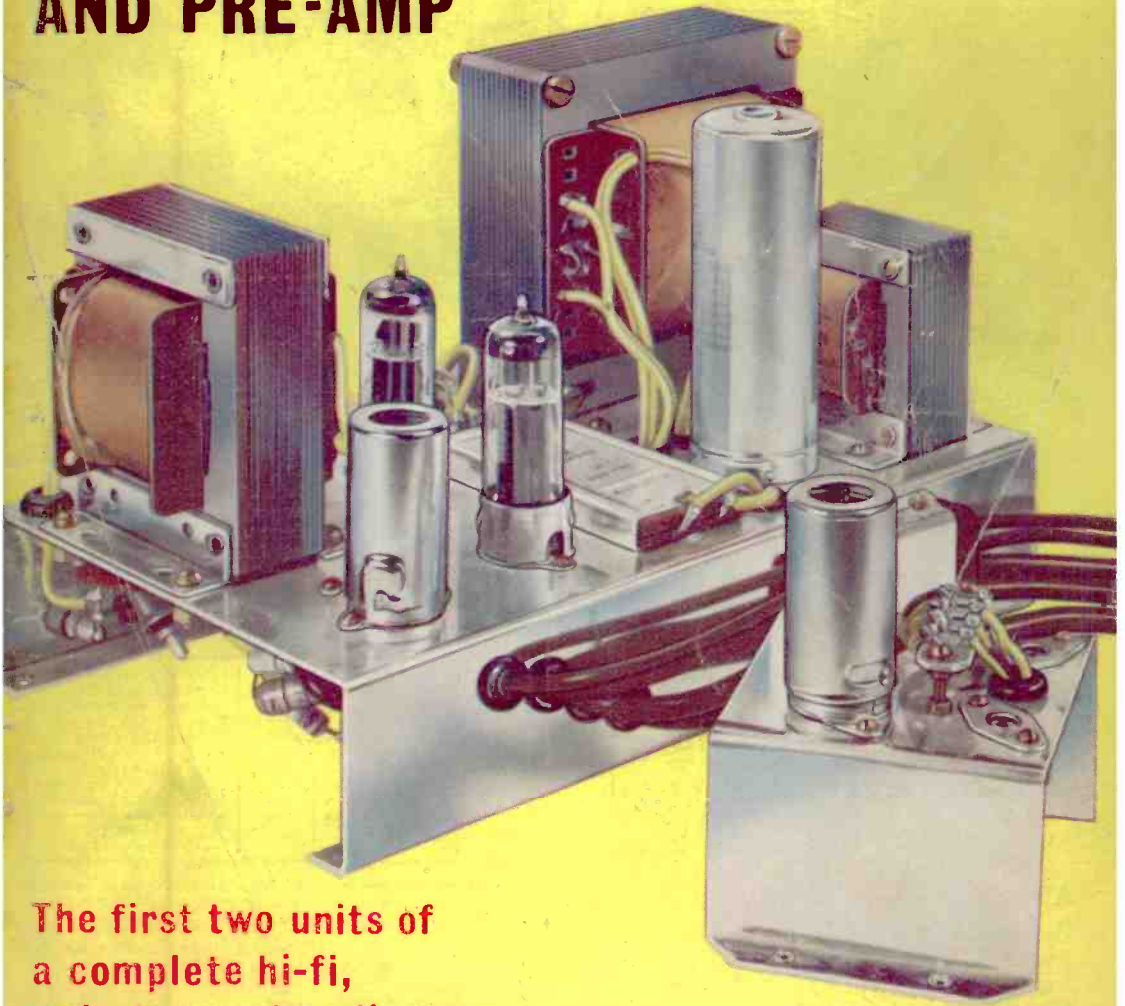


JANUARY  
1963

# *Practical* 2/- **WIRELESS**

## **QUALITY AMPLIFIER AND PRE-AMP**



The first two units of  
a complete hi-fi,  
switch-tuned radiogram

Top Band Transmitter

Transistor Portable



**SOLDERING INSTRUMENTS AND EQUIPMENT**

**DESIGNED FOR THE AMATEUR'S RADIO STATION**

**ILLUSTRATED**

List No. 70.  $\frac{1}{8}$ " BIT IN PROTECTIVE SHIELD  
List No. 68

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Sales and Service Dept.

**ADCOLA PRODUCTS LTD**

**ADCOLA HOUSE GAUDEN ROAD,**

Telephones MACaulay 4272 & 3101



**LONDON, S.W.4**

Telegrams SOLJOINT LONDON SW4

# Model 8 Universal AVOMETER



**Designed for Dependability**

The Model 8 Universal Avo Meter is a high sensitivity multi-range a.c./d.c. electrical testing instrument providing thirty ranges of readings on a 5-inch hand calibrated scale. Range selection is effected by two rotary switches for a.c. and d.c. respectively.

The instrument has a sensitivity of 20,000 ohms per volt on d.c. voltage ranges and 1,000 ohms per volt on a.c. from the 100-volt range upwards, and meets the accuracy requirements of B.S.S.89/1954 for 5-inch scale length portable industrial instruments. It is robust, compact, and simple to operate, and is protected by an automatic cut-out against damage through inadvertent electrical overload.

VOLTAGE		CURRENT		RESISTANCE
D.C.	A.C.	D.C.	A.C.	
2.5V	2.5V	50µA	100mA	First indication 0.5Ω
10V	10V	250µA	1A	0—2,000Ω
25V	25V	1mA	2.5A	0—200,000Ω
100V	100V	10mA	10A	0—20mΩ
250V	250V	100mA	—	0—200MΩ
500V	—	1A	—	} using internal batteries
1,000V	1,000V	10A	—	
2,500V	2,500V	—	—	
				<b>DECIBELS</b>
				—15 dB to +15 dB

Various external accessories are available for extending the above ranges of measurement. Leather carrying cases are also available if required.

Dimensions: 8½" x 7½" x 4½". Weight: 6½ lb.

Write for fully descriptive Folder or for complete Catalogue of AVO Instruments.



**AVO LTD**

AVOCET HOUSE, 92-96 VAUXHALL BRIDGE ROAD, LONDON, S.W.1

Tel: VICToria 3404 (12 lines)



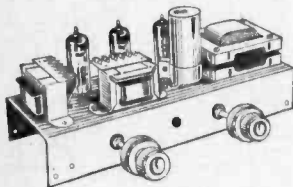




### RECORD PLAYER AMPLIFIER

- ★ 2 watt output.
- ★ Ready built with valves and 6 $\frac{1}{2}$ in. speaker, tone and volume controls. Mounted on panel 13 x 7 $\frac{1}{2}$ . 75/-, P. & P. 2/-.

### STEREO AMPLIFIER Bargain Offer



- ★ 4 watts per channel.
- ★ Full tone and volume controls.
- ★ Complete with sockets, etc.

89/6 P. & P. 2/6.

### QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29in. record player) employs ECC83, EL84, EZ80 valves. Bass, treble and volume. On/off controls.

PRICE 69/6 P. & P. 3/6.

DITTO. Mounted on board with output transformer and 6 $\frac{1}{2}$  in. speaker. Complete at 89/6 P. & P. 4/6.

### 4-SPEED PLAYER UNIT BARGAINS

#### SINGLE PLAYERS

TU/12, £3.15.0. Carr. 3/6

#### AUTO CHANGERS

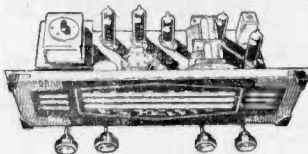
B.S.R. UA14, £6.19.6. Latest B.S.R. UA16, £7.19.6. Latest Garrard "Auto-Slim" £7.15.0. Carr. 5/- on each.

### LOUDSPEAKER SILKS 54in. wide

Heavily woven in ivory and gold. Originally 35/- per yard length. OUR SPECIAL PRICE 13/6 per yard length. P. & P. 1/6. Also Red Rexine. Dark Grey and Oatmeal fabrics for cabinet covering, 54in. wide, 13/6 per yard length. P. & P. 1/6.

SEND STAMP FOR  
OUR SURPLUS  
VALVE LIST.

### RADIOGRAM CHASSIS

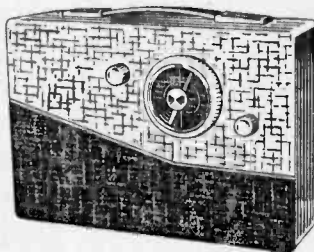


A chassis of distinction, by a famous maker. Covering Long, Med. and Short Waves, plus gram position. (Size 15 $\frac{1}{2}$  x 7 x 6 $\frac{1}{2}$ in. high). Incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol. On/Off, W/Change (L.M.S. and Gram), Tuning. Tapped input 200-250 v. A.C. only. An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads, etc. OUR PRICE ONLY **£9.19.6**

Plus 8/6 post and packing. **£9.19.6** ALSO AVAILABLE: 6 valve, 3 waveband, F.M. M.W., L.W., ECC85, ECH81, EF89, EABC80, EL84, EZ80, £11.11.0. P. & P. 8/6. Deluxe version of above with F.M., S.W., M.W., L.W. and piano-key wavechange, same line up, £13.13.0. P. & P. 8/6.

### 6 TRANSISTOR AND TWO DIODES RECEIVER

Easy to build, using 6 super transistors and 2 diodes 750 M/W output, full medium and long wave coverage, printed circuit, 5in. speaker, prealigned IFTS & OSC. Very fine tuning, ferrite aerial with car aerial socket, attractive 2-colour cabinet. Simple to follow instructions with circuit, everything complete.



£8.19.6 P. & P. 3/6 Battery 3/6

All parts sold separately.

### BARGAIN OFFER!

TELEFUNKEN HI-FI STEREO AMPLIFIER 110/250 v. A.C. input. 5 watt undistorted output (10 watts nominal). Size 12 x 9 x 2in. Weight 9 lb. Complete with spec. and instructions.

£5.19.6 Carr. 5/-.

Also Model S82. Similar specification but with balance control. £6.19.6. Carr. 5/-.



### SPECIAL OFFERS!

GAULER F.M. TUNER HEADS. 10.7 Mc/s. I.F., 15/-, plus 1/9 P. & P. (ECC85 valve 8/6 extra).

ELECTROSTATIC H.F. TWEETERS. Type L.S.H. 75. Size 3 x 3in., 2/6 each, plus 9d P. & P.

MIDGET 2 GANG CONDENSERS. Capacity 195 and 100 P.F. Polystyrene case with built in trimmers. Size  $\frac{1}{2}$  x  $\frac{1}{2}$  x  $\frac{1}{2}$ in. Not used but removed from P/C Boards. 2 for 9/-, Plus 1/- P. & P.

ACOS CRYSTAL MIKES. Hi-imp., 18/6. P. & P. 1/6.

4 MFD MANSBRIDGE PAPER CONDENSERS. Ideal for Crossover Units. 4/6 each. P. & P. 1/-.

TRANSISTOR DRIVER and O/P TRANSFORMERS. (Tapped 3 ohms and 15 ohm o/p), plus 4 suitable Transistors giving approx. 1 watt o/p. 30/-, P. & P. 2/-.

### MAINS TRANSFORMERS

Tapped Primary.  $\frac{1}{2}$  wave or Bridge Rectifier. Secondary 250 v. at 75 m/a 6.3 volts at 2 amps. 7/6 each. P. & P. 3/-.

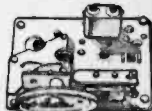
3 PUSH-BUTTON TRANSISTOR SWITCH. D.P.—D.T. Each Switch 5/6 and 1/- P. & P.

### SPECIAL PURCHASE! TURRET TUNERS

by famous maker. Brand new and unused Complete with PCC84 and PCF80 valves. 34-38 Mc/s I.F. Biscuits for Channels 1 to 5 and 8 and 9. Circuit diagram supplied.

ONLY 25/- EACH P.P. 2/6

### F.M. TUNER HEAD



A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) and drum and spindle, 18/6, plus 1/9 P. & P. Valve 8/6 extra. Drum and spindle 3/6 extra.

### E.M.I. 4-speed Player and P.U.

FURTHER HUGE PURCHASE enables us to offer these at ONLY 69/6 P. & P. 4/6



Heavy 8 $\frac{1}{2}$ in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head.

### MARTIN RECORDKITS

Tape Amplifier for B.S.R. deck.

£8.8.0 P. & P. 3/6.

Cabinet with 7 x 4in. speaker for above £4/4.0. Carr. and Ins. 5/-.

Tape Amplifier for Collaro Studio deck, £11.11.0. P. & P. 3/6.

Cabinet with 9 x 5in. speaker for above, £5.5.0. Carr. and Ins. 5/-.

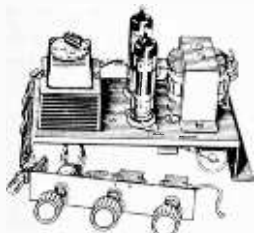
Tape Pre-Amplifier, complete with power supplies, £8.8.0. P. & P. 3/6.

Full easy-to-follow instructions supplied. Send S.A.E. for leaflet.

Full range of Microphones and Tape always in stock.

# HARVERSON SURPLUS CO. LTD.





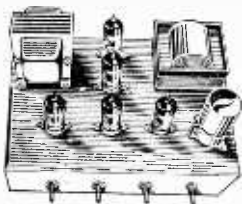
## SPECIAL OFFER!

### 6 Watt Push-Pull Amplifier

2 ECL82 metal rec., separate bass and treble cont. on aux. panel. Made for one of the largest manufacturers of record players. Used in 30 gn. units. Size 7 x 4in. panel, 6 x 1½in. 3 ohm output, trans. included.

Our Price **£4.9.6** Post 4/-

### 10/14 WATT HI-FI AMPLIFIER



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded ultra output transformer (to match 3-15 speaker) and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.)

All parts sold separately.

ONLY **£6.19.6** P. & P. 6/6.

### LOUDSPEAKERS

All 3 ohm impedance.

2½in. ....	12/6
5in. ....	12/6
6½in. ....	15/-
12in. ....	27/6
Goodmans 5in. tweeter .....	10/6
E.M.I. 2½in. tweeter .....	10/6
Goodmans 8in. x 5in. middle register speaker .....	10/6
E.M.I. 13½in. x 8½in. high flux .....	32/6
Rofa Celestion, approx. 9in. x 6in., middle register speaker .....	10/6

P. & P. 1/6 per Speaker.

### TAPE DECKS

#### B.S.R. Monardeck

(Single speed) 3½in. per sec., simple control, uses 5½in. spools, **£6.15.0**, plus 5/6 carr. and ins. (Tapes extra.)

**COLLARO STUDIO DECK** £10.10.0, plus 5/6 carr. and ins. (Tapes extra.)

### TRANSISTORS

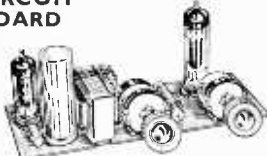
All Post Free.

GET15 (Matched Pair), 15/-.

OC72 ..... 6/-	OC71 ..... 5/-	XA103 .... 6/6
OC76 ..... 6/-	PXA101 .... 6/6	V15/10p .... 12/6

Set of Mullard 6 transistors 25/-, Set of G.E.C. 1.874; 2.873; 3, 51 or GET114 20/-.

### AMPLIFIER ON PRINTED CIRCUIT BOARD



Two valve, UY85, UL84 with O.P. trans., use with 80 volt tap off motor. **39/6.**

P.P. 2/6 on above. Dropper res. for filaments if required, 2/6.

### B.S.R. AUTO UNITS

160 v. Suitable for use with above. (Slightly soiled.) **£5.5.0.** P. & P. 5/-.

### LARGE CABINET



Suitable for above two items. Complete with 3 ohm speaker. **£3.9.6.** Carr. 5/-.

Superior Cabinet. Similar to above to take 8 x 5in. speaker, with motor board, will accommodate BSR UA14 or UA16. **£3.9.6.** Carr. 5/6. Speaker 15/- extra. P. & P. 1/6 extra.

### WODEN TRANSFORMERS

(Ex equip.). 200-240 v. input. Output 12 v. 1 amp., tapped 1, 8 and 10 v. Ideal for model railways and chargers. **8/6.** P.P. 2/-.

Colvern Wire Wound Potentiometers, 3in. 10 ohm 1 amp. Suitable for above. **5/-.** P. & P. 1/-.

### LARGE WODEN MAINS TRANSFORMER

220/240 v. input. Output 40 v. at 3 amps. tapped 30 and 35 v. H.T. voltages 300 v. 100 mA. tapped 10 v. 150 v., 230 v., 260 v., also 90 v. 100 mA., 350 v., tapped at 200 v. 100 mA. Size 4½ x 5 x 5in. Weight approx. 12 lb. **20/-** each. P. & P. 5/-.

### 6 TRANSISTOR AND DIODE SUPERHET

A first class 2 waveband transistor superhet in kit form. ● Printed circuit panel (size 8½ x 2½in.) ● 3 pre-aligned. I.F. transformers. ● High-gain Ferrite rod aerial. ● First-grade G.E.C. transistors. ● Car aerial winding. ● Push-pull output. ● All parts down to the minutest item with simple instructions.

All parts sold separately.

ONLY **£4.5.0** P. & P.

2½in. 35 ohm speaker, 10/6; 3½in. 35 ohms speaker 16/6; 35 ohm 5in. P.M. 18/6; 7 x 4in. 35 ohms speaker 21/-, P. & P. 1/6 per speaker.



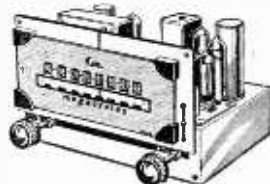
### PORTABLE CABINET

Size approx. 9½ x 6½ x 3½in. Suitable for above using 3½in. speaker. **25/-.** P. & P. 2/-.

### COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. transformers, one oscillator coil, one driver transformer and wound Ferrite aerial (med., long and aerial coupling), 28/6 complete, post 1/-, 6 transistor printed circuit, board to match, 8/6, post 9d. Circuit diagram 1/6 extra.

### HARVERSON'S F.M. TUNER MARK I



● F.M. tuning head by famous maker. ● Guaranteed non-drift. ● Permeability tuning. ● Frequency coverage 88-100 mc/s. ● OA81 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC83, two EF80s, and EZ80 rectifier. ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5½in. ● All parts sold separately. **£5.19.6**, plus 8/6 P.P. and ins. Circuit diagram and illustrations 1/6 P. free.

Mark II Version as above but complete with magic eye, front panel and brackets. **£6.12.6.** P. & P. 8/6.

Mark III Version as Mark I but with output stage (ECL82) and tone control. **£7.7.0.** P. & P. 8/6.

Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I 25/-, P. & P. 2/6. To fit Mark II 17/6, P. & P. 2/6.

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**UNIVERSAL AVOMETERS**



Guaranteed perfect working order. Supplied complete with leads, batteries and instructions. Model "D" 34 range £8.19.6 Model "T" 50 range £11.0.0 Registered Post 5/- extra.

**COSSOR 1035 DOUBLE BEAM OSCILLOSCOPES**  
Guaranteed perfect working order. £45 each. Carriage £1.

**7.5 K.V.A. AUTO TRANSFORMERS**  
0-115-230 volts. Brand new boxed, £15. Carriage 10/-.

**230/250 VOLT A.C. MOTORS**  
4 1/2 in. dia., 90 watts, 5,000 r.p.m. 1 in. spindle. £27/6. P.P. 1/6.

**1 K.V.A. ISOLATION TRANSFORMERS**  
230 v. PRI 230 v. Sec. Boxed, £5 each. Carriage 10/-.

**VARIAC TRANSFORMERS**  
24 amp., 230 volt primary, 185 to 250 volt output, £12.10.0. Carriage 10/-.

**TELEPHONES TYPE "L"**  
Generator Bell Ringing, 2 line connection. With batteries, fully tested, 69/6 per pair. Carriage 5/-.

**100 AMP A.C. METERS**  
Nalder Thompson 6in. scale. Brand new, boxed, 65/-, P.P. 3/6.

**3000 WATT AUTO TRANSFORMERS**  
0-115-230 volts, step-up or step-down. Brand new, boxed ex-U.S.A. £7.10.0 each. Carr. 10/-.

**FANTASTIC TAPE OFFER**  
Brand new American High Fidelity recording tape, 7in.-1800ft. 20/-, 7in.-1200ft. 15/-, P & P extra. S.A.E. for full bargain tape lists.

**PANEL METERS**

100µA	24"	F.M.	D.C.	42/6
100µA	34"	F.M.	D.C.	62/6
1mA	24"	F.M.	D.C.	25/-
3000/30mA	24"	F.M.	D.C.	9/6
350mA	24"	F.M.	D.C.	10/6
5V	24"	F.M.	A.C.	17/6
10 v.	24"	Proj.	A.C.	15/6
100 v.	24"	Proj.	A.C.	19/6
500 v.	24"	F.M.	A.C.	25/-
500 v.	24"	F.M.	A.C.	25/-
150 v.	24"	F.M.	D.C.	32/6
1500 v.	24"	Electrostatic		25/-

**FIELD TELEPHONES TYPE "F"**  
Suitable for many applications. Generator bell ringing, 2 line connection. With batteries and wooden carrying case, fully tested. £4.19.6 per pair. Carr. 5/-.

**P.C.R. COMMUNICATION RECEIVERS**  
6 valves. Frequency coverage on 3 bands: 850-2,000 metres, 190-550 metres and 6-18 Mc/s. Super slow motion drive. AE trimmer, tone control, built in speaker. AS NEW £8.19.6 each. Carr. 7/6.

**P.C.R.2 RECEIVERS**

850-2,000 metres, 190-550 metres 6-22 Mc/s. output for phones or 3Ω speaker. As new £5.19.6. Carr. 7/6. Both above models can be supplied with internal power unit to operate on 200/250 v. A.C. at 39/6 extra or alternatively plug-in external power units are 35/-.



**NATIONAL H.R.O. RECEIVERS**

**BRAND NEW!** Senior model, table mounting. Complete with a full set of 9 coils covering 50 kc/s to 30 Mc/s. Supplied complete in original transit cases, £25, Carr. 20/-. Power units to operate direct from 200/250 volt. A.C. 59/6 extra.



**PRECISION COMBINATION VOLTMEETER/AMMETER FOR A.C. AND D.C.**

Two separate instruments housed in polished wood case, 6in. scales with knife edge pointers.

Ranges: Volts A.C. and D.C. 160-300-600 v. Amps. A.C. and D.C. 25-50-150-200 A. Supplied complete with all current shunts, leads and leather carrying case. Manufactured by Elliott Bros. Supplied brand new, £9.18.6 each. Carriage 7/6.



**MINE DETECTOR No. 4A**

Will detect all types of metal. Fully portable. Complete equipment supplied tested with instructions, 39/6. Carriage, 10/6. Battery 8/6 extra.

**COLLARO STUDIO TAPE TRANSCRIBER**

Brand new 1962 model, 3 speeds, 3 motors, digital counter, etc. Fitted with latest bradmatic heads and interlock button. Supplied with spare spool. Instructions, fixings, 10 gns. each. Carr. paid.

**CLASS "D" WAVEMETERS MK. II**

Heterodyne crystal controlled frequency meter covering 1.9 to 8 Mc/s. 6 volt D.C. operation. Supplied brand new. Complete with crystal, valves, spare vibrator, headset and instruction manual, 59/6 each. P.P. 3/6.

**CT-53 SIGNAL GENERATORS**

Precision instruments covering 8.9 to 15.5 Mc/s. and 20 to 300 Mc/s. on 6 bands. Variable attenuator from 1 microvolt to 100 millivolts. Operation 110/200/250 volts A.C. Supplied in perfect working order. Complete with calibration charts, 19 gns. each. Carriage 10/6.



**PRECISION A.C. AND D.C. VOLTMETERS**

Two ranges, 160 and 320 volts, 8 inch mirror scale with knife edge pointer. Housed in polished wooden case. Ideal for schools, labs., etc. Supplied brand new, £5.19.6 each. P.P. 3/6.

**R.C.A. AR.88 LF RECEIVERS**

These world-famous 14-valve receivers are offered in excellent condition. Fully tested and checked before dispatch. Frequency coverage on six bands is 75 to 550 Kc/s and 1.5 to 30 Mc/s. Completely self-contained except phones or speaker. Operation for 100-200-250 volt A.C. £32.10.0 each, carriage 30/- ex.



**JEMCO 4,000 OHM/VOLT TESTMETER**

1% Precision Resistors throughout. Single control system for all ranges. Highly accurate. Sensitivity 4,000 Ω/volt A.C. and D.C.



Ranges:  
D.C. volts: 0-10-50-250-500-1,000v.  
A.C. volts: 0-10-50-250-500-1,000v.  
D.C. current: 0-250vA  
0-25-500mA  
Resistance; 0-30kΩ  
0-300kΩ  
0-3MΩ  
Decibels: -20 to +36 db (2 ranges).

Meter sensitivity: 100 microamp, 62/6 each P.P. 2/6.

**JEMCO 20,000 OHM/VOLT TESTMETER**

As above but with increased sensitivity and extended resistance range (0-5M Ω), 97/6 P.P. 2/6. Either type brand new. Guaranteed with leads, prods, batteries, instructions.

**L.T. METAL RECTIFIERS**

All full wave, bridge connected. Brand new, guaranteed.  
12/18v. 1.5A, 3/9 24/36v. 4A, 15/6  
12/18v. 2.5A, 6/3 24/36v. 15A, 45/-  
12/18v. 4A, 8/6 36/48v. 2A, 19/6  
12/18v. 6A, 12/3 36/48v. 4A, 29/6  
12/18v. 10A, 22/6 36/48v. 6A, 32/6  
12/18v. 15A, 37/6 48/60v. 2A, 21/-  
24/36v. 1A, 7/8 48/60v. 10A, 82/6  
Please add postage.

**L.T. TRANSFORMERS**

All primaries tapped 200/250 volts, 1 Battery (charging, 3.5, 9 or 17 volt, 1 amp., 9/8. Ditto 2 amp, 14/3. Ditto 4 amp., 16/6, 9 or 17 volt, 6 amp., 26/-  
2 Model Type 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30 volt, 2 amp., 18/6. Ditto 4 amp., 27/6. Ditto 5 amp., 37/6. Add Postage.

**AUTO TRANSFORMERS**

Step-up, step-down, tapped 0-115-200-230-250 volts, 15w., 9/- 60w., 12/6; 150w., 18/6; 300w., 27/6; 300w., 42/6; 500w., 37/6; 1,000w., 99/6; 1,500w., £8.19.6 P.P. extra.

**R.C.A. PLATE TRANSFORMERS**

Pri. 200/250 v, sec., 2,000-0-2,000 v, 500 mA, tapped 1,500 v, New, boxed, £6.10.0. Carriage 15/-.

**DUMONT KIOSIPI DOUBLE BEAM C.R.T.**

Twin Gun, Brand new, boxed, 59/6, P.P. 3/6.

**1.2 Ohm 12 Amp RHEOSTAT**  
Gehrdt slider type, new boxed-15/6 each. P.P. 3/6.

**PAINTON 100KΩ 3/4 DIA. INSTRUMENT POTS**

Fully screened, precision wire, wound, 10/6 each. P.P. 1/6.

**CADMIUM SULPHIDE PHOTOCELLS**

Very sensitive, full data supplied, 12/6 each. P.P. 6d.

**MINIATURE PANEL METERS**

For 1 1/2 in. dia. panel hole.  
0-50µA 39/6 0-300 v. D.C. 27/6  
0-500µA 32/6 "S" meter 35/-  
0-1 mA 27/6 "VU" meter 42/6  
0-5mA 27/6

Hours of Business: 3 LISLE STREET, 9 a.m.—6 p.m. Half Day Saturday  
34 LISLE STREET, 9 a.m.—6 p.m. Half Day Thursday

Send S.A.E. For Bargain List

**GW. SMITH & CO (RADIO) LIMITED**  
Phone: GERRARD 8204/9155  
Cables: SMITHEX LESQUARE  
3-34 LISLE STREET, LONDON, W.C.2



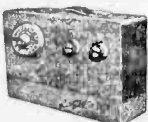


**COMPLETE V.H.F./A.M. RADIO FOR £12.10.0**

(carr. paid)  
Brand new set, in superb walnut cabinet (size 19 x 8½ x 14½ in. high). Covering 80-100 Mc/s. 16-49 M. and 200-500 M. Mains trans. 200-250 v. with 2 lappings. Ferrite rod aerial for A.M. Controls: volume on/off, tone tuning w/change. Grain and ext. speaker position provided. Valves 12A17, 12AH8, 6HJ6, EABC80, 6BW6 and metal rectifier. Fully guaranteed. Today's Value, £20.

**TAPE TOP QUALITY BOXED.** 5½ in.—850ft., 15/-; 1,200ft., 17/6; 7 in.—1,200ft., 17/6; 1,800ft., 26/8 (all plus 1/8 post. 2/- for 2).

**THE "CANTATA" 6-TRANSISTOR AND DIODE PORTABLE COMPLETE KIT FOR ONLY £7.19.6** (post 3/6)



500mW push-pull output. Ferrite rod aerial. Car aerial socket and coil M.W. and L.W. full coverage. Operates on two 4.5v. cells. Printed circuit board 8½ x 2½ in. All holes drilled and component positions marked. Instructions 2/6 for 16 p. (refunded on purchase of kit). Size 9 x 3½ x 7½. 8 x 2½ in. P.M. high quality speaker. Attractive Vynair covered cabinet two tone. Two batteries 5/6 the pair (Ever Ready 120). Multitran transistors OC44, 2 x OC45, OC81B, and 2 x OC81. Top grade Westmouth Radio coils and transformers. Alignment service if required 17/8 (inc. post). Write for list of prices. All parts supplied separately. Built in two hours.

**BUILD YOUR OWN RECORD PLAYER**

Price £12 carr. paid  
Fully built 2-valve amplifier

B.S.R. 4-sp. autochanger, case 17 x 15 x 8½ in. Assembled in 15 mins. Similar cabinet for tape recorder with plain board only 23, carr. paid. Attractive covers.

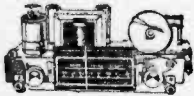
or with 3-valve amplifier 15/- extra

**AUTOMATIC RECORD CHANGERS—LATEST MODELS. 4 SPEED CRYSTAL CARTRIDGE.** All 5/- extra carr. B.S.R. UA14, £7.10.0. Garrard Silhouette Mono 23. Stereo. £8.5.0. Motor board for UA4, UA20, UA14, Silhouette. 5/- (post 1/6) or 3/6 post paid when purchased with Autochanger. Motor Board for Collaro £60. 4/-.

**TELEFUNKEN STEREO AMPLIFIERS.** 2 EC182—2 x 2½ watts. 12 x 9 x 2½ in. piano keys. 27. post paid. (Complete with power).

**SELF-POWERED VHF TUNER CHASSIS**

Covering 88-95 Mc/s. Multitran permeability Tuner. Dims. 10½ x 4½ x 5½ in. high. EOC85, EF91, EF91 and 2 diodes. Metal Rectifier. Mains transformer. Fully wired and tested. Only £7.10. (carr. pd.). Some tarnished chassis otherwise O.K. 26.10.0.



Attractive Vynair Cabinet 20/- . Room dipole 12/8. Feeder. 6d. vt.

**PUSH-PULL AMPLIFIER £5.5.0**

(3/- Carr.)

Brand new 200-240 A.C. mains. Bass, treble and vol. controls. With valves E280, EOC83 and 2-EL84 giving full 4 w. Chassis 12 x 3½ x 3½ in. With o.p. trans. for 2-3 ohm speaker. Front panel

(normally screwed to chassis) may be removed and used as "flying panel." Stereo version 2 x 4 w. same price.

**TAPE RECORDER AMPLIFIER**

Type TR3. Fully built, high gain, low noise, printed circuit. Attractive grey and gold front panel. 13 x 1½ in. Height 5½ in. overall. Front to back 5½ in. Vol. and on/off tone. Mke. radio, monitor and ext. speaker jacks. Valves EOC83, ECL82, E280. Mains trans. Ready to bolt to B.S.R. Deck. Complete with switch wafer wired. Our Price ONLY 26.2.8. (6/- Packing and Carr.). Similar model without magic eye. Type T.R.1. 3in. Instead of 1½ in. 25.15.0. (6/- Carr.).

Also available for Collaro Deck. 8/- with chain.

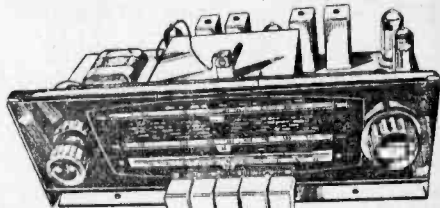
Transistor Set Battery Eliminator. Converts four 6 transistor receiver to mains operation. Size 1½ x 1 x 1 in. With flex lead and battery charging attachment. 18/6.

Staar "Galaxy" or Garrard 9v. battery operated single 45 r.p.m. record player deck, with pick-up arm, and stylus, etc. Only 50/- . P. & P. 4/-.

**NEW LOUDSPEAKER BARGAINS. Good Makes.**

2-3 ohms 13 x 8½ in. 25/- (4/-); 7 x 4 in. 14/8 (2/-); 6½ x 4½ in. 12/8 (2/-); 10 x 6 in. 25/- (3/-); 5 in. 12/- (2/-); 4 in. tweeter 7/8 (2/-); 7 x 5 in. 17/8 (2/-); 9 x 6 in. 22/- (2/6); 8 in. circ. 13/6 (2/6); 10 in. circ. 25/- (3/-). Postal charges bracketed.

**BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £14.0.0 (Carriage Paid)**



A.C. ONLY. Chassis size 16 x 6½ x 5½ in. high. New manufacture. Dial 14½ x 3½ in. in 2 colours predominantly gold. 9 x 1½ in. ELLIPTICAL SPEAKER. 20/- to purchasers of this chassis. TERMS: (chassis) 25 down and 5 monthly payments of 22. Cheap Room Dipole for V.H.F. 12/8. Feeder 6d. vd. Circuit diagram 2/6.

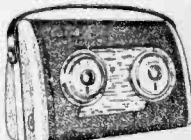
**6-TRANSISTOR PORTABLE—Fully Built**



The "SCALA" for only £9.17.6, carr. paid. 8½ x 2 x 5½ in. high. Choice of colours—Redline, M.W. and L.W. Ferrite aerial. Battery included. Printed circuit. Nicely styled. A professional job. 3½ in. speaker. Fully Tunable M.W. and L.W.

**THIS SUPERB SET for £10**

6-transistor radio covered in sponge clean Duracour fabric. In latest two tone shades, M.W. and L.W. ferrite rod, provision for car aerial, 2-colour scale. With PP9 battery giving 300 hours use. Weighs under 4 lbs. With carrying handle. 12 x 7½ in. high x 4½ in. at base tapering to 2½ in. at top. Brand new, fully guaranteed, £10. Carr. paid. Worth £16.



**SUPERIOR GRAMOPHONE AMPLIFIER**

Valves UY80, EF90 and U184. Mains trans. 200-240 a.c. Covered grille 13½ x 7½ in. (6½ in. speaker) or 11 x 7½ in. (8 x 5 in. speaker). 3 front controls, bass, treble, on/off vol. 74/- (post 4/-) either type. Restine cabinet to fit, with carrying handle, and lid (detachable) 14 in. or 12 x 8½ x 5½ in. 10/- extra.

**GRAMOPHONE AMPLIFIER.** With 5in. SPEAKER Baffle 12½ x 6 in. ECL82 and Rectifier, Tune and Volume. On/off switch. Two knobs. Useful for Stereo. 57/- (post 4/-).

**SPECIAL OFFER**

Brand new tape recorder, two tone beige case, "gold" trimmings. Magic eye, monitor, ext. speaker sockets. With 5½ in. tape and mike. Fully guaranteed. Price usually 191 gns. Very high gain with low noise. Price £14 carr. paid.

**COLLARO STUDIO TAPE TRANSCRIBOR. 3 MOTORS. 3 SPEED—11, 37 and 71 r.p.m. Push buttons. £10.17.8 (10/- carr. p. incl. post).**

**3-VALVE AMPLIFIER (Inc. RECT.)**

2½ watts. EOC83, ECL82 and E280. Controls, volume, bass and treble. On/off switch. Mains and O.P. trans. Size as for Push-Pull Amp. Suitable for microphone input and for Guitar. 95/- . P. & P. 5/-.

Also acts as telephone amplifier using pick-up coil price 14/-. Chassis 12 x 3½ x 3½ in. Fixed front panel. Price includes handsome walnut finish polished cabinet. 13 x 7½ in. fascia containing high quality 3 ohm P.M. speaker 5½ x 4½ in. (20/- less without cab. and speaker).

**BATTERY ELIMINATOR**

For 4 Low Consumption Valves (9v range) 80v, 15mA and 1.4v, 125mA A. 45/- (2/6 post). 200-250v. A.C. Also for 250mA, 1.4v. and 90v. 16mA at same price.

**CHASSIS BATTERY RADIO**

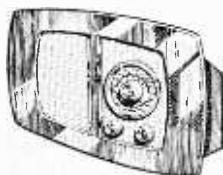
Valves DK96, DF96, DA96, D196. Two Short Wavebands 16 to 49 M and 25 to 76 M. Size 10½ x 4½ x 6 in. £4.18.0, carr. paid. MW and SW, 25, carr. paid. Or see Kit 75/-.

**ALL ITEMS ARE NEW AND FULLY BUILT UNLESS OTHERWISE STATED. TESTED BEFORE DESPATCH.**

Terms Available on Items over £5. Send 6d. (stamps will do) for 20 page illustrated catalogue. Delivered by return. C.O.D. 2/- extra.

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FARNBOROUGH CLOSED SATS.—PORTSMOUTH WEDS.



**TABLE MODEL  
TRANSISTOR SET  
£9.10.0 (carr. paid)**

6 transistors and diode, 5in. circular speaker, superhet circuit. Cabinet 13 x 7 1/2 x 4 1/2in., battery included. Fully tunable LW and MW. Polished walnut front.

**MAINS OPERATED RADIO CHASSIS AND AMPLIFIER OF FAMOUS MANUFACTURE**

Chassis 10 x 5 1/2 x 4in. front to back. Valves: UBC41, UCH41, UF89, UL84 with metal rectifier. 5in. speaker. Ferrite rod aerial. Tone, vol. and gram. position. Covers L. and M waves. Limited quantity at only £8 (5/- carr.) complete with small dial. Unused and in working order.



**TELEFUNKEN**

German made F.M. front end 22/6 (post 2/6), with EOC85 valve. Permeability tuned, 88-99 Mc/s. 4 x 1 1/2 x 2in. high plus valve 2in. Circuit 2/-.

**MULLARD**

Permeability tuned F.M. front end 22/6 (post 2/6), with EOC85. 4 x 3 x 3 1/2in. 88-99 Mc/s.

**TRANSISTOR BABY ALARMS**

Two attractive moulded units with connecting lead. Just plug the units together. FULLY BUILT, not a kit. Battery included, last months. Is excellent intercom. ONLY 25, carr. paid.

**BRAYHEAD "TRANSTRONIC" TRANSISTOR CONSTRUCTION KIT**

Two Mullard transistors and diode. Seven circuits can be built inc. transmitter and receiver. 15-page instruction book. Includes all necessary components. Just the gift for a beginner. Originally over 25. Our price 42/6 (post 2/6).

**MINIATURE EARPHONES FOR TRANSISTOR RADIOS**

3 foot cord. Miniature Jack and Socket. Crystal 8/-, magnetic 7/6.



**4 TRANSISTOR  
MINIATURE PUSH-PULL  
AUDIO AMPLIFIER**

For 3 ohm speaker. 200mW output suitable for intercoms. Portable radios, etc., with free instruction sheet and diagram. For mike or radio input 4 x 1 1/2 x 7. Printed circuit 47/6, post paid.

**TRANSISTORS POST FREE**

Set of 6 Mullard transistors OC44, 2-OC45, OC81D, 2-OC81 (matched) and OA70 diode 30/-; set of G.E.C. transistors 874, 2-873, 3-82 or 83. 17/8

**TEST LEAD KIT**

Leads, prods, terminals clips in case, 10/-, post paid.

**PANEL OF 7 POTS.**

10 x 1 1/2in.—4 x 1M and 3 x 2M. 4/- (post 1/-).



**THREE-VALVE AMPLIFIER AND RECTIFIER**



4 watts. Valves EOC88, EL84 and EZ80. Controls, volume, bass and treble. On/off switch. (Chassis size 6 1/2 x 3 x 2 1/2in.) 6 1/2in. round or 7 x 4in. elliptical speaker. Not suitable for microphone input. A.C. only. 57/-, P. & P. 3/-.

**PERSPEX**

12 1/2 x 9 1/2 x 3 1/2in. clear, 5/-.  
16 x 14 x 3 1/2in. clear, 7/6.  
Postage on one sheet 2/-, on two or more 3/-.

**TRANSISTOR COMPONENTS**

M.W. and L.W. ferrite rod aerial, with car coupling coil. For 200pF condenser. 8/-; Osc. coil; 1st, 2nd and 3rd I.F.'s, all 5/6 ea.; Driver trans., 7/6 min. 64mF 10v; 10mF 16v; 30mF 6v, all 1/8 ea.; Tuning cond. 208mF +1 176pF 8/6; post 9d. on all orders.

**NEW 5 WATT AMPLIFIER**

By famous manufacturers made to sell at 26.10. Our price ONLY 45/- (post 4/-); a few hundred only; valves EF91 and EL84 with metal rectifier; 6 x 4 x 1 1/2in. high (5in. over EL84). Mains trans. and o.p. with vol. and tone controls; on-off; co-ax input.

**100 RESISTORS**

100 resistors 8/-; 100 condensers inc. ceramic and silver mica, 9/6.

**A FEW EX-RENTAL 4-WATT AMPLIFIERS**

With 10P14, U404, and 10F3 valves; used but in fair condition. 8in. speaker; useful for record player, baby alarm, general amplifier, etc., 15 x 12 1/2 x 6 1/2in. Mains operated, 18/6 (8/- carr.). Some wood and some moulded cabinets.

**SPECIAL OFFER OF  
RECORDER CABINET**

Plain boards, polished walnut finish. 38 x 15 1/2 x 23in. high plus 8in. legs. Part delivery charge of £1, as offered elsewhere at over £22, brand new.

Fitted with 3 sliding doors.



PRICE £13

**"READY TO USE"  
ITA CONVERTER**

Direct switching ITA to B.B.C. metal rectifier, co-axial plug. Can be fitted in 5-10 mins., and needs no alteration to your set. ALL AREAS. ALL SETS. ALL CHANNELS. 12 months' guarantee (3 months on valves). Separate gain controls. Valves ECR80 and EC934. Switch positions OFF—ITA—B.B.C. Bakelite moulded cabinet. 8 1/2 x 4 x 6in. 70/- (3/- P. & P.).



**AERIALS**

Combined B.B.C. (Single Dipole) and Band 3 I.T.A. (5-Element) Aerial, with chimney lashings and Stand-off Arm. Carriage paid £3.15.0.

I.T.A. (Band 3) Aerials for clipping to existing mast of diameter 1in. to 2in. Alternatively with wall-fixing plate at same price: 3 element £1.2.0. 5 element £1.10.0, 8 element £2.10.0, 11 element £3.2.6. Chimney lashings and Stand-off Arm 20/- extra for each of above.

Loft Mounting I.T.A. Aerials, 3 element 20/-, 5 element 26/-. All aerial prices carriage paid. Larger aerials for I.T.A. and B.B.C. can be supplied to special order.

Double 6 Element I.T.A. Plus B.B.C. "H" Aerial with 10ft. pole and double chimney lashings, £8.10.0.

An I.T.A. Table Top Aerial with amazing performance. The Wolsey Hi-Q at 19/6 (2/6 post). Good reception up to 20 miles. Cross-over unit in base with socket for B.B.C. aerial. Slightly tarnished at 12/6 (2/6 postage).

PERSPEX. 15 x 12 x 3 1/2in., tinted blue/grey, 6/6; 12 1/2 x 9 1/2 x 3 1/2in. Clear, 5/-; 16 x 14 x 3 1/2ins., Clear, 7/6. Postage 2/- on 1; 3/- on 2 or more; 6 post paid.

**A FANTASTIC OFFER OF EXTENSION  
SPEAKERS**

Made by Goodman. Wooden Cabinet 12 x 7 x 10 1/2in. Containing 8in. P.M. 3-ohm speaker; used but good condition. Vol. control fitted. Our price 12/6 (3/6 Post).

**COMPONENTS FOR "P.W." AMPLIFIER,  
GENERATOR, ETC.**

Tubular condensers 350v 0.01, 0.02, 0.05mFd, 6d. ea; 0.25 and 0.5mFd, 9d. ea; Resistors 1/2 10% 6d. ea. 20% 3d. ea; Contact rectifier 250v, 50mA, 6/6; 16-16mFd Elect. 500v, 3/6; D.P.S.T. toggle switch, 3/-; High stab resistors 1 1/2 ea; Valve holders BTG and B9a with skirt and screen, 1/- ea; Co-ax socket 1/-; 1M and 25k pots, with spindle 2/6 ea; SK2, SK4, and SK5 sockets 3/- ea; ditto plus 3/- ea; add postage Also many other items specified. S.A.E. enquiries.

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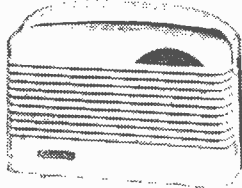
# LASKY'S RADIO

## "BUILD-YOURSELF" TRANSISTOR RADIOS

### The "REALISTIC" Seven

STAR FEATURES ★★★★★

- ★ 7 Transistor Superhet. 350 Millit. output into 4-inch high flux speaker.
- ★ All components mounted on a single printed circuit board, size 5 1/4 x 5 1/2 in. in one complete assembly.
- ★ Plastic cabinet, with carrying handle, size 7 x 10 x 3 1/2 in. in choice of colours:
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- ★ I.F. frequency 470 Kc/s.
- ★ Ferrite Rod internal aerial.
- ★ Operates from PP9 or similar battery.
- ★ Full comprehensive data supplied with each Receiver.
- ★ All coils and IF's, etc., fully wound ready for immediate assembly.



An Outstanding Receiver. Lasky's Price for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. **£6.19.6** Postage and Packing 4/6 Battery 3/9 (included free with complete parcel). Data and instructions separately 2/6, refunded if you purchase the parcel.

### THE BETA TWO

A 2-transistor plus 2-diode personal receiver for home construction. Uses printed circuit and ferrite rod aerial. Personal earphone gives clear reception for private listening. Tunes over full medium wave-band. Size 5 1/2 x 3 1/4 x 1 1/2 in. over all. All components available separately. **CAN BE BUILT FOR 2/1-**



Postage. 2/6 ex. Including personal earphone, cabinet, etc. Circuit diagram and step by step instructions 1/6. (Free with parcel.)

### THE COROVER '6'



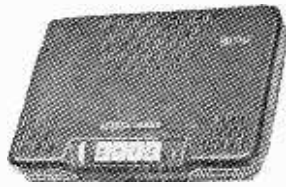
The latest in our range of Constructors' Parcels. The Corover '6' is a 6-transistor plus two diode receiver using the latest circuitry.

Three Mullard AF117 alloy diffused transistors are used in the first stages with OA79 and OA91 diodes, followed by OC 81D and two OC81's in push-pull to complete the output stages. Covers the full medium & long wavebands, with separate easy to read scales for each. Sockets are fitted for a personal earpiece or tape recorder, and car radio aerial. Large internal ferrite rod aerial ensures good reception of local and distant stations. Operates from 4 1.5 v. pen torch batteries. All components mounted on a single printed circuit. Simple stage by stage instructions. Cabinet size 6 1/2 x 4 x 1 1/2 in. With carrying handle. All coils add I.F.'s ready wound. All components available separately. Data and instructions separately 2/6. Refunded if you purchase the parcel.

### TELEFUNKEN STEREO HI-FI AMPLIFIERS £5.19.6

Further Great Purchase Enables us to Offer this Excellent Unit at **£5.19.6** Post 7/6.

A complete stereo amplifier of unsurpassed quality, with inputs for radio, tape recorder, F.M. tuner or any other hi-fi source, either monaural or stereo. Output power 5 watts total (2 1/2 watts each channel). New and unused, listed at 16 gns.



**CAN BE BUILT FOR £5.19.6** Post. and packing 4/- extra.

WE ARE PLEASED TO ANNOUNCE OUR NEW PREMISES at 152/3 FLEET STREET, LONDON, E.C.4. Tel: FLE 2833.

The new branch will carry our full range of tape recording equipment, valves, components, etc. Open all day Thursday, early closing Saturday.

### KAPURA Model U1 Multi-Test Meters

- ★ Complete with test leads.
  - ★ Brand new, fully guaranteed.
- Sensitivity: 1,000 ohms per volt A.C. and D.C.  
 Ranges: (A.C. and D.C.) 0-15-50-250-500-1,000 v. D.C. current 0-100-500 mA. 0-1 mA (used at 0-10 v. range). Resistance: 1-2,000 ohms (centre 2 1/2 ohms), 100-200,000 ohms (centre 2.4k). Size: 5 1/2 in. x 3 1/2 in. x 2 1/2 in.



**LASKY'S PRICE 39/6**  
Carriage and Packing 5/-

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By famous manufacturer, I.P. 33-38 Mc/s., PCC84 and PFC80 valves fitted, also 12 sets of coils. Lasky's Price Complete with Valves and Coils 29/6. Postage 2/6.

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6 volt battery operated 7/11. P. & P. 2/6.

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  - Ronette Studio 0 ..... 15/-
  - Acos GP.65/3 ..... 15/-
  - Acos GP.65/1 ..... 17/-
  - Acos GP.67/1 ..... 17/-
  - Acos GP.61/1 ..... 18/-

- STEREO**
- Acostereo 73/1 with two sapphires ..... 25/-
  - Acostereo 73/2 with Diamond, L.P./Stereo and sapphire Std. .... 29/6
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  - Collie S.C.I. Turnover with 2 sapphires ..... 24/6
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### THE VERY LATEST "PHONOTRIX" TRANSISTOR BATTERY TAPE RECORDER



Supplied in Real Leather Carrying Case, with Shoulder Strap (not illustrated). Capstan drive, push-button controls. Constant speed 3 1/2 i.p.s., uses 3in. spool. High impact plastic case with leather outer case. Size: 9 1/2 x 5 x 3 1/2 in. List 25 gns. **LASKY'S PRICE: 18 Gns.** With Mike and Tape, Carr. 7/6.



### Electric Motors

Brand New Single-phase motors, suitable for tape recorders, workshops, etc. Many uses. Reversible 200-250v. 5in. oz torque, 1,400r.p.m. Capacitor Start. Weight 4 1/2 lb., length 5 1/2 in. Spindle both ends 1/2 x 1/2 in. Price, including capacitor, 19/11. P. & P. 3/6 ex.

207 EDGWARE ROAD, LONDON, W.2. | 33 TOTTENHAM COURT ROAD, W.1. | 152/3 FLEET STREET, LONDON E.C.4

Near Praed St. PADDINGTON 3271/2 | Nearest Stn. Goudge St. MUSEUM 2605 | Telephone: Fleet Street 2833.

BOTH OPEN ALL DAY SAT: Early Closing Thurs. Mail Orders to Dept. P.W., Edgware Rd. | Open all day Thursday. Early closing Sat.



**TRANSISTOR SET CASE.** 11½ x 8 x 3in. with carrying handle finished in two-tone grey with gold trim, price 22/6. Set of suitable knobs, 5/- extra.

**LEATHERCLOTH COVERED RECORD PLAYER CASE,** suitable for single player unit, etc. Size 14½ x 13 x 6½in., supplied with uncut motorboard, carrying handle, gold trim, available in red/grey and two-tone grey. Price 44/-.

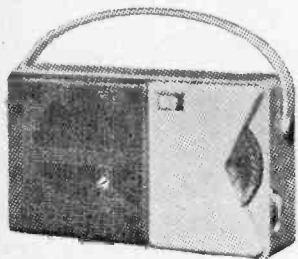
**LEATHER CLOTH CASE,** as above but suitable for automatic record player, size 14½ x 14½ x 8½in., available in blue/grey, red/grey, price 56/-.

Miniature Jack plug and socket 2/6 set.  
Miniature Slide Switch 2 pole change over 2/6.  
Transformers LT.44/700 Driver and Output 8/- pair.  
Top Quality co-axial Cable semi airspaced 6d. yard.  
All Co-Axial Accessories available from stock.

**PERSONAL EARPHONE**

A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully guaranteed and complete with ear insert, 3 feet cord, sub miniature plug and socket. **Model CR5** Crystal Earpiece high amp. **Model MR-4.** Magnetic earpiece low amp., 6/- each.

**"PRACTICAL WIRELESS"  
POCKET TRANSISTOR  
SUPERHET**



COMPLETE KIT £7.19.6.

**BUILD YOUR OWN  
PORTABLE RADIO**

**FUN TO BUILD!  
FUN TO OWN!**

★ Up to the minute styling, precision-engineered circuitry and extraordinary tonal quality highlight the design of this popular kit. You'll be proud of its "big set" performance—and doubly proud to have built it yourself!

★ Advance GEC drift-field transistors, high impedance 2½in. speaker, powerful reflex circuit.

★ Built-in ferrite rod aerial, extremely efficient circuit. Uses popular 9V battery (Ever-Ready pp.4) available everywhere.

★ Attractive high impact ivory case is virtually unbreakable. Two controls—off-on/volume and tuning. Ready drilled circuit board.

The perfect kit for beginners interested in transistor circuits. 52/6

Complete set of parts and step-by-step pictorial instructions.

★ ALL PARTS SOLD SEPARATELY ★

**LOUDSPEAKER CABINETS**

- Baffle type, walnut finish—
- Type suitable for an 8" unit Price 21/-
- Type suitable for a 10" unit Price 25/6
- Type suitable for a 7" x 4" unit Price 17/6

**AUTOMATIC RECORD  
CHANGERS**

- BSR UA14 ..... £6.19.6
- COLLARO C60 ..... £7.19.6
- GARRARD AUTOSLIM ..... £7.19.6

**SINGLE PLAYERS**

- EMT. 4 Speed with pick-up ..... £3.15.0
- BSR GU6 ..... £4.19.6
- GARRARD TA MK11 ..... £8.10.0
- EMI BATTERY VERSION ..... £5.9.6

**J.B. DILEMIN CONDENSER**

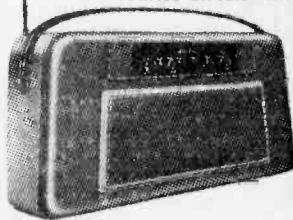
Solid Dielectric available in 300pF or 500pF, 7/6 each.

**A NEW EDITION OF THE ALPHA  
60-PAGE HI-FI CATALOGUE**

A really up-to-date catalogue illustrating and providing Technical Data on all the latest equipment. Price 2/6, post 6d.

Our new 1962/63 48-page catalogue, profusely illustrated, is now available. Please send 1/- in stamps for your copy. Trade Catalogue also available for which please attach your Business Letter Heading.

**"MERCURY SIX"  
Components Price List for the  
Printed Circuit Version**



- COIL SET (OSC. and 3 I.F.s) ..... 22/-
- DRIVER TRANSFORMER..... 8/3
- Type PW/DT
- OUTPUT TRANSFORMER..... 8/-
- Type PW/OT.
- FERRITE ROD AERIAL..... 8/6
- Type PW/FR
- 2-GANG CAPACITOR, Type "OO" 12/6
- VOLUME CONTROL, EGEN 10K. 8/6
- S/P SWITCH ..... 6/6
- SWITCH ..... 3/6
- TRANSISTOR Type Y.C. (set of six) } 43/-
- XTAL DIODE Type GD9..... 22/5
- SPEAKER
- CASE complete with handle, front grille, studs ..... 25/-
- CAPACITORS ..... 17/6
- RESISTORS ..... 5/-
- TRIMMERS, Type MT.31/4A, 1/3 ea. 3/9
- PRINTED CIRCUIT BOARD ..... 14/6
- COMPLETE DIAL ASSEMBLY (BOXED) ..... 14/6
- HARDWARE (Screws, Nuts, Washers, Spacers, Battery Clips, Aerial Cradle) ..... 5/9
- Postage and Packing 2/6
- INSTRUCTION HANDBOOK ..... 2/6

COMPLETE KIT £9.9.0

**TRANSISTORS AND DIODES**

Transistors	OC75 8/-	OCP71 25/-	OA73 3/-	GECSI
OC35 18/-	OC77 12/-	Matched Pairs	OA79 3/9	Audio 3/6
OC36 21/6	OC78 8/-	2xOC72 16/-	OA81 2/6	Red 3/6
OC44 6/-	OC81 8/-	2xOC78 16/-	OA85 3/-	Spot 3/6
OC45 8/-	OC84 8/6	Diodes	OA91 3/-	White 3/6
OC70 6/6	OC170 9/6	OA5 6/-	OA95 3/6	Spot 5/-
OC71 5/-	OC171 10/6	OA10 8/-	Sundry Types	GEX34 3/-
OC72 8/-	OC201 31/-	OA10 8/-	PXA102 4/-	GEX35 3/-
OC73 16/-	OC202 26/-	OA70 3/-		XD201 1/-

A set of Transistors comprising 1 OC44, 2 OC45, 1 OC81D, 2 OC81, 32/6 set.  
Set of Audio Transistors, 1 x OC81, 2 x OC81, Driver Matched Pair, 15/6 set.

**TERMS:** Cash with Order or C.O.D. Postage and Packing Charges extra. Single valves 9d., Minimum Parcel Post charges 2/-. Please include sufficient postage with your order. Minimum C.O.D. fees and postage 3/6. These Postal Rates apply to U.K. only. For full terms of business see inside cover of catalogue. Personal shoppers 9 a.m. to 5 p.m. Mon. to Friday, Saturday 10 a.m. to 1 p.m.



**103 LEEDS TERRACE  
WINTOUN STREET  
LEEDS 7**

# STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN'S strictly to specification

## MULLARD "5-10" MAIN AMPLIFIER

For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply SPECIFIED COMPONENTS AND NEW MULLARD VALVES, including PARMEKO MAINS TRANSFORMER and choice of the latest Ultra-Linear PARMEKO or the PARTRIDGE Output Transformer.

COMPLETE KIT OF PARTS (PARMEKO Output Trans.) **£10.00**

Alternatively we supply ASSEMBLED and TESTED. **£11.10.0** INCORPORATING PARTRIDGE OUTPUT TRANSFORMER. £1.6.0 EXTRA.



## MULLARD'S PREAMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves, and designed to operate with the MULLARD MAIN AMPLIFIERS, but also perfectly suitable for other makes.

KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

- ★ Equalisation for the latest R.I.A.A. Characteristics.
- ★ Input for Crystal Pick-ups, and variable reluctance magnetic types.
- ★ Input (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-Amplifier.
- ★ Sensitive Microphone Channel. ★ Wide range BASS and TREBLE Controls.

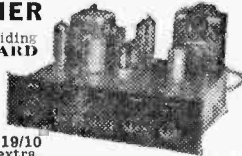


## THE MULLARD "510/RC" AMPLIFIER

The popular complete "5-10" incorporating Control Unit providing up to 10 watts. Specified Components and new MULLARD VALVES are supplied including PARMEKO MAINS TRANSFORMERS and choice of the latest PARMEKO or PARTRIDGE ULTRA-Linear Output Transformers.

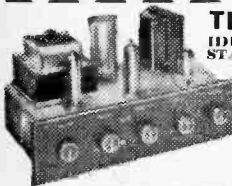
KIT OF PARTS **£11.10.0** OR ASSEMBLED AND TESTED **£13.10.0**

Dep. £2.6.0. 12 months at 17/0. Dep. £2.14.0. 12 months at 19/10 ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.



## THE MULLARD "33/RC"

IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS



KIT OF PARTS **£7.10.0**  
OR ASSEMBLED AND TESTED **£8.19.6**

(plus 5/6 carr. and ins.) Deposit £2.0.0 and 8 months £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and PARMEKO OUTPUT TRANSFORMER.

valves and PARMEKO OUTPUT TRANSFORMER.



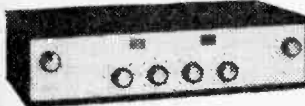
## "The TUDOR" AM/FM TUNING UNIT

A SELF POWERED HIGH FIDELITY TUNER OF OUTSTANDING DESIGN.

PRICE ONLY **£19.19.0** Deposit £4.0.0 and 12 months at £1.9.4.

Provides full coverage of the VHF/FM band (87-108 Mc/s) and also the LONG and MEDIUM wavebands. Incorporates Multiplex outlet socket for stereophonic purposes and separate controls for tuning the FM and AM bands. Operates perfectly with the STERN-MULLARD AMPLIFIERS and contains matching FRONT PANEL in Black/Gold or White/Black. Also operates equally well with any Amplifier requiring input of 100 to 350 m/Volts.

## THE "TUDOR" STEREO AMPLIFIER



For Only **£18.18.0**

Deposit £3.16.0. 12 months £1.7.8.

A self contained Amplifier designed to provide high quality stereophonic and monophonic reproduction. Each channel provides a rated output of 6 watts and for monophonic operation approx. 12 watts. Separate BASS and TREBLE CONTROLS. DESCRIPTIVE LEAFLET IS AVAILABLE.

## PRICE REDUCTIONS

- (a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9 **£15.15.0**
  - (b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months at £1.7.8 **£18.18.0**
- With Partridge Output Transformer £1.6.0 extra.

## RECORD PLAYERS

THE GARRARD "AUTO-SLIM" 4-speed Autochanger with **£8.10.0** Crystal Pick-up

GARRARD "AUTO-SLIM DELUXE" 4-speed Autochanger Incorporates transcription Pick **£12.14.6** Up Arm

COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER **£3.15.0** ER with separate Crystal Pick-up. Above Pick-up separately for £1.6.6.

THE COLLARO C60 4-speed Autochanger unit with Studio "O" Pick-up **£7.19.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with **£7.19.6** Crystal Pick-up

GARRARD MODEL TA/MK.II 4-speed Player fitted high output Crystal Pick-up **£8.10.0**

PHILIPS MODEL AG1015 ... A 4-speed Player which can be operated both manually and automatically. Suitable for Mono or Stereo operation **£13.13.0** Carr. and Ins. on each 5/- extra.

This attractive PORTABLE AMPLIFIER CASE



with a good quality GRAM AMPLIFIER and P.M. SPEAKER **ONLY £8.7.6** (Plus 7/6 Carr. & Ins.)

A 2 stage Amplifier incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

- WE SUPPLY SEPARATELY—
- (a) The 2-stage (plus Rectifier) AMPLIFIER **£4.2.6**
- (b) The PORTABLE CARRYING CASE **£3.17.6**
- (c) 6in. P.M. SPEAKER 18/9. Carr. and ins. 4/- extra.

## MULLARD FOUR CHANNEL MIXER UNIT

Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Kit of Parts **£8.8.0** Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 2 months at 15/- Alternatively MODEL I.L. provides for one microphone Input matched for moving coil or Ribbon Mike. £1.17.0 extra.



## STERN'S INTER-COMM BABY ALARM

Employing the new MULLARD ECL86 valve to provide two (or three) way conversation up to extreme distances. A.C. 200 to 250 Volts.

PRICES... MASTER UNIT and ONE EXTENSION **£8.8.0**

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.8.0** Consists of a MASTER UNIT, size only 8 1/2 x 5 1/2 x 6 in. and ONE EXTENSION (a second extension may be added to any time)

WE WELCOME ENQUIRIES and our TECHNICAL STAFF will with pleasure assist with choice of suitable equipment.



**STERN RADIO 109, FLEET ST., PREMIER RADIO 23, TOTTENHAM COURT RD., LONDON W.1**  
TELEPHONE FLEET ST., 58123 LONDON, E.C.4. TELEPHONE MUSEUM 3457  
MAIL ORDERS and all POSTAL ENQUIRIES to 7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.11. MUSEUM 61289



# Stereophonic Sound by Stern's

## THE "STP-1" STEREO TAPE PRE-AMPLIFIER

● BRENELL Mk. V TAPE DECK  
Incorporating 1-TRACK MINIFLUX  
TAPE HEADS.

- PUSH PULL OSCILLATOR CIRCUIT
- 4-SPEED EQUALISATION
- FERROXUBE OSCILLATOR TRANSFORMER
- SENSITIVE METER FOR SIGNAL LEVEL
- SEPARATE GAIN CONTROLS IN EACH CHANNEL
- MULLARD VALVES



### COMBINED PRICE SCHEDULE

- (a) The BRENELL Mk. V 1-TRACK DECK with the KIT to build the STP-1..... **£61.0.0**  
Deposit **£12.4.0**, 12 months of **£4.9.6**.
- (b) The COLLARO "STUDIO" 1-TRACK DECK with the KIT to build the STP-1..... **£39.0.0**  
Deposit **£7.16.0**, 12 months of **£2.17.3**.

## DESIGNED TO OPERATE WITH

COLLARO "STUDIO" TAPE DECK  
Incorporating the latest 1-TRACK  
TAPE HEADS.

OVERALL SIZE CASE 13½ x 3in.  
FRONT PANEL (choice of Black or  
White) 14 x 3½in.

PRICES... INCLUDES SEPARATE  
POWER UNITS

Kit of Parts **£22.0.0** Deposit **£4.8.0** 12  
months of **£1.12.3**

Assembled **£28.0.0** Deposit **£5.12.0** 12  
Months of **£2.1.1**

- (a) The BRENELL Mk. V 1-TRACK DECK with the Assembled STP-1 and matched to the Deck..... **£67.0.0**  
Deposit **£13.8.0**, 12 months of **£4.16.3**.
- (b) The COLLARO "STUDIO" 1-TRACK DECK with the STP-1 Assembled and matched to the Deck..... **£45.0.0**  
Deposit **£9.0.0**, 12 months of **£3.6.0**.

## STEREOPHONIC RECORD PLAYER UNITS ARE AVAILABLE FROM STOCK

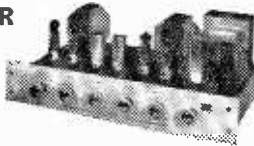
THE MULLARD "10 + 10" AMPLIFIER (described below) with the "STP-1" PRE-AMPLIFIER and one of the TAPE DECKS provide a complete STEREOPHONIC INSTALLATION.

Details are readily available.

## MULLARD'S "10 PLUS 10"

### STEREO AMPLIFIER

A high fidelity design Provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3db from c/s. to 50 K/c/s at 50 mV. Total Harmonic Distortion at 10 watts 0.1%.



- (a) ASSEMBLED AMPLIFIER, including CONTROL UNIT (as illustrated)..... **£21.0.0**  
Deposit **£4.4.0**, 12 months at **£1.10.10**.
- (b) A complete KIT OF PARTS..... **£18.10.0**  
Deposit **£3.14.0**, 12 months at **£1.7.2**.

We supply the assembled MAIN AMPLIFIER only for operation with the DUAL CHANNEL PRE-AMPLIFIER, this provides for a more versatile installation and is essential if a low output Magnetic Pick-Up is to be used.

- (a) THE ASSEMBLED AMPLIFIER and DUAL CHANNEL PRE-AMPLIFIER..... **£30.0.0**  
Deposit **£6.0.0**, 12 months at **£2.4.0**.
- (b) A KIT OF PARTS for both Units..... **£26.0.0**  
Deposit **£5.4.0**, 12 months at **£1.18.2**.

Illustrated and Descriptive Brochure available. Please enclose S.A.E.

## DUAL CHANNEL PREAMPLIFIER

Two Mullard 2-valve Pre-amplifiers combined into a Single unit enabling it to be used for both STEREOPHONIC or MONOPHONIC operation. It is designed primarily to operate with our range of MULLARD MAIN AMPLIFIERS but will also operate equally well with any make of Amplifiers requiring an input of up to 250mV/ohms



ASSEMBLED **£15.0.0**  
AND TESTED

KIT OF PARTS **£12.10.0**

H.P. £2.10.0 & 12 mths. at 18/4. H.P. £3.0.0 & 12 mths. at £1.2.0

## STEREO "TWIN THREE" AMPLIFIER

ASSEMBLED AND TESTED  
**£7.15.0**  
for  
(Carr. & Ins., 7/6 extra).



Based on a recent design by MULLARD LTD. Ideally suited for use in PORTABLE RECORD PLAYERS for which purpose we offer a specially designed Portable Case. Incorporates MULLARD ECL86 valves, separate BASS and TREBLE CONTROLS, and produces excellent reproduction of up to 3 watts per channel. Frequency response is 40 c/s to 30K c/s. Size 11½ x 3 x 5in. To construct a STEREO PORTABLE RECORD PLAYER Assembled AMPLIFIER with two ROLA 8 x 5in. LOUDSPEAKERS and the PORTABLE CASE for (Carr. & Ins., 10/- extra). Deposit **£2.16.0**, 12 months of **£1.0.8**. **£14.0.0**

SUITABLE RECORD PLAYERS FROM **£8.14.0**

An alternative "TWIN THREE" can be supplied for DUAL CHANNEL MONOPHONIC operation producing output of 6 watts. PRICE AS ABOVE.

## ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK, please enclose S.A.E. for leaflets.

### STEREO 12 Mk.2 £43.10.0

(ILLUSTRATED)

Deposit **£3.14.0**, 12 months at **£3.3.10**.

Combines AM and FM Bands, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provides a total of 16 watts output. Other features include: inputs for tape recording, play back, pick-ups and stereo radio; separate bass and treble and balance controls.



### STEREO 55 £32.15.0

A junior version of the Stereo 12 Mk. 2. Ten watts output, five watts from each amplifier. Covers the VHF and Medium wavebands.

Deposit **£6.15.0**, 12 months at **£2.7.8**

JUBILEE Mk.2 £30.12.0

A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF, medium and long bands. Tape Record and RC play inputs.

Deposit **£6.4.0**, 12 months at **£2.4.9**

### AF208 £22.18.0

An AM/FM chassis providing 5 watts output and covering the VHF and medium wavebands. Tape Record and RC play inputs.

Deposit **£4.18.0**, 12 months at **£1.13.0**

TVB VHF TUNER £21.18.0

A self-powered high-fidelity tuner of outstanding design, incorporating features which are normally found only in the most expensive tuners. The VHF band (87-108 M/c/s) is covered and an output control enables the output to be varied between 0 and 500 mV.

Deposit **£4.14.0**, 12 months at **£1.11.7**

"HI-FI" LOUDSPEAKERS. A COMPLETE RANGE BY GOODMAN'S-WHAREFADALE-W.B. ILLUSTRATED AND PRICE LEAFLETS ON REQUEST.

## THE "MONO-GRAM" AMPLIFIER

A small Amplifier of genuine high quality performance. It incorporates the new Mullard ECL86 Valve, separate BASS and TREBLE CONTROLS and when driven by the standard Crystal Pick-up a power output of 3 watts is achieved without distortion. PRICE... READY FOR USE

**£4.19.6** Carr. & Ins. 5/- extra.

The MONO-GRAM is ideal for portable applications, an attractive case finished in two tone Rexine is available to accommodate the amplifier-speaker and a variety of record changers. Price **£4.0.0**. The 8" x 5" matching speaker **£1.0.0**.

Constructors can build a Really First-Class Record Player, complete in all respects, for approx. **£14**.

## STERN RADIO PREMIER RADIO

MAIL ORDERS and all POSTAL ENQUIRIES to



# BUILD A HIGH QUALITY TAPE RECORDER LIKE THIS FOR

# £35.0.0

FOR THIS WE SUPPLY . . . . .

- ★ Complete Kit of Parts to Build the HF/TR3 Tape Amplifier
- ★ The Latest Collaro "Studio" Crystal Tape Deck.
- ★ Rola/Celestion 10 x 6in. p.m. Loudspeaker.
- ★ Portable Carrying Case (as illustrated).
- ★ ACOS Crystal Microphone and 1,200 ft. Spool E.M.I. Tape.

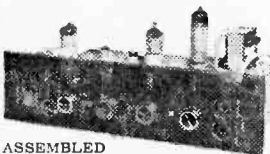
CARR. and INS. 10/- extra  
Deposit £7.0.0 and 12 months of £2.11.4.

**ALTERNATIVELY WE SUPPLY THE COMPLETELY ASSEMBLED and GUARANTEED TAPE RECORDER FOR £39.10.0**

H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11

A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROCUBE POT CORE INDUCTOR, FOR COLLAROTRUVOX-BRENNELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit. KIT OF PARTS **£13.13.0**  
Deposit £2.15.0  
12 months at £1.0.0.

## HF/TR3MKII TAPE AMPLIFIER (Mullard Type "A" design)



ASSEMBLED and TESTED  
Deposit £3.8.0.  
12 months at £1.4.11. **£17.0.0**

## ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT

The "HI-FI" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROCUBE POT CORE PUSH-PULL OSCILLATOR and 3-speed treble equalisation by FEROCUBE POT CORE INDUCTOR FOR WEARITE-COLLAROTRUVOX or BRENNELL TAPE DECKS. Includes separate power supply unit. KIT OF PARTS

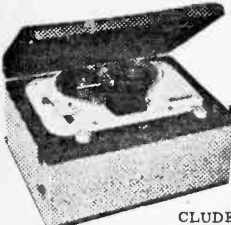


OR ASSEMBLED  
Deposit £2.16.0.  
12 mths. at £1.0.6  
Deposit £3.8.0.  
12 months at £1.4.11  
(Excluding power unit £11.15.0 and £14.10.0 respectively.)

## SPECIAL "COMBINED ORDER" PRICES

- For Constructors with their own cabinet—WE OFFER—
- (a) KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK **£26.0.0**  
Deposit £5.4.0. 12 monthly payments of £1.18.2
  - (b) As above but with the HF/TR3 supplied ASSEMBLED and TESTED **£29.10.0**  
Deposit £5.18.0. 12 monthly payments of £2.3.4
  - (c) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENNELL Mk. V TAPE DECK **£42.0.0**  
Deposit £8.8.0. 12 monthly payments of £3.1.7
  - (d) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£45.10.0**  
Deposit £9.2.0. 12 monthly payments of £2.6.9
  - (e) THE ASSEMBLED and TESTED HF/TR3 AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. Deposit £12.12.0. 12 monthly payments of £4.8.9  
(Carriage and Insurance on each above is 10/- extra).

- (a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED and TESTED **£29.10.0**  
Deposit £5.18.0. 12 monthly payments of £2.3.3
- (b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS Deposit £5.6.0. 12 monthly payments of £1.18.10
- (c) The BRENNELL Mk. V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**  
Deposit £8.4.0 and 12 months at £3.7.6
- (d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**  
Deposit £8.12.0. 12 monthly payments of £3.3.1
- (e) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PREAMPLIFIER and POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER, etc. Deposit £12.2.0 and 12 months at £4.8.9  
(Carriage and Insurance on above is 10/- extra.)



## The MODEL HF/G2R PORTABLE TAPE RECORDER (Original Price £33.0.0) FOR ONLY 22 gns.

Deposit £4.14.0. 12 months £1.13.9  
Crystal Microphone £1.0.0 extra.  
(Carr. and Ins. 10/- extra). Incorporates THE GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. Price INCLUDES THE GARRARD TAPE MAGAZINE and 4in. SPOOL OF DOUBLE PLAY

TAPE. Comprises a Twin Track Recorder operating at 3in/sec. speed and providing up to hour 10 mins. playing time. Truly "Portable", weighs only 22lbs.

## THE 'ADD-A-DECK'

Incorporating GARRARD TAPE DECK and MODEL HF/G2R PRE-AMPLIFIER

Supplied on ONE CHASSIS (as illustrated) READY 18 Gns. FOR USE (Carr. & Ins. 10/- extra.)

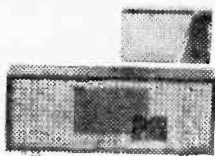
Price includes Garrard Magazine and a 4 in. Spool Double Play Tape H.P. Deposit £3.16.0. and 12 months of £1.7.8. Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3in/sec. speed providing up to 1 hr. 10 mins. playing time.



## SENSATIONAL BARGAIN

A BULK PURCHASE ENABLES US TO OFFER THE GRUNDIG "MINI-BOY" TRANSISTOR RADIO for only **£10.10.0**  
USUAL PRICE £26.5.0

Small enough to fit in your pocket—or a big set performance at home by sliding the transistor set into the speaker enclosure Ferrite Rod Directional Aerial, Med. Wave Coverage 185-590M. Size 4 x 2 1/4 x 1 in. Speaker Enclosure size 9 1/2 x 3 1/2 x 1 1/2 in., fully guaranteed.



## The JEMCO MODEL MT-955 MULTIMETER



50,000 ohms per volt—D.C.  
5,000 ohms A.C.  
A truly efficient Meter for the amateur or professional man, having features found normally in more expensive Meters. Ranges  
D.C. volts 2.5-10-50-250-1 K  
A.C. .. 2.5-10-50-250-1 K  
D.C. Current 100µA-10mA-100mA-500mA. 10 amps  
Resistance 4 Ranges up to 20 meg.  
Add D.B. 048 Size 7 x 5 1/2 x 3 1/2 in.  
PRICE, including Full Test **£12.19.6** 4/-  
Lead Kit ..... p. & p.

## STEREO-MONO CRYSTAL CARTRIDGES AT GREATLY REDUCED PRICES

- RONETTE Model "OV" Output 110m/Volts ..... 29/6
  - RONETTE Model "105" Output 250m/Volts ..... 35/-
  - RONETTE Model "105" with DIAMOND STYLUS ..... 39/6
  - RONETTE Model "106" Output 500m/Volts ..... 32/-
  - COLLARO "CERAMIC" Output 50m/Volts ..... 25/6
- All above are "TURNOVER" type Cartridges.

**109, FLEET ST., LONDON, E.C.4.**  
TELEPHONE FLEET ST., 5812-3  
**23, TOTTENHAM COURT RD., LONDON W.1**  
TELEPHONE MUSEUM 3451  
**7-9 TUDOR PLACE, TOTTENHAM COURT RD.**  
LONDON, W.1. TELEPHONE MUSEUM 4178/9

**R.S.C.**

Manchester  
Ltd.

MAIL ORDERS to 5 County Arcade, Leeds 1. Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 2/9 extra under £2. 4/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please.

**BIRMINGHAM:**  
6 Gt. Western  
Arcade  
Opp Snow Hill Stn  
(Half-day Wed.)

**SHEFFIELD:**  
13 Exchange St.  
Castle Market  
Bldgs.  
(Half-day Thurs.)

**HULL:**  
51 Savile St.

**LIVERPOOL:**  
73 Dale St. (8 mins.  
from Lime St. or  
Exchange Stations)

**BRADFORD:**  
56 Morley St.  
(above Alhambra  
Theatre)  
(Half-day Wednesday)

**LEEDS:**  
5-7 County  
(Mecca) Arcade,  
Briggate

**MANCHESTER:**  
8-10 Brown St.  
Market St.  
(No half-day)

**SENSATIONAL STEREO OFFER**

A complete set of parts to construct a Good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Including pair matched 6Hn. speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head 19/9 extra with above only.

(4 Gns.)

**R.S.C. 30-WATT ULTRA LINEAR HIGH-FIDELITY AMPLIFIER A10**

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db down. Frequency response ±3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard one-playing records. OUTPUT SOCKET PROVIDES L.T. and H.T. for a RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram. and "Mikes" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied factory built with EL94 output valves and 12 months guarantee, for 14 gns. TERMS: DEPOSIT 33/9 and 9 monthly payments of 33/9.

**11 Gns.**  
Carr. 10/-  
Suitable microphones and speakers available at competitive prices.

**WE STOCK ARMSTRONG AND JASON EQUIPMENT GOODMAN AND W.B. SPEAKERS**

**SUPERHET FEEDER UNIT.** Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V.C. Controls are Tuning, W/Ch. and Vol. Only. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with instructions 2/6. Total building cost £4.15.0. S.A.E. for leaflet.

attractively covered in two tone rexine. Terms: Deposit £4.2.0 and 12 monthly payments of £3.9.0.

**R.S.C. BATTERY TO MAINS CONVERSION UNITS**

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers receiving 1.4 and 90 v. This includes low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/6.



kit of parts with diagrams and instructions. 49/9, or ready for use, 59/6.

**TRANSISTOR RADIO CHARGER/ELIMINATOR UNITS.** Ready for use, fitted "Snap On" clips. When connected to 200-250v. A.C. mains will charge 9 v. battery or replace same. PP3 Size 19/8. Larger size 29/8.

**BASS GUITAR LOUDSPEAKER IN CABINET.** 15in. 50 watt, highly sensitive unit in rexine covered acoustically lined cabinet. Deposit £3.15.9 and 12 monthly payments of £3. **36 Gns.** Carr. 15/-

**P.M. SPEAKERS.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF 1012 10 watts, hi-fidelity type. Recommended for use with our All Amplifier, £4.12.9. 12in. R.A. 3 ohms 10 watts (12,000 lines), 59/6.

**LINEAR 1.45 MINIATURE 4/5 WATT QUALITY AMPLIFIER.** Suitable for any record playing unit and most microphones. Negative feed-back 12db. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves E200, ECC83, EL84. Size only 7-5-5in. high. Guaranteed 12 months. Only £5.19.6. Send S.A.E. for leaflet. Terms: Deposit 22/6 and 5 monthly payments of 22/6.

**R.S.C. 4.5 WATT AS HIGH-GAIN AMPLIFIER**

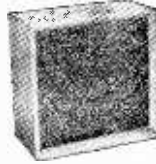
A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 30 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down 15 db. of Negative feedback is used. H.T. or 300 v. 25 mA. and L.T. or 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with base plate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

**R.S.C. PORTABLE GUITAR AMPLIFIERS**

(For 200-250 v. A.C. Mains)  
**Junior 5 watts High Quality output.** Separate Bass and Treble "Cut" and "Boost" controls. Sensitivity 15 m.v. "Twin inputs. High Flux 8in. Loudspeaker "built-in". Handsome, strongly made Cabinets (size approx. 14x14x7in.) finished in attractive and durable poliorome, and fitted carrying handle. Terms **£8.19.6** Deposit £2 and 9 monthly payments £1. S.A.E. for leaflet. Carr. 10/-  
**Senior 10 watts High Fidelity output** Separate Bass and Treble "Cut" and "Boost" controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4in. elliptical for Treble. Cabinet is well made and finished as Junior model. Size approx. 16 x 18 x 9in. H.P. Terms. Deposit 34/9 and 9 monthly payments of 34/9. Carr. 10/- Send S.A.E. for leaflet of this or 15 watt.  
**Super Hi-Fi 15 Watt.** All facilities as 10 watt. Cabinet size 20 x 15 x 13ins. Terms: Deposit £2.11.6, and nine monthly payments of 51/6. Cash 22 gns. Carr. 12/6.  
**R.S.C. Bass-major 30 Watt,** incorporating massive 12in. high flux speaker and tweeter. For high impedance. Two 6.3 v. inputs for simultaneous connection of four instruments, etc. Substantial cabinet of four instruments, etc. **39 gns.** Carr. 15/-

**12in. 10 WATT HIGH QUALITY LOUDSPEAKER**

In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.18.6 Carr. 5/-. Terms: Deposit 11/9 and 8 monthly payments of 11/3.  
**12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10 in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6 Carr. 8.6.



**SPECIAL OFFER OF HIGH FIDELITY REPHODUCER.** Latest Axiette 8 Goodman speaker (retailing at approx. £55.0) fitted in our Junior Bass Reflex Cabinet. Only £7.19.6.

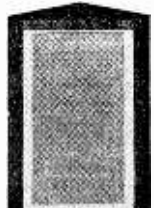
**R.S.C. BASS REFLEX CABINETS.** JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Ensure superb reproduction for only £28.19.6.

**STANDARD MODEL.** As above but for 12in. speakers. Size 20 x 15 x 13in. Especially recommended for Audiotrine Loudspeaker systems. £5.19.6. Suitable legs with brass ferrules, 19/6 per set of 4.

**R.S.C. CORNER CONSOLE CABINETS**  
Polished walnut veneer finish. Pleasing design. JUNIOR MODEL. Size 20 x 11 x 8in. for 8 x 5in. or 10 x 6in. speakers. £2.9.9. **STANDARD MODEL.** Size 27 x 18 x 12in. for 8 or 10in. speakers. £4.11.9. **SENIOR MODEL.** Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below Only 7 gns.

**AUDIOTRINE HI-FI SPEAKER SYSTEMS.** Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction Standard 10 watt rating £4.19.9. Carr. 5/-. Or Senior 15 watt, 7 gns. Carr. 7/6.

**AUDIOTRINE EQUIPMENT CABINETS.** Size 36 x 15 x 18in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut removable baseboard. Depth above baseboard 5". Only 121 gns. Carr. 15/-





# AUDIOTRON HI-FI TAPE RECORDER KIT 25<sup>1</sup>/<sub>2</sub>

GNS. Carr. 17/8

**REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR**  
 Incorporating the latest Collaro Studio Tape Transcriber. The Audiotrone High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 14 1/2 x 15 x 8 1/2 in. high, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS.** Deposit £2-15-6 and 12 monthly payments of 44/-. Cash price if settled in 3 months.



**ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS**

**SPECIAL NOTE.** The Tape Decks we supply are latest models. Where customers already have a Deck or wish to use one of those being offered cheaply we can supply Kit less Deck at 13 kns. carr. 10/-. Or deposit 2 kns. and 12 monthly payments 25/9. Also if required we can supply in lieu of portable cabinet and 7 x 4 in. speaker, the Equipment Cabinet illustrated at foot of opp. page and a high flux 8 1/2 x 5 1/2 in. speaker for 8 kns. extra.

# HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

**PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES**

Two input sockets with associated controls allow mixing of "mike" and gram., as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, E281. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "LIFT" and "CUT".** Frequency response  $\pm 3$  D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. **ONLY 23 millivolts INPUT required for FULL OUTPUT.** Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING-BASS, GUITARS, etc.**  
**OUTPUT SOCKET** with plug provides 30 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. **Only 8 Gns. Carr.** (Or factory buy £51/- extra.)



If required louvred metal cover with 2 carrying handles can be supplied for 13/6. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9. and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets. Speaker. Microphones, etc., with cash and credit terms.

**B.S.R. MONARDECK TAPEDECKS.** Speed 3 1/2 in. per sec. With high quality recording heads. £6-19-6. Carr. 5/-. Cabinets, to take Deck and amplifier 39/6.  
**TWEETERS.** Plessey 30 19/9, 15 25/9. Jason FM11 V.H.F./FM Radio Tuner design. Total costs of parts including valves Tuning dial, Escutcheon, etc. £6-19-9. Other Jason equipment in stock.

# R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, E281. Outputs for 2-3ohm speakers. Point-to-Point wiring diagrams and **8 Gns.** Full instructions supplied. Send S.A.E. for leaflet. Full constructional details and price list 2/8. Carr. 10/-. Kit can be assembled, ready to use 59/6 extra.



Kit can be assembled, ready to use 59/6 extra.

**HI-FI CRYSTAL PICK-UP HEADS.** (Cartridges) Acos Standard replacement for Garrard, B.S.R. and Collaro, 19/9. Acos Stereo-Monaural 48/9. Ronette Stereo-Monaural 59/9.

**HEADMATIC RECORDING HEADS.** High Impedance Record/Playback 22/- Low Impedance Erase 12/6.

**PICK-UP ARMS.** Complete and with latest Acos/hi-Turnover Cartridge 29/11.  
**CRYSTAL MICROPHONES.** Harp type NP110 14/9. R.T.C. 19/9. Acos mic 40 25/9. Acos Mic 45 29/9. Stick type Acos 39-1 39/9. BM3 with neck band and heavy table stand 59/9. Lapel type 35/9.

**COLLARO JUNIOR** 4-speed Single Player Unit and Crystal Pick-up with hi-Turnover head. Only £23-18-6.

**COLLARO CONQUEST 4-SPEED AUTO-CHANGER.** with high fidelity Studio pick-up. Latest model. For 200-250 v. A.C. mains. £2-10-6. Carr. 5/6.

**COLLARO RC 45 4-SPEED MIXER AUTO-CHANGERS.** Turnover Studio head, for 200-250 v. A.C. £7-10-6. Carr. 4/6.

**B.S.R. UA14-60-0 AUTO-CHANGERS** with hi-fi turnover head. £2-19-6. Carr. 4/6.

**ULTRA MINIATURE 2-3 WATT GRAM AMPLIFIER.** For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 1 1/2 x 2 1/2 in. Controls: Vol. and Tone with switch. Only 59/6.

# R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50c/s. Guaranteed 12 months.

## HEAVY DUTY CHARGER KIT

6/12 v. 6 amps, variable output. Consisting of Mains Transformer 0-200-230-250 v. F.W. (Bridge) Selenium Rectifier; Ammeter. Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit. 59/9 Carr. 4/6.

## CHARGER KIT, 12v. 14 AMP or 24v. 7amp.

Consisting of mains trans. 200-230-250 v. F.W. (Bridge) selenium Rectifier, F. Ammeter, Fuses, Variable Resistor and Circuit. Only 4 kns. Carr. 15/-. Please state if 12v. or 24v. kit required.

**SOLDERING IRONS.** 230-250 v. 30 watts. First quality. For Radio work. 19/6. Spare elements and bits available.

## Assembled 4-5 amps.

6/12v.  
 Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. Carr. 5/-.  
**TERMS:** Deposit 13/3 and 5 monthly payments 13/3.  
 6/12 v. 3a., all facilities as above. Only 59/9 Carr. 3/6.

**ASSEMBLED 12v. 10 Amp.** with variable charge rate adjustment. Ammeter and strong louvred, stove enamelled case. Ready for use. Only 7 kns. Carr. 10/- or in Kit For 5 kns.

## ASSEMBLED 6/12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive blue. Fused, ready for use with mains and output leads. Carr. 3/9.  
**49/9 Carr.** 6/12v. 1 amp. 27/9 Less meter.

## BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders, Grommets, panels, Heavy Duty Clips, circuit. Carr. 3/6 extra.  
 6v. or 12v. 1 amp. .... 22/9  
 6v. or 12v. 2 amps. .... 21/9  
 6v. or 12v. 2 amps. .... 27/9  
 6v. or 12v. 2 amps. inclusive of Ammeter. .... 35/9  
 6v. or 12v. 4 amps. .... 45/9  
 6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector. .... 59/9

## CHARGER AMMETERS

0-1 a. F.S. a. 0-4 a. 0-7 a. 0-25 a. 0-50 a. 5/9.

# R.S.C. MAINS TRANSFORMERS (GUARANTEED)

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened **TOP SHROUDED DROP THROUGH**  
 250-0-250v. 70mA. 8.3v. 2a. 0.5-6.3v. 2a. 17/9  
 350-0-350v. 150mA. 8.3v. 2a. 5v. 2a. 18/9  
 250-0-250v. 100mA. 8.3v. 2a. 8.3v. 1a. 21/9  
 250-0-250v. 100mA. 8.3v. 3.5a. C.T. 19/9  
 250-0-250v. 100mA. 8.3v. 4a. 0.5-6.3v. 3a 25/9  
 300-0-300v. 150mA. 8.3v. 4a. 6.3v. 1a. for Mullard 610 Amplifier. 29/9  
 300-0-300v. 100mA. 8.3v. 4a. 0.5-6.3v. 3a 26/9  
 350-0-350v. 100mA. 8.3v. 4a. 0.5-6.3v. 3a 26/9  
 350-0-350v. 150mA. 8.3v. 4a. 0.5-6.3v. 3a 29/9  
 425-0-425v. 200mA. 6.3v. 4a. 5v. 3a. 49/9  
**FULLY SHROUDED UPRIGHT**  
 250-0-250v. 60mA. 8.3v. 2a. 0.5-6.3v. 3a  
 Midret type 21-3-31n. .... 17/11  
 250-0-250v. 100mA. 8.3v. 4a. 0.5-6.3v. 3a 27/9  
 300-0-300v. 100mA. 8.3v. 4a. 8v. 3a 27/11  
 300-0-300v. 150mA. 8.3v. 4a. C.T. 8.3v. 1a. for Mullard Amplifier. 33/9  
 350-0-350v. 100mA. 8.3v. 4a. 5v. 3a 27/11  
 350-0-350v. 150mA. 8.3v. 4a. 5v. 3a 35/9

**FULLY SHROUDED (continued)**  
 425-0-425v. 200mA. 8.3v. 4a. C.T. 5v. 3a 55/-  
 425-0-425v. 200mA. 8.3v. 4a. C.T. 6.3v. 4a. C.T. 5v. 3a 59/9  
 450-0-450v. 250mA. 8.3v. 4a. C.T. 5v. 3a 60/9  
**OUTPUT TRANSFORMERS**  
 Midret Battery Pentode 68 : 1 for 3S4, etc. .... 4/6  
 Small Pentode, 5000 $\Omega$  to 3 $\Omega$  .... 4/6  
 Small Pentode 70,000 $\Omega$  to 3 $\Omega$  .... 4/6  
 Standard Pentode 5,000 $\Omega$  to 3 $\Omega$  .... 5/9  
 Standard Pentode 7,000 $\Omega$  to 3 $\Omega$  .... 5/9  
 10,000 $\Omega$  to 3 $\Omega$  .... 5/9  
 Push-Pull 8 watts, EL84, or 6V6 to 3 $\Omega$  or matched to 15 $\Omega$  .... 9/9  
 Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-9 or 15 $\Omega$  .... 19/9  
 Following types for 3 and 15 $\Omega$  speakers:  
 Push-Pull 10-12 watts 6V6 or EL84 .... 19/9  
 Push-Pull 15-18 watts 6L6, KT66 .... 22/9  
 Push-Pull Midret 510 Ultra Linear. 22/9  
 Push-Pull 20 watts, sectionally wound, 6L6, KT66, EL34, etc. .... 49/9

**MIDGET MAINS Primaries** 200-250 v. 60 c/s. 250 v. 50 c/s. 8.3 v. 2a. 11/9  
 250-0-250 v. 80 mA. 6.3 v. 2a. 12/11  
 Both above size 2 1/2 x 2 1/2 in.

## FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5a. 5/8; 8.3 v. 2a. 7/8; 0-6.3 v. 2a. 7/9; 12 v. 1.5a. 7/11; 6.3 v. 1a. 8/11; 6.3 v. 6a. 17/8; 12 v. 1.5a. twice. 17/8.  
**SMOOTHING CHOKES**  
 150 mA. 7-10 H H 250 ohms .... 11/9  
 100 mA. 10 H 200 ohms .... 8/9  
 80 mA. 10 H 350 ohms .... 8/9  
 60 mA. 10 H 400 ohms .... 4/11

## CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries  
 0-9-15 v. 1a. 19/9; 0-9-15 v. 2a. 14/9; 0-9-15 v. 3 a. 16/9; 0-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9; 0-9-15 v. 8 a. 28/9.

## AUTO (Step up/Step down) TRANS.

0-10/120-230/250 v. 50-80 watts. 13/9.  
 250 watts. 39/9; 150 watts. 27/9.  
**MICROPHONE TRANSFORMERS**  
 120 : 1 high grade, clamped. 6/8; 120 : 1 Potted. Mu-metal screened. 9/8.

# D. & B. TELEVISION

(Wimbledon) LIMITED

131 & 131a KINGSTON ROAD  
SOUTH WIMBLEDON, LONDON S.W.19  
PHONE: CHerrywood 3955

OPEN MONDAY—SATURDAY 10 a.m.—7 p.m.  
(Except Wednesday—1 p.m.)

Nearest Tube: South Wimbledon (North Line)

## COMPARE OUR PRICES

FOR THE FINEST IN THE COUNTRY  
YOUR PROBLEMS ARE OUR BUSINESS

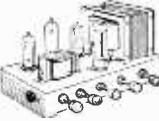
### MOST LINE-OUTPUT TRANSFORMERS

### COMPLETE NEW RANGE OF TRANSISTOR COMPONENTS IN STOCK

BRAND NEW \*STAR\* BARGAIN

Designed for quality and outstanding value.

\*NEW\* E.T.D. 6 Watt Monaural Amplifier, using heavy duty, double-wound mains Transformer. With separate rectifier winding. Valves: Rectifier, Driver and Output. 5 Controls: Switch, Volume, Base, Treble, Middle. Heavy duty output Transformer. METAL CHASSIS. All components brand new. Ready built. ONLY £5.5.0. COMPLETE or all parts in kit form. Point to point diagram. ONLY £3.15.0. P. & F. 9/6.



### TV TUBES

ALL TUBES ARE REGUNNED WITH FULL 12 MONTHS' GUARANTEE  
12in. MULLARD TYPE.....£3.15.0      12in. MAZDA TYPE.....£3.15.0  
14in. MULLARD TYPE.....£4. 5.0      14in. MAZDA TYPE.....£4. 5.0  
15in. MAZDA TYPE.....£4. 5.0      16in. G.E.C. TYPE.....£4.15.0  
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90° AND 110° TUBES ON EXCHANGE BASIS ONLY

ADD 5/- FOR ELECTROSTATIC TUBES. ADD 10/- FOR 90° AND 110° TUBES.  
CARR. AND INS. 12/6. C.W.O. OR C.O.D.

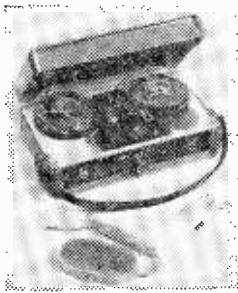
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AZ31	8/6	ECH35	9/-	KTW63	5/8	U37	17/-	5U4	4/8	1001	10/-
B36	5/6	ECH41	7/6	PX84	7/6	U50	5/6	5V4	6/3	10C2	13/-
D77	3/-	ECH81	7/6	PCU89	5/8	U52	5/-	5Y3	6/3	10P13	8/6
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DF91	3/6	ECL83	11/6	PCF86	14/6	U282	14/6	6AM6	3/-	12AT7	4/8
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DB63	6/-	EP80	6/6	PCL83	9/6	UAB08	8/6	6BG6	12/-	12AX7	6/3
DB77	4/6	EP85	4/3	PCL84	7/6	UAF32	8/6	6BW6	7/6	12AX7	6/3
DK91	6/-	EP86	8/6	PCL85	15/-	UB41	7/6	6CD6	25/6	19R6G	14/6
DK92	7/6	EP89	6/6	PCL33	8/-	UBC41	7/6	6D2	3/-	201L	8/6
LN96	7/3	EP84	3/-	PCL36	9/6	UBF49	7/6	6F1	4/6	20F2	8/3
DL91	8/6	EP92	4/-	PY32	12/-	UC854	12/6	6F2	6/3	20L1	12/6
DL92	6/3	EL33	7/6	P182	6/6	UCC85	7/6	6F13	6/8	20P1	9/6
DL94	7/-	EL38	12/-	P183	6/6	UCF80	14/6	6P14	9/-	20P3	12/-
DL96	7/-	EL41	7/6	P184	8/6	UCH42	7/6	6P13	9/6	20P4	16/6
EABC80	7/3	EL84	6/6	PY31	7/-	UCF81	8/6	6P33	6/3	20P5	14/6
EAF42	7/6	FY51	7/6	PY32	12/-	UCF83	12/6	6L4	12/-	28U4	14/6
EB41	6/6	EY86	7/6	PY80	6/-	UF42	3/6	6L6	9/6	30C1	7/6
EB91	3/-	EZ40	6/3	PY81	6/-	UL41	7/-	6L13	8/-	30L1	7/6
ER41	7/6	EZ41	6/3	PY82	6/-	UL44	10/6	6L19	12/-	30L1	9/6
EPF80	7/6	EZ90	6/6	PY83	8/-	UL46	7/-	6AN7	4/6	30P4	11/6
EPF89	8/3	GZ32	8/6	PZ30	8/-	UL84	7/3	6V8	6/3	30P4	8/3
ECU32	6/3	GZ34	12/6	R18	10/-	U98	14/6	6U4	10/-	30P12	8/6
ECU81	4/6	KT33C	6/-	U22	6/6	U99	6/3	7C5	7/3	52K10	10/-
ECR82	5/6	KT36	8/6	U24	10/-	UY41	6/-	7C6	7/3	53K10	10/-
ECU4	7/6	KT61	8/3	U25	12/-	UX83	6/6	7C6	6/6	54K10	10/-
ECU85	7/6	KT63	8/6	U28	9/6	UV77	4/-	787	9/3	54K10	8/6
ECF80	8/-	KTW61	8/6	U31	7/-	Z77	3/-	10F1	4/6	185BT	14/6

We pride ourselves that we can obtain and supply any TV spare. Please ask us for ANY components you may require we are almost certain to have them.

TERMS: S.A.E. all enquiries. C.O.D. 3/- extra.  
C.W.O. Postage on Valves. 6d each. C.R. 12/6 inc. insurance.  
SATISFACTION ASSURED. RETURN POST SERVICE.

## FINAL PRE-XMAS OFFER!



**A MINIATURE TAPE RECORDER IN KIT FORM**  
Consisting of three transistor amplifiers, record/play, volume control, miniature speaker, forward-stop-rewind-switch, reel of tape and spare reel, motor, attractive coloured case, Mic. and a phone sockets, pick-up coil, mike, earphone and carrying handle supplied. Standard battery operated. Simple to put together in less than one hour. Brand new and guaranteed.

**ONLY £6.19.6**

A guaranteed saving of at least £4! Results comparable with similar built-up recorders selling at around 12 gns.

## CALLERS ONLY BARGAINS!

**LEAD ACID ACCUMULATORS ONLY**  
(unspillable), 2 volts 16 A.H. Ideal for 6 volts and 12 volts supply. Brand new original cartons. Size **2/6** Each each 4in x 6in. x 2in.



Minimum lots of six will be sent by post for 20/-, post paid.

ARR8 L.F. RECEIVERS. Tested, only..... **£25.0.0**

T.E.15. PORTABLE VALVE TESTER, only..... **£16.12.6**

## ALL DIRECTIONAL STUDIO CRYSTAL MICROPHONE



**MODEL MC-70**  
A professional microphone with 360° pickup, using a new variable "D" shock mounted crystal cartridge (for added power and sensitivity. Smooth response in 50-12,000 cps.) and natural reproduction. Size 7in. high x 3in. wide. Complete with shielded cable. Lavalier cord and 7in. stand holder. **69/6 complete**

## 9V BATTERY CHARGER A "MUST" AND A.C. ELIMINATOR

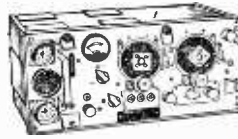
for every transistor set owner!  
**MODEL 29/6 P. & F. 1/6.**



Save those batteries by running your transistor set direct from A.C. Mains. Reactivate all your old 9V batteries. Unit contains neon indicator and standard battery connections with nearly 2 yards of mains lead and plug. Also snap cord for connection to set.

Over 25,000 already sold. Rush your order NOW.

## FINAL OFFER!!! WIRELESS SET No. 19



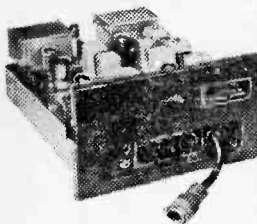
This most famous Army Trans/Receiver covers 2-8 Mc/s. (150-37 metres in two bands and 230-240 Mc/s V.H.F.). Has an intercom. amplifier. Designed for 12 and 24 volt operation. Uses a 6 valve superhet receiver. I.P. being 485 Kc/s. and a 6 valve transmitter designed for voice and C.W. operation. Incorporates test and tuning meter for voltages, aerial loading and current tests. Panel Controls: Frequency tuning, P.A. tuning, Gain control, MCW, CW, R/T switch, Het-tone netting. On-off. Quench, aerial AVC LT-HT—Drive tests. Supplied complete with valves and instruction book.

**ONLY 65/- FEW ONLY LEFT**  
Carriage 10/- Don't be disappointed—Order Now



See opposite page for addresses

**F.M. TRANS/RECEIVERS**  
HC620



Frequency range 20-27.9 Mc/s. Crystal controlled, operating on any two of 90 different channels in 100 Kc/s. steps. Average range 5-10 miles. Contains 14 valves, filament plate, alignment meter, volume control, mike and 'phone inputs, 6 and 12 volt supply unit and dry battery case.  
**Complete Station offered for only £5 Carr. 20/-.**



**DOUBLE CONE HI-FI**  
Speaker, Model 8A7. Frequency range 50-18,000 c/s. Lowest resonance 60 + 15 c/s. S.N. 51 + 1 v. i. v. t. y. 98db. Programme source input 8 watts. Voice coil impedance 16 ohms. Net weight 12.970 grammes.  
**BRAND NEW AND GUARANTEED. 92/6**

**TUNING CONDENSER**

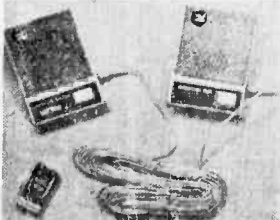
Model P.V.C.-103. The most popular type of miniature sized single plastic variable condenser for 2 transistor sets. Especially insulated plastic films make smallest loss of high frequency and keep super performance on electrical characteristics. Capacity 260pF, frequency 530-1660 Kc/s.  
**PRICE 5/- P. & P. 1/-.**

Portable **TRANS/RECEIVER** No. 1R. Still available with all accessories at only **£5** carr. 10/-.



**TAPE SPLICER & CUTTER.** Model T.633 Cuts 2 rounded indentations in the tape splice leaving the edges of the tape which contact parts of the recorder entirely free of adhesive. As little as 1/16" tape need be removed. Complete with instructions, 18/9. Post Paid.

**HANDY TWO-STATION TRANSISTORISED INTERCOM & BABY ALARM**



Fully Guaranteed Fantastic Value  
**6gns**  
Complete with battery and 60ft. of wire.  
An intercom system for both calling and conversing, operated from a single battery. Ideal Baby Alarm. S.A.E. for further details.

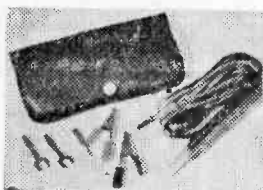
**TOOL KITS!**

**6 Piece Screw Driver Set, Model 3360.** Consisting of mechanics, electricians, Phillips, midjet and stubby types. Magnetised blades of tempered, hardened tool steel. Unbreakable, flameproof and shockproof plastic handles. **DIS- play bagged. PRICE 8/-**

**Multi Purpose Tool Set, Model 7990.** Consisting of insulated plastic handle, 5 interchangeable screw driver bits, including Phillips type, one hammer, 5 hexagon sockets (1"-7/16") and extension bar. Complete in Vinyl roll case. **PRICE 12/6**

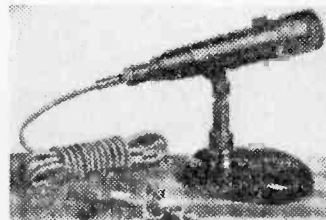


**BUDGET UNIVERSAL TEST LEAD KIT IN PLASTIC CASE**



Consists of 41in. long x 1/4in. dia. red and black plastic handle pin prods with heavy duty 37in. rubber leads with 500V. breakdown insulation terminating 2in. long x 1/4in. dia. plastic grip banana plugs. 3 sets of interchangeable terminals are included (spade lugs, phone tips, alligator clips), all slip directly on to banana plugs. 9/6. Post Paid.

**3-WAY SLIM CRYSTAL MICROPHONE**



**MODEL 100C** May be hand-held, stand mounted (either floor stand) or desk stand) or suspended by lavalier cord. Response 60-10,000 cps. Built in on/off switch. Output level -52db. Omni-directional head. Clips on or off standard stand adaptor per- mitting tilting for multi-angle use. Satin chrome finish. Supplied complete with 7 ft. of shielded cable, lavalier cord, Brand new Floor Stand and Base, suitable for above. 65/- Carriage Paid.

**ONLY 39/6**

**MAKE A FANTASTIC BABY ALARM/INTERCOM**

Complete set of parts including 4 transistor push-pull amplifier microphone, speaker, attractive case and full instructions. **FOR 90/- P. & P. 2/6.**

**MINIATURE COMPONENTS**

- As previously advertised
- P.31 Standard jack plug 2/6 ea.
  - PS.35 Sub-miniature plug and socket 2/6 pr.
  - CB.25 "Tiny" plug and socket 2/6 pr.
  - CH.305 Chrome mini-ature plug and socket 3/6 pr.
  - CR.5 Crystal earpiece 6/- ea.
  - MR.4 Magnetic earpiece 6/- ea.
  - LM.179 Crystal lapel microphone 14/- ea.
  - SS.219 Standard slide switch, D.P.D.T. 2/6 ea.
  - T.104 S.P. S.T. Toggle switch 2/6 ea.
  - SS.3271 Miniature slide switch 2/6 ea.
- Please add P. & P. on above items

**SF-20 RADIO EARPHONES**

Hi-impedance-2,000 ohms-general use headset. Black and Ivory plastic cased electro-magnetic units with adjustable head-band for comfortable fit. Individual listening for all types of applications. Individually packed, with flexible cord attached. 14/6, post paid.



**HOOPER ROTARY TRANSFORMERS**

12v. input, 500 v. output at 65 mA. or 6 v. input, 250 v. output at 75 mA. Only **10/6** EACH P. & P. 2/-.



**TELESCOPIC AERIAL SNIPS!**

Exclusive purchase of entire range. Finest finish—sturdy construction. Three sizes and types available. Limited supply. Ideal for all types of Transistor Radios and Kits, Crystal Sets, Transmitter Receivers, Remota Control Units, Signal injectors and probes. T.A.1. Size 31/14" Nickel finish 3/6 T.A.2. Size 81/23" Nickel finish 6/6 T.A.3. Size 91/31" Chrome finish 9/- Plus P. & P. 9d. each.

**VERNIER DIAL Model T.501**

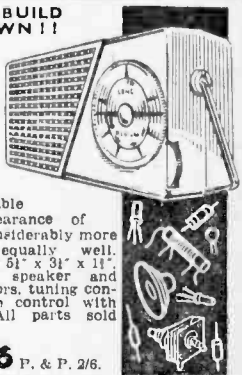


A precision vernier dial with approx. 8 to 1 ratio. Surface mounting. Accurately centred metal insert for 1/16" shaft. Reads counter clockwise 0-100 in 100/11in. diameter dial 13/16in. front to back 14/- Post Paid.

**SIMPLE TO BUILD FUN TO OWN!!**

**A 5 STAGE TRANSISTOR RADIO**

which can be built in one hour and will give you endless amount of pleasure. Completely portable has the appearance of sets costing considerably more and works equally well. Attractive case 5 1/2" x 3 1/2" x 1 1/2" containing 21in. speaker and 6 E.C. transistors, tuning condenser, volume control with switch, etc. All parts sold separately.



**ONLY 37/6 P. & P. 2/6.**

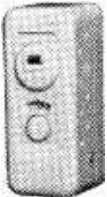
MAIL ORDERS TO  
DEPT. P., 32A COPTIC STREET,  
LONDON, W.1.



CALLERS WELCOME AT  
87 TOTTENHAM COURT ROAD,  
LONDON, W.1. MUS 9808

\*\*\*\*\*

**Pullin Thermostat**



This is a wall mounting thermostat intended for the control of room heating up to 3 KW (A.C.) Scale calibrated from 30°-90°F. with neon lamp for on/off indication. Price 27/6, plus 1/6 Post and Ins.

**15 Amp Thermostat**

You can make yourself a thermostat similar to the above using a "Sunvic" unit which we can offer at 9/6. This is adjustable over the same range as the Pullin and will control the same amount of heating. We can also offer a crackle finished calibrated case which can be used for containing the Sunvic. Price two items together 14/6, plus 1/- Postage.

**Ice-Stat**

This is a small thermostat which cuts on and off at around freezing point. Has many uses, one of which could be an ice warning device to be fitted under your motor car. Price 7/6. Post 1/-.

**Speaker Bargain**



12in. High-fidelity loudspeaker. High flux permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 27/6, plus 3/6 Post and Ins.

**Hi-Fi Snip—Infinite Wall Baffle**

Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low priced 4in. speaker. Fitting for tweeter. Only 45/- each. Carr. and insurance 3/6.

**Hi-Fi Speakers**

E.M.I. Gemmic magnet 12,000 lines, size 13 x 8in. (roughly equivalent to 12in. round speaker). Handles up to 10 watts. Price 33/6, plus 5/- carriage and insurance. State whether 15 ohm or 3 ohm. Similar model but specially designed and hand made for very low frequencies (40 to 55 cycles). Price 27.10.0.

**Miniature Transistor Sets**

Cheaper than you can possibly make them, we are able to offer these made up, ready to work, complete with leather carrying case and earphone.



Astra 7 uses 7 transistors, covers 555-1065 kc/s, sensitivity 300 micro volts/m, output 150 mW, ferrite slab aerial. Size approximately 4 1/2 x 2 1/2 x 1 1/2 ins. Price 28.19.6, Post & Ins. 3/-. Zephyr 6, very similar specification to the above but only 6 transistors. Price 25.19.6 with leather case and earphone, plus Post & Ins. 3/-.

**The 'Good Companion' Mk.II using Transfilters**



In the 'de-luxe' cabinet as illustrated it costs £10.19.6 to build—but What a set! Scan these pages: you will find nothing to compare with its specification. It uses transfilters instead of I.F. transformers, has variable feedback as well as all the usual features. A.V.C., Push-pull output, Ferrite Aerial, Slow Motion Tuning, etc., etc., and is a very powerful Medium & Long Wave set, conservatively rated at 750mW. Every component used is by a famous maker, such as American Philco MADT R.F. transistors—Mullard A.F. transistors—Jackson Brothers' tuning condensers—Rola-Celestion loudspeakers—Dubblier—T.C.C.—Morganite resistors and controls. Also full after sales service available. You will definitely be doing the right thing if you buy a 'Good Companion'.

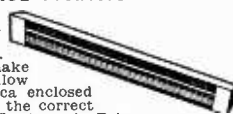
**"A jolly fine set but deserving a better case"**



This is a comment which many constructors have voiced and therefore we now offer a de-luxe version of the Pocket Companion. This uses a solid hide case of very pleasant red with gold lettering and our Pocket Companion now has the 15 guinea look. The most up-to-date Superhet portable of its type, it uses a transfilter in conjunction with Philco R.F. transistors and Mullard output transistors. Complete building costs with plastic case 28.15., or with solid hide case, 27.15.. If you have already built and want to change your case, then return the plastic case with a postal order for 21/- or if you wish to retain the plastic case then send 26/-, plus 1/6 Post and Ins. for the hide case only.

**Infra-Red Heaters**

Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions 15/6, plus 2/6 post and insurance.



**Battery Charger Bargain**

Components Would Cost More Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvered case. New, complete and ready to work. Rated at 12 v. 5 amps, and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250. A.C. mains. Special snip price of 65/-, plus 3/6 post and ins.

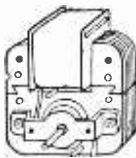


**LIMITED QUANTITY ONLY!**

**Waterproof heater wire. 16 yds. length. 70 watts. Self regulating temperature control. 10/-.** Post Free.

**THIS MONTH'S SNIP !!**

Silent running mains motor by very famous maker. Ideal for gramophone, tape recorder, fan, etc., etc., 200-250 volts, A.C., shaded pull start. Size approximately 2 1/2 x 2 1/2 x 1 1/2 in. 2,750 r.p.m. Spindle diameter 5/32in. Spindle length 1/2 in. Brand new guarantee. Price 12/6, plus 1/- post.



**"Starlux 208"**

Solderless '3' TRANSISTOR. Ideal for home and holidays as no Aerial or Earth required. Enjoy assembling and performance. Our solderless Terminals ensure perfect connections using first grade Transistors and all parts incl. Earpiece for private listening. Will receive Luxembourg (the station of the stars) and other stations on both Medium and Long waves. Penlight Battery operated, 37/6. Post and insurance, 2/6.



**Building A 'Scope?**



3in. oscilloscope tube, American made type No. 3P7. 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope, 15/- each, plus 2/6 post and insurance.

**Tape Recorders**



One of the easiest ways to learn anything, is to "tape" it and then keep playing it back. Try this new learning technique—you will be amazed.

The industrious Japanese have really gone to town on tape recorders this year and many bargains are on offer. It is the writer's opinion that there is bound to be a big demand for them as Christmas presents so there is a good reason why you should buy your tape recorder immediately. Prices range as follows:  
 Child's Model..... £4.19.6  
 Assemble yourself Model 26.19.6  
 Model No. III-3..... £7.15.0  
 The "Pocket Secretary"..... £4.14.0  
 The first two are not really good enough for music but they are quite good for speech. The last two are reasonable also for music. All have a value out of all proportion to their cost.

**Fluorescent Lighting**

Complete Kit. Comprises: Hi-C r a f t c h o k e u n i t , starter lamps, 2 lamp holders, white enamel metal work and 40 watt tube. Price 30/-, complete, plus carr. and ins. 6/-.



**Yaxley Switches**

All new, first class condition.  
 1 pole, 2 way 1/6; 1 pole, 3 way 2/6  
 1 pole, 4 way 1/9; 1 pole, 5 way 2/6  
 1 pole, 7 way 3/-; 1 pole, 9 way 3/-  
 1 pole, 11 way 3/-; 1 pole, 12 way 3/3  
 2 pole, 2 way 2/-; 2 pole, 4 way 2/6  
 2 pole, 5 way 3/6; 2 pole, 6 way 3/6  
 2 pole, 12 way 7/6; 3 pole, 3 way 2/-  
 3 pole, 6 way 3/6; 3 pole, 12 way 6/6  
 4 pole, 2 way 2/-; 4 pole, 3 way 3/-  
 4 pole, 4 way 3/6; 4 pole, 5 way 4/6  
 4 pole, 6 way 5/6; 4 pole, 11 way 11/6  
 4 pole, 12 way 11/6; 5 pole, 3 way 3/6  
 5 pole, 6 way 7/6; 5 pole, 12 way 14/6  
 6 pole, 2 way 2/6; 6 pole, 3 way 3/6  
 6 pole, 6 way 8/6; 6 pole, 11 way 18/6  
 6 pole, 12 way 17/6; 7 pole, 2 way 3/6  
 7 pole, 4 way 8/6; 8 pole, 6 way 11/6  
 8 pole, 12 way 23/6; 12 pole, 2 way 3/6  
 12 pole, 5 way 16/6; 12 way fader 3/6  
 6 pole, 6 way, shorting 3/6  
 Big stocks of most types.  
 Special prices for quantities.

\*\*\*\*\*



## FEW ONLY LEFT Cabinet & Pick-up

Made for a famous Company intending to change their minds. This is an extremely fine looking cabinet, must have cost at least £2 to make. It is complete with handle and fasteners as illustrated. Also included in the parcel is a Cosmo-cord pick-up with crystal cartridge and sapphire stylus. Both items new and perfect. Price 19/6, plus 4/6 Post & Ins.

## MULTI-METER BARGAINS!

**MODEL IT1/2** (illus. on right). 20,000 ohms per volt, 20 ranges comprising A.C. volts, 5 ranges up to 1,000; D.C. volts, 6 ranges up to 2.5kV; C.C. current, 3 ranges up to 26 ohms; resistance, 2 ranges up to 6 meg.; capacity 2 ranges up to 0.1; decibels—20 to +22. Scale cornerwise to the equivalent of 4 in. movement is a pocket size instrument measuring 4½ x 3½ x 1in. Complete with test prods, battery and operating instructions, price £5.5.0, post free.

**MODEL EP10K.** Similar in size and appearance to IT1/2 except that this is 10,000 ohms per volt and maximum D.C. volts 1,200 instead of 2.5kV, also no capacity range. Price £4.19.6. Post free.

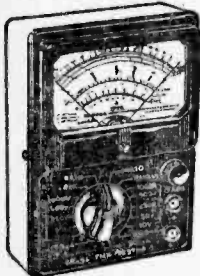


### ALL METERS BRAND NEW AND FULLY GUARANTEED

**MODEL TP55.** (Illus. on left). 20,000 ohms per volt; D.C. volts, 5 ranges up to 1,000; A.C. volts, 5 ranges up to 1,000; resistance, 2 ranges up to 10 meg.; capacity 2 ranges up to 0.1; decibels—20 to +26. One switch control, really beautifully made precision instrument, size only 3½ x 5½ x 1½in., price only £5.19.6. Post free.

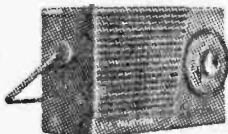
**MODEL TP10.** Similar in size and appearance to TP55, but sensitivity 2,000 ohms per volt, price £3.19.6. Post free.

**MODEL 500.** 30,000 o.p.v. Reads voltages up to 1,000 D.C. at 30,000 o.p.v., and A.C. at 15,000 o.p.v.; D.C. current to 12 amps.; Resistance to 60 Megs.; Decibels from -20 to +56. Size 3½ x 6½ x 2½in. £8.19.6. Post free.



### Transistor Set Cabinets

Very modern cream cabinet, size 5½ x 3 x 1½in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 Post & packing. Special quotations for quantities.



### LAST OF THESE! Tabby Equipment

With details to make Closed Circuit TV Lens system? "See in the dark" equipment comprising 5,000V power pack which contains ignition coil vibrator etc. Control unit, interconnecting cables and Infra-red binoculars. Offered for one month only at the give away price of £3.19.6, plus 10/- carriage. These are unused, just as received from the Ministry, believed in good working order but sold without guarantee.



### A.C./D.C. Multimeter Kit

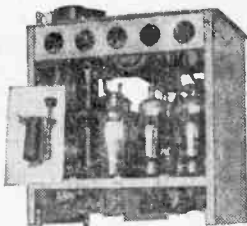
Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000 A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000 D.C. milliams 0-5, 0-100, 0-500, Ohms 0-50,000 with internal batteries, 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions. Price 24/6, plus 2/6 post and insurance.



### Power Unit

A useful source of D.C. for experimenting, energising instruments, electroplating, reactivating batteries etc. This power unit can be made in a few hours and due to the availability of the rectifier valve at a very low price, we can supply the complete kit of parts with ABC instructions. Fits into any box for 9/6, plus 1/- post and insurance.

### Building An Amplifier?



Here is a buy for you! Modulator Unit Type 20. Contains parts ideal for building a large output amplifier and already set out in metal case. To name a few—Four high output valves Type KT44. Driver valve Type MH41. Iron cored choke for up to 200 milli-amps. Dozens of wire-wound and carbon resistors, paper and Mica condensers. Terminals and tag panels, etc., etc. Three other items of interest to everybody and well worth the price asked for the unit are—

1. **Transformer Reference 10K/143.** This can act as auto transformer to convert 230 to 110 or 230 to 460, and also as a filament transformer 230 to 6.3 or 230 to 12.6 volts.
2. **Miniature Circuit Breaker.** For breaking 10 amps A.C. reset by pushing knob.
3. **Steel Case.** With heavy gauge chassis, already cut out and fitted with valve holders, etc. Price for complete unit is 10/6. Carriage 5/-.

### Miniature Microphone

American made. Dynamic type, real bargain at 2/6, plus 6d. postage.



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Just screw it together. Uses 1250 watt copper clad element which gives off black heat. Will last a lifetime. Ideal for bedroom, it's so safe. Complete in crackle finished case. £3.19.6, easily worth double. Carriage and insurance, 6/6.



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Our dim and full switch is ideal for controlling photo flood lamps: it gives two lamps in series, two lamps full brilliance and lamps off. Similar control of other appliances can be arranged where used in pairs or where circuit can be split exactly in half. Technically the switch is known as a double-pole change over with off. Our price 3/6, plus post and insurance 1/-.



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post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 7. Callers may use any one of the Companies below.

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520 High Street North Manor Park, E.12. Phone: ILFord 1011 Half day Thursday

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**H.R.O. Senior. Table Model.** In excellent, fully checked, and tested condition (without coils and power pack), £15.10.0. As above but rack mounted model, £14.10.0.  
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**CARBON INSET MICROPHONE,** G.P.O. type, 2/6. P. & P. 1/6.

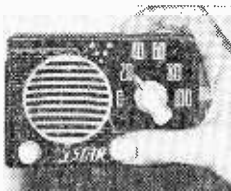
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TAKE-OVER BID MAKES THIS FANTASTIC OFFER POSSIBLE—the beautifully compact "5-STAR VOLKSRADIO" measuring 4½ x 2½ x 1½ in. receives perfectly—in the Bedroom, Office, (Garden—over all medium waves (incl. Luxembourg). Under 1d. hour running cost. ANYONE can assemble it in one or two hours using our simple A.B.C. plan. Complete set of parts ONLY 19/6, plus 2/6 P. & P. (C.O.D. extra. (Parts can be bought separately.) Money Back Guarantee.



**NO EARTH OR AERIAL REQUIRED**  
**ALL TRANSISTOR RADIO**  
 ONLY **37/6**  
**THE COSTA BRAVA**

Revolutionary INTERNAL FERRITE AERIAL Makes this sensational pocket-size radio the best money-saving bargain of all time. Powerful, superb tone and clarity, ensures perfect reception for all your favourite programmes

Completely portable, only 5½ x 3 x 1½ in. Two-tone case. Anyone can assemble with our simple PRINTED CIRCUIT PLAN. Send 37/6, plus 2/6 P. & P. (C.O.D. 2/- extra). Satisfaction guaranteed. (All parts available separately).

**FREE HIGH SENSITIVITY HIDE-AWAY EAR-PIECE GIVEN WITH EACH SET.**

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Build this newly-designed "MINUETTE" 4-STAGE transistor set in very strong ready drilled ULTRA-MODERN CASE, size only 6 x 3½ x 1½ in. Uses three transistors and diode and SELF-CONTAINED LOUDSPEAKER. Very sensitive, ideal for office, bedroom, holidays, etc. Months and months of listening off a 1/2 battery. Can be built FOR ONLY 39/6, including PROPER CASE, miniature speaker, etc. SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS etc., plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



## THE MINUTE TRANSISTOR RADIO

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Unbelievably small—Outrageously cheap! You will be amazed at the fine quality of tone and volume of this great little radio. Only a fantastic 3½ x 2½ x 1½ in. the MIAMI will bring you great entertainment for months on a 1/2 battery. Simple assembly plan with each set. ONLY 32/6. YES 32/6!

Plus 2/6 P. & P. (C.O.D. 2/- extra). Satisfaction Guaranteed. Demonstrations given daily. Parts available separately if required.

## THE NEW "COSTA BRAVA" 49/6

**NO EARTH OR AERIAL REQUIRED**  
**ALL TRANSISTOR RADIO**



Revolutionary INTERNAL FERRITE AERIAL and moving coil speaker makes this sensational pocket-size radio the best money-saving bargain of all time. Powerful, superb tone and clarity, ensures perfect reception for all your favourite programmes. Completely

portable, only 5½ x 3 x 1½ in. Two-tone case. Anyone can assemble with our simple PRINTED CIRCUIT PLAN. Send 49/6, plus 2/6 P. & P. (C.O.D. 2/- extra). Satisfaction guaranteed. (All parts available separately). **FREE HIGH SENSITIVITY HIDE-AWAY EAR-PIECE GIVEN WITH EACH SET.**

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This is a pocket 2-stage transistor set not much larger than a matchbox. Excellent clear reception covering all medium waves, works for months off a 1½ or 3 volt battery costing only 8d. Easy to build and an excellent introduction to transistor circuitry. Everything can be supplied down to the last nut and bolt. **SIMPLE PICTORIAL STEP-BY-STEP PLANS FOR ONLY 19/6**, plus post and packing 1/6. (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



**THE RINGO BURGLAR ALARM CLEARANCE SALE!**  
 AT UNBEATABLE PRICES

**BIG PROFITS FOR YOU IF YOU BUY NOW!** Made to retail at 7 gns. you can now buy this famous Tasting Alarm for only 37/6—but only if you act now... stocks are strictly limited. Easily installed and operated. Switches on or off at any time. Fantastic FINAL reduction to clear 2/- (minimum order of 3) Carr. Free. **37/6** Free literature sent with each alarm.

**SELL SAFETY TO THE MOTORIST**

**Bulk purchase of bankrupt stock ensures this fabulous money-making offer.**  
**AUTOMATIC CIGARETTE LIGHTER** instantly provides ready lit cigarettes, without the driver taking his eyes from the road. Heavily chromium plated case holds 10. Easily and simply fitted to any car's dashboard. Works off 6 or 12 volts. Retail Price **44/6**. Special Clearance offer only sold in minimum lots of 5. **12/6** each. Carr. free.

## THE NEW "SAN REMO" 6 STAR 32/6

This All Transistor Speaker Radio—The "San Remo" 6 Star covers all medium waves including "Home," "Light," etc. Reliable and lightweight—Slips easily into the Pocket or Handbag—size only 4½ x 2½ x 1½ in. Works for Months of 1/2 Battery! Ideal for holidays, Camping, Bedroom, etc. Anyone can assemble it in an hour or two with our simple-as-ABC PLAN! Complete set of parts including miniature speaker—everything—only 32/6, plus 2/6 P. & P. (C.O.D. 2/- extra.) Parts can be bought separately.

Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. Complete range of components and valves stocked. Regret no C.O.D. abroad. DEMONSTRATIONS DAILY AT WORKS.

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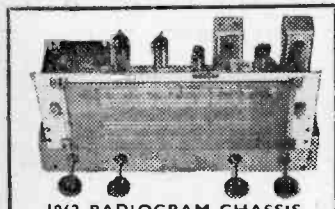
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**ARMSTRONG AF208AM/FM RADIOGRAM CHASSIS**



★ Full VHF Band (87-108 Mc/s and Medium Band, 187-570M) ★ 7Valves ★ 5 Watts Output  
★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2dB ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programmes Value ★ For 3, 7i and 15 ohm speakers. Send S.A.E. for leaflet.

**PRICE £22.18.0** Carr. Free



**1962 RADIOGRAM CHASSIS**

THREE WAVEBANDS FIVE VALVES  
S.W. 16 m. -50. LATEST MULLARD  
M.W. 200 m. -550 m. ECH81, EF89, EBC81,  
L.W. 800 m. -2,000 m. EL84, EZ90.

12-month guarantee;  
A.C. 200/250 v. 4-way switch; Short-Medium, Long-gram. A.V.C. and Negative feedback, 3 ohm output, 5 watts. Chassis 13 1/2 x 5 1/2 x 2 1/2 in. Glass dial, horizontal or vertical wording, size 10in. x 4 1/2 in. Aligned and calibrated. Isolated Chassis.

**£9.10.0** Carr. & Ins. 4/6.

**BARGAIN SALE PRICES**

New Boxed VALVES 90 day Guarantee

024	5/-	6K7G	5/-	EAB08	8/-	PCL82	10/-
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1T4	3/-	6BT7M	5/-	EBC81	8/-	PL83	8/-
2X2	6/-	6BT6	8/-	EBF80	8/-	PY80	7/-
3B4	7/-	6AN7	5/-	ECH42	9/-	PY81	8/-
3V4	7/-	6V6G	5/-	ECH81	9/-	PY82	7/-
3Q5	7/-	6X4	5/-	EF85	6/-	PY83	8/-
5U4	6/-	6X5	5/-	EF89	8/-	QP25	7/-
3X3	6/-	12A1T	6/-	EL32	5/-	SP41	3/-
6Z1	9/-	12AU7	6/-	EL84	7/-	SP81	3/-
6AC7	4/-	12AX7	7/-	EY51	9/-	U22	8/-
6AM6	4/-	12BH7	7/-	EY86	9/-	URC41	8/-
6AT6	6/-	12K7	5/-	EZ40	7/-	URC81	9/-
6BA8	7/-	12K8	14/-	EZ90	7/-	UF89	9/-
6BE6	5/-	12Q7	5/-	EZ81	7/-	UCH81	9/-
6BW6	7/-	25Y5G	9/-	E1148	1/-	UCL82	10/-
6C4	5/-	35L6	9/-	HAB08C10U	9/-	UL83	12/-
6D6	5/-	35Z4	5/-	HV78A	5/-	UR89	9/-
6C6	4/-	80T8	8/-	KTR80	8/-	UL41	9/-
6H8	3/-	85A	2/-	KV78	8/-	UV41	7/-
6J5	5/-	DAF86	8/-	MU14	7/-	UV85	7/-
635	5/-	DF96	8/-	PCC84	8/-	UT9	7/-
6T7G	8/-	DK96	8/-	PCP80	8/-	VR150	7/-
6K5	8/-	DL96	8/-	PCP82	8/-	VR1	6/-

**L.F. TRANSFORMERS 7/6 pair**

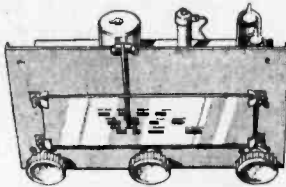
485 K/s Sling Tuning Miniature Can, 2 x 1 x 1 in. High Q and good bandwidth. Data sheets.

**NEW ELECTROLYTICS FAMOUS MAKES**

TUBULAR	2/-	TUBULAR	5/8	CAN TYPES	5/-
1/350V	2/-	50/350V	3/1	16/450V	5/-
2/350V	2/3	100/25V	3/1	32/350V	5/-
4/450V	2/3	250/25V	3/1	100/270V	4/8
8/450V	2/3	500/12V	3/1	2,000/6V	4/8
16/450V	3/1	500/12V	3/1	5 000/1V	4/8
32/450V	3/1	8+8/450V	3/1	32+32/350V	6/-
25/25V	1/8	8+16/450V	3/1	32+32+32/350V	7/-
50/25V	2/-	18+16/450V	4/3	50+50/350V	8/-
50/50V	2/-	32+32/350V	4/6	64+120/350V	11/8
				100+200/275V	12/8

**COMPLETE RADIO CHASSIS £5.19.6. post free**

4 Mullard valves. 5in. speaker. Superhet Circuit. BRAND NEW. Size 9 x 8 x 5 1/2 in. high. Tested by us ready for use. 200/250 v. A.C.-D.C. Mains.



DE LUXE MODEL, as illustrated with illuminated dial. Fully tunable over Medium and Long Wave. 12-month Guarantee. Only £5.19.6 post free

**MAINS TRANSFORMERS 200/250 v. A.C. Postage 2/- each transformer.**

STANDARD, 250-0-250, 60 mA. 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. 22/8, ditto, 350-0-350 ... 29/8  
MINIATURE 200 v. 20 mA. 6.3 v. 1 a. 10/8  
MIDGET, 220 v. 45 mA. 6.3 v. 2 a. ... 15/8  
SMALL, 250-0-250, 60 mA. 6.3 v. 2 a. 17/8  
STD. 250-0-250, 65 mA. 6.3 v. 3.5 a. ... 17/8  
HEATER TRANS. 6.3 v. 1 1/2 amp. ... 7/8  
Ditto, tapped sec. 2, 4, 6.3 v. 1 1/2 amp. ... 8/8  
Ditto, sec. 6.3 v. 3 amp. ... 10/8  
GENERAL PURPOSE LOW VOLTAGE, 2 amp. 2 a. 0. 5, 6, 8, 10, 12, 15, 18, 24, 30 v. 22/8  
AUTO TRANSFORMER, 150 w. ... 22/8  
0. 115, 200, 230, 250 v. 500 w. ... 32/8  
MULLARD "610" Mains transformer, 30/-  
FARMER'S MAINS TRANSFORMER, made under special contract, the ratings can safely be doubled. Guaranteed 2 years. Primary 0-110-210-230-250 v. H.T. 300-0-300 v. 50 mA. L.T. 6.3 v. 1.5 amp. Size 4 x 3 1/2 x 3 1/2 in. Weight 6lb. Post 2/6

MAINS POWER PACK. Size 3 1/2 x 4 1/2 x 4 in. with mains transformer, metal rectifier and condensers to provide smoothed H.T. output 220 v. 45 mA. D.C. L.T. 6.3 v. 2 a. Centre tapped. All ready built on a strong metal chassis. Brand New. Bargain. Post 2/6 ... 29/8

**INTERVALVE TRANSFORMERS 3/1 or 5/1, 9/0-P. TRANSFORMERS. Heavy Duty 60 mA. 4/6.**

Multitrate, push-pull, 7/8. Ditto, 10 w., 15/8. Miniature, 3844 etc., 5/8. L.F. CHOKES 15/10H, 60/45 mA, 6/-; 10 H, 85 mA, 10/8; 10 H, 150 mA, 13/6. FULL WAVE BRIDGE SELENIUM RECTIFIER, 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/8. CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v. 1 1/2 amp., 15/6. 2 amps., 17/8; 4 amps., 22/6. Circuit included. 4 AMP CAR BATTERY CHARGER with amp meter leads, Fuse Case, etc., for 6v. or 12 v. 6/9. AMMETER, 0 to 5 amp. 9/8

**BOOKS list S.A.E.**

40 Circuits for Germanium Diodes 3/-.  
"H.V." Radio Valve Data, 6/-.  
High Fidelity Speaker Enclosure, 5/-.  
Valve and TV Tube Equivalents, 9/8  
TV Fault Finding, 5/-.  
Quality Amplifiers, 4/6.  
Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each.  
Transistor Superhet Receivers, 7/8.  
Practical Radio Inside Out, 3/6.  
Master Colour Code Chart, 1/6.  
Transistor Controlled Models, 7/6.

**4 TRANSISTOR PUSH-PULL AUDIO AMPLIFIER**

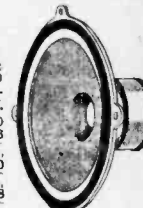
Size 3 x 1 1/2 x 1. A ready built miniature push-pull amplifier with input and output transformers, 4 transistors. Ideal for use with record players, intercoms, baby alarms etc. Complete with full instructions and circuit.  
Price **52/6** 9v. Batt. 2/3. 2 1/2 in. Speaker 15/-

**C.R.T. BOOSTER TRANSFORMERS** for heater cathode short circuit, or tubes with falling emission. Full instructions supplied. Mains input. Type A optional 25% and 50% boost. 2v. or 4v. or 6.3v. or 10.8v. or 12.6v. State voltage required. PRICE 10/6.

**LOUDSPEAKERS P.M. 3 OHM. 2 1/2, 3 1/4 in., 19/6.**  
5in. Rola, 17/8; 8in. Piesey, 19/6; 7in. x 4in. Rola 18/-; 6 1/2 in. Rola, 18/8; 10 x 8 in. 27/8; 10in. Rola, 30/-; 4in. Tweeter, 25/-; 12in. R. A. 30/-; 13 1/2 x 8 in., Double Cone, E.M.I. 45/-.

**STENTORIAN HF1012.** 10in. 3 to 15 ohms, 10 v. 95/- 35 ohm, 7 x 4in., 25/-; 5in., 22/8; 3 1/2 in., 19/6.

**BAKER SELHURST LOUDSPEAKERS**



Details S.A.E.  
12in. Baker 15w. Stalwart 3 or 15 ohms, 45-13,000 c.p.s. ... 9/6  
12in. Stereo, Foam Suspension, 12w., 35-16,000 c.p.s. ... 28.17.8  
12in. Baker Ultra 2Tw. 20 c.p.s. to 25 kc/s. £17.10  
15in. Auditorium, 35 w., Base, 20 c.p.s. to 12kc/s, £18  
Details and Enclosure plans S.A.E.

**TWIN GANG TUNING CONDENSERS.** 300 pF miniature 1in. x 1 1/2 in. 15in. 104, 300pF Standard with trimmer, 8/-; 9/-; midret, 7/6; with trimmer, 9/-; 500pF slow motion tuning, standard or midret, 9/-  
SMALL 3 gang 500 pF, 17/-, SINGLE 365 pF 7/8. SINGLE 25 pF, 50 pF, 100 pF, 160 pF, 500 pF. Solid dielectric 100, 300, 500 pF, 3/8.

**CONDENSERS.** New stock, 0.001 mfd. 7 kV. T.C. 5/6; Ditto, 20 kV, 9/6; 104, mfd., 7 kV, 9/8. Tubular 500 v. 0.001 to 0.05 mfd. 9d. 0.1, 1/-; 0.25, 1/6; 0.5/500 v., 1/8; 1/1350 v., 9d.; 0.1/2,000 v. 0.1/1,000 v., 1/8; 0.1 mfd., 2,000 volts, 3/8.

**CERAMIC COND.** 500 v. 0.3 pF to 0.01 mfd., 8d. SILVER MICA CONDENSERS. 10% 5 pF to 500 pF 9d.; 800 pF to 3,000 pF, 1/-; Close tolerance (± 1 pF) 32 pF to 37 pF, 1/-; Ditto 1% 50 pF to 513 pF, 1/-; 1,000 pF to 5,000 pF, 1/9.

**465 kc/s SIGNAL GENERATOR** Price 15/-. Uses B.F.O. Unit, ZA-30038 ready made with valve 155. LOCKER'S SIZK 2 1/2 x 4 1/2 in. One resistor to change, full instructions supplied. Battery 8/6 extra. 69V 1 1/2 v. Details S.A.E.

**WAVECHANCE SWITCHES**

8 p. 4-way 2 wafers long spindle ... 8/8  
2 p. 2-way, or 2 p. 6-way long spindle ... 3/6  
4 p. 3-way or 4 p. 3-way long spindle ... 3/6  
3 p. 4-way, or 1 p. 12-way long spindle ... 3/8

**Wavechance "MAKITS" Wafers** available: 1 p. 12 way, 2 p. 8 way, 3 p. 4 way, 4 p. 3 way, 6 p. 2 way, 1 wafers switch, 6/8; 2 wafers switch, 12/8; 3 wafers switch, 19/-; additional wafers up to 12, 3/6 each extra. Toggle Switches, s.d., 2/-; d.p., 3/6; d.p.d.t., 4/-; Rotary s.d., 3/6; d.p., 4/6.

**CRYSTAL MIKE INSERT, 6/6** Precision engineered. Midget size

**ACOS 39-1 DE LUXE STICK MIKE 35/-** QUALITY STICK MIKE. ... 25/-

Valveholders, Fax. int. oct. 4d. EA50, 6d. B12A, CRT, 1/3. Engl. and Amer. 4. 5d. and 7 pin, 1/-, MOULDED Mazda and int. oct. 6d.; B7G, B8A, B8C, B9A, 6d. B7G with can, 1/6. B9A with can, 1/8. Ceramic EF50, B7G, B9A, int. oct. 1/-, B7G, B9A cans, 1/- each.

**Quality 2-Stage HI-FI AMPLIFIER** A.C. only. 200-250 v. Valves ECL86 and EZ90. 3 watt quality output. Mullard tone circuits, bass boost, treble and volume controls. Separate engraved front panel with de-luxe finish. Heavy duty output transformer 3 ohm. Quality mains transformer. Stove enamelled chassis size 6in. x5 in. x 3 1/2 in. Bargain Price £4.10.0. Circuit supplied.

**Christmas Greetings THE ORIGINAL RADIO COMPONENT**  
Our written guarantee with every purchase. Bus 133 or 68 pass door NEW COMPONENT LIST 1/- S.R. Station Selhurst

**Volume Controls** **80 ohm COAX**

Linear of Log Tracks. Semi-air spaced  $\frac{1}{2}$  in. Long spindles. Midget 40 yds. 17/8. 6d. y/s. 5 K ohms to 2 Meg. 60 yds. 25/- Fringe Quality 1/- y/s. Stereo L/S 10/6, D.P. 14/6

**TELESCOPIC CHROME AERIALS.** 15in. extending to 43in. 8/6 ea. Coax. Adaptor Plug, 1/6 extra. **TRIPLEXERS Bands I, II, III** 19/6 **COAX PLUG** 1/- **LEAD SOCKET** 2/- **PANEL SOCKETS 1/-** **OUTLET SOCKET** 4/6 **BALANCED TWIN FEEDER** yd. 8d. 80 or 300 ohms. **DITTO SCREENED** per yd. 1/6. 80 ohms only. **Wirewound Ext. Speaker Control** 10g 3/-. **WIRE-WOUND POTS, 3 WATT.** Pre-set. Min. TV Types. All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/- (Carbon) 30 K., 2 to meg., 3/-. **WIRE-WOUND 4 WATT POTS.** Long spindle. Value, 50 ohms to 50 K., 4/6; 100 K., 7/6. **PHILIPS TRIMMERS** 0-10 pF, 3-30 pF, 1/-; TRIMMERS. Ceramic. 30, 50, 70 pF, 8d.; 100 pF, 150 pF, 1/3; 250 pF, 1/6; 500 pF, 750 pF, 1/9. TV etc. TRIMMER. 1000 pF, with knobs. 2/-. **RESISTORS.** Preferred values. 10 ohms to 10 meg, 1 w., 8d.; 1 w., 9d.; 1 w., 10d.; 1 w., 11d.; 2 w., 1/-. **High Stability.** 1 w., 1/2; 2/- Preferred values 10 to 10 meg. Ditto 5%, 10 to 22 meg., 9d. 5 watt { **WIRE-WOUND RESISTORS** } 1/3  
10 watt { 10 ohms-10,000 ohms } 2/-  
15 watt { } 2/-  
12.5K to 50K 10 w. . . . . 3/-

**AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE**

Double Play 7in. reel, 2,400ft. 60/-	Spare 5in. reel, 1,200ft. 37/8	Plastic Reels
Long Play 7in. reel, 1,800ft. 35/6	5in. reel, 1,200ft. 23/8	3in. 1/6
5in. reel, 900ft. 18/6	5in. reel, 900ft. 18/6	4in. 2/-
Standard 7in. reel, 1,200ft. 25/-	5in. reel, 600ft. 16/-	5in. 2/-
5in. reel, 600ft. 16/-	7in. 2/6	

"Instant" Bulk Tape Eraser and Head Defuzzer, 200/250 v. A.C., 27/6. Leaflet with full details. S.A.E.

**CRYSTAL SET BOOKLET, 1/-.**  
**CRYSTAL DIODE (I.E.C.) 2/-.** GEX34, 4/-, OA81, 3/-.  
**HIGH RESISTANCE PHONES, 4,000 ohms, 15/- per.**  
**SWITCH CLEANER.** Fluid squirt sprayer, 4/6 tin.

**HIGH GAIN TV PRE-AMPLIFIERS BAND I B.B.C.**  
Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PC884 valves if preferred.)  
**BAND III I.T.A.**—Same prices. Tunable channels 8 to 13. Gain 17dB. Circuit and Coils only. 9/6.

1/16in. Paxolin Panels, 10 x 8in., 2/-.  
Miniature Contact Cooled Rectifiers, 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200mA, 21/-; 300mA, 27/6.  
TV etc., Siltcon Sub-Min. Rectifier, 125V, 300mA, 6/6; 250V, 300mA, 14/6.  
Selenium Rect., 300V 85mA, 4/6.  
Coils Wearite "P" type, 3/- each.  
Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E.  
Teletron D.W.R. L. and Med. T.R.F. with reaction, 4/-.  
Med. wave D.R., 3/6.  
Ferrite Aerials, M., 8/9; M. and L., 12/6.  
Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.  
Ferrite Rods, 8 x 3in., 3/-; 8 x 5 1/2in., 3/-.  
H.F. Chokes, 2/6.  
Osmor Q1, 6/9.  
T.R.F. Coils, 7/- pair; HAX, 3/-.  
Repaco DR2, 4/-; DRX1, 2/6.  
Radio Screwdriver, 5in., 6d.  
Neon Mains Tester Screwdriver, 5/-.  
Solder Radiograde, 4d. yd., 1lb, 5/-.  
Black Crackle Paint, Air drying, 3/- tin.

Aluminium Chassis, 18 s.w.g. Plain undrilled, 4 sides, riveted corners, lattice fixing holes. 2 1/2in. sides, 7 x 4in. 4/6; 8 x 7in., 5/6; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6.  
Aluminium Panels, 18 s.w.g., 12 x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-.

**"6 + 1" TRANSISTOR RADIO MEDIUM AND LONG WAVE KIT**  
First class components to make a 6 transistor 2 wave band superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, printed circuit, 3 1/2in. x 2 1/2in., but EXCLUDING speaker and cabinet. Simple instructions 1/6 (Free with kit).  
Speakers, 35 ohm, 7 x 4in. 25/- 5in. 22/6, 3 1/2in. 19/6. **£4.50**

**BULGIN PLUGS AND SOCKETS.** Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/8; P194, 6-pin, 5/6  
**JACKS.** English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.  
**JACK PLUGS.** English, 3/1; Screened, 4/-; Grundig, 3 pin, 3/6.  
**ALADDIN FORMERS** and cores, 1in., 8d.; 2in., 10d. 0.3in. FORMERS 5937 or 8 caas TV1 or 2, 3in. sq. x 2 1/2in. or 2in. sq. x 1 1/2in., 2/- with cores.  
**STOP MOTION DRIVES.** 6.1. 2/3.  
**SOLENOID IRON,** 25W, 200V or 230V, 24/-.  
**ANTEX SUB-MIN IRON** 15w. 200 or 240 v., 29/6.

**JASON FM TUNER COIL SET 29/-.** H.F. coil, aerial coil, oscillator coil. Two i.f. transformers 10.7 Mc/s detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. Complete Jason FM11 Kit. Jason chassis with calibrated dial, components and 4 valves. **£6.50.**

**MAINS DROPPERS.** Midget adjustable sliders. 0.3A, 1,000 ohms, 5/-; 0.2A, 1,200 ohms, 5/-; 0.15A, 1,500 ohms, 5/-; 0.1A, 2,000 ohms, 5/-.  
**M.I.C.E. TRANSFORMER.** 50-1, 3/9.  
P.V.C. Conn. Wire, single or stranded, 2d. yd. Sleeving, 1 or 2 mm, 2d.; 4mm, 3d.; 6 mm, 5d. yd.  
**SPEAKER FRET.** Cloth, 17 x 25in., 5/-; 25 x 35in., 10/-. Tykan, various colours, 52in. wide from 10/-; 4 1/2, 20in. wide, from 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/.

**TELEVISION REPLACEMENTS Line Output Transformers**  
from 45/- each, NEW Stock and other timebase components. Most makes available. S.A.E. with all enquiries

**WEYRAD COILS AND TRANSFORMERS FOR 2-WAVE TRANSISTOR SUPERHETS WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL**  
Long and Medium Wave Aerial—RA2W On 6in. rod, 208pF tuning. 12/6  
Car Aerial Coil 1/6  
Osc. Coil P501AC, 176pF tuning. 5/4  
1st and 2nd I.F. Trans.—P50/2CC, 470Kc/s 1 1/2in. dia., by 4in. 5/7 each.  
3rd I.F. Trans.—P50/3CC, 6/-  
Spare Cores 6d. each.  
Driver Transformer—LFDT4, 9/6  
Wavechange Slide Switch, 3/6  
Printed Circuit—PCA, Size 27 x 8 1/2in. Ready drilled and printed, 9/6  
Volume Control, 5KDP, 4/6  
7 x 4in., 35 ohm Speaker, 25/-  
3 1/2in. round 35 ohm speaker, 19/6  
24 Fixed Resistors, 10/6  
16 Fixed Condensers, 10/6  
Tuning Gang with trimmers, 10/6  
6 Mullard Transistors and diode, 42/6  
Constructor's Booklet, 2/-  
Circuit and Details S.A.E.

**NEW MULLARD TRANSISTORS**  
OC71 6/-, OC72 7/6, OC81D 7/6, OC81 7/6, OC44 8/9, OC45 8/9, OC171 10/6, AF119 9/6  
Sub Miniature Condensers, 0.1 mFd, 30 v. 1/3, 1.2, 4, 5, 8, 16, 30, 50, 100 mFd. 15 volt 2/6 each. Transistor Holders 1/3.  
**B.B.C. Pocket 2 Transistor, M.W. and L.W. Radio Kit, 22/6.**  
Miniature earpiece, 7/6. Batt. 2/3.  
Circuit details, etc. S.A.E.

**MONARCH RECORD PLAYER**

Kit with ready built amplifier, speaker and cabinet. **£12.10.0**  
carr. and ins. 5/-



**Garrard deluxe auto-player kit**

**£12.19.6** Carr. and ins. 5/- details S.A.E.

**GARRARD QUALITY AUTO-CHANGER, 4-speed, with plug-in xtal head.** Ready built 2-valve amplifier, Loudspeaker and contemporary styled Portable Player Case.

All items guaranteed to fit together perfectly, can be assembled in thirty minutes, full instructions supplied.

- 4 Speed Autochanger, B.S.R., U.A.14 £7.10.0
  - B.S.R., U.A.12 Stereo/Mono . . . 85.5.0
  - Garrard Model Autolim . . . 27.18.6
  - 4 Speed Single Players, EMI with auto stop . . . 26.5.0
  - E.M.I. with separate pick-up . . . 23.9.6
  - Amplifier player cabinets . . . 70/-
  - 2-valve amplifier and 6 1/2in. speaker . . . 95/-
  - 3-valve amplifier and 8 1/2in. speaker . . . 105/-
- Wired and tested ready for use with above.*  
Replacement sapphire styli available from 6/-.  
Replacement Xtals from 21/-; Stereo from 35/-.

**SINGLE PLAYER KITS**

**£8.15.0** post 4/6.

With ready-built, 2 stage, 3 watts output amplifier. High flux 5in. speaker. Handsome portable case 13 x 10 1/2 x 7 1/2in. Collaro 4-speed junior motor. LP/Std xtal pick-up for 7, 10, and 12in. records.  
**FEW ONLY KITS AS ABOVE** but with 3-speed B.S.R. Motor **£7.15.0** complete (Post 4/6)

**GABY MULTIMETER**

Moving-coil Model M.L. 54/-  
Measures D.C. or A.C. 6 v., 30 v., 120 v., 600 v., 1200 v. D.C. 30 mA, 300 mA. Ohms 0-001 k.

**ARDENTE Transistor Transformers**  
Type D3035, 7.3 CT: Push-Pull to 3 ohms for OC72, etc., 1 x 1 x 1 1/2in. 9/6  
Type D3034, 1.75 x 1CT, Push-Pull Driver for OC72, etc., 1 x 1 1/2 x 1in. 9/6  
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x 1 x 1 1/2in. 9/6  
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., 1 x 1 x 1in. 12/-  
Type D235, 4.5 : 1 Driver Transformer, 10/-  
Type D240, 8.5 : 1 Driver Transformer, 10/-

**ARDENTE VOLUME CONTROLS**  
Type VC1545, 5K with switch, dia. 0.9in., 5/3.  
Type VC1760, 5K with switch, dia. 0.7in., 10/6  
Deaf aid earpiece xtal or magnetic, 7/6.

**COMPONENT SHOP SPECIALISTS**

Post 1/-, unless otherwise stated.

**337 WHITEHORSE ROAD WEST CROYDON**

Telephone: THO 1665  
C.O.D. 2/-. (Export welcome. Send remittance and extra postage).

Easy-to-build kit-sets of



highest quality at lowest cost



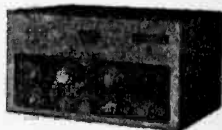
DX-40U

**AMATEUR TRANSMITTER. Model DX-40U.** Self-contained. 80-10 m. Power Input 75 w. CW., 60 w. peak, C.C. phone. Output 40 w. to aerial. Provision for V.F.O.

£33.19.0

**AMATEUR TRANSMITTER. Model DX-100U** Covers all amateur bands, 160-10 m. 150 w. D.C. input, self contained with power supply. Modulator, V.F.O.

£74.19.0



DX-100U

**AUDIO SIGNAL GENERATOR. Model AG-9U.** 10 c/s-100 kc/s, switch selected. Distortion less than 0.1%. 10 v. sine wave output metered in volts and dB's ... £21.9.6

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**R.F. SIGNAL GENERATOR. Model RF-1U.** Gives accurate source of R.F. up to 100 Mc/s on fundamentals and 200 Mc/s on harmonics. Up to 100 mV output on all bands. ... £12.15.6

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# Practical Wireless

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The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments we give no warranty that apparatus described in our columns is not the subject of letters patent.

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## The Social Side

THE amateur radio enthusiast is singularly well served in the various outside activities arranged for his interest and entertainment. Perhaps this is often taken for granted but it is interesting to reflect that there are probably more public exhibitions relating to radio, audio and electronics than for any comparable subject.

There are exhibitions galore, from the brash, brassily commercial glitter of the National Radio Show to the more sedate specialist affairs such as the Physical Society's Exhibition. There is the Radio Communications Exhibition, the International Audio Fair and many others either directly associated or closely linked with the radio enthusiast's field of activity or of borderline interest.

The radio enthusiast is, by and large, a gregarious being, though he retains a sturdy individuality, so that apart from keeping him up-to-date on new developments these exhibitions provide an opportunity to relax with fellow enthusiasts and to discuss ideas, problems and to formulate new plans.

The big shows, however, are concentrated in the large cities (mainly London). But there is another source of entertainment and instruction of a more parochial nature and perhaps because it is purely altruistic gets closer to the heart of things—the local radio club.

There are dozens of them all over the country: big ones and small ones, ambitious ones and modest ones. But they all serve the same useful purpose—entertainment and instruction, social contact and practical activity.

Local radio clubs offer so many advantages that it is surprising they are not all overwhelmed with prospective members. Beginners and experts alike find many added hours of enjoyment to their hobby in the local club. Social, economic and educational barriers rarely exist, if at all, in such clubs. The beginners can obtain guidance and the advanced enthusiasts have the incentive of friendly competition.

And if you have no local radio club, remember that it only needs one or two keen sponsors to get one going; many of the established clubs began in very humble circumstances.

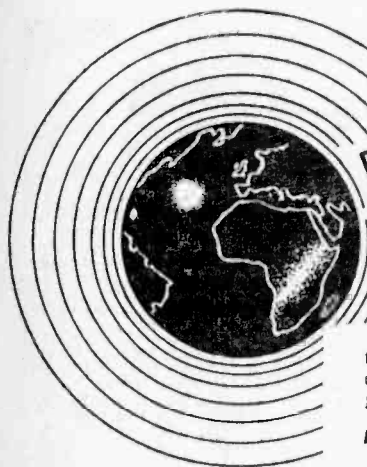
## Seasonal Greetings

to all our readers

from the Editor and Staff of

Practical Wireless

Our next issue dated February will be published on January 4th.



# ROUND THE WORLD of WIRELESS

## NEWS AT HOME AND ABROAD

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of September, 1962, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	834,290
Home Counties	589,969
Midland	425,631
North Eastern	460,548
North Western	395,556
South Western	346,938
Wales and Border Counties	196,242
Total England and Wales	3,029,074
Scotland	322,523
Northern Ireland	108,843
Grand Total	3,460,440

### Commemoration for Morse

SAMUEL MORSE, the originator of the Morse code, is commemorated by an L.C.C. plaque at 141 Cleveland Street, St. Marylebone. It was unveiled recently in the presence of G.P.O. employees and representatives of the Royal Institute of Electrical Engineers.

When he was 20, Morse came to London to study art. His first contribution to the science of communication was discovering a method of making a permanent record of electro-magnetic impulses which were already being used to transmit messages by swinging a needle from letter

to letter on a dial. He also made experiments in submarine telegraphy.

### Radio in a Pair of Sunglasses

AN ingenious idea for housing a radio receiver has been produced recently by an American firm, the parts being built into the side pieces of a pair of sunglasses.

Burton Transistor Radio Sunglasses, as they are called, are complete with a tuning control and earphone, with an aerial which does not always have to be used.

Worn as ordinary sunglasses, the radio is tuned by a dial on the left earpiece. The glasses can be fitted with lens to any prescription.

This latest radio novelty comes from Precision Electronics, of California, U.S.A.

### New Outside Broadcasts Base at Bristol

WORK has begun on the BBC's new West Region sound and television outside

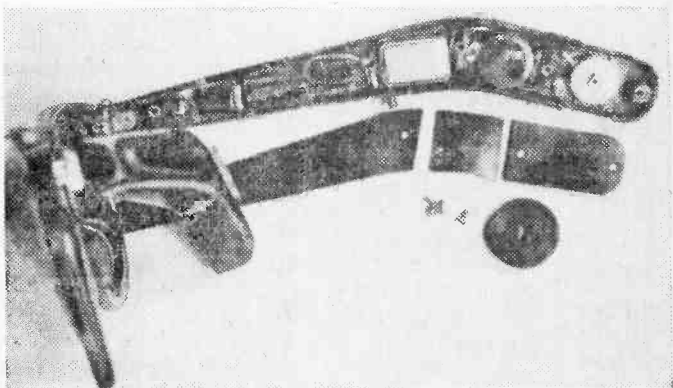
broadcasts base to be built on a site in Belgrave Road, Bristol. The new base will consist of a garage 200ft by 72ft for the outside broadcast vehicles, workshops and test rooms for the maintenance of the vehicles and their technical equipment and stores. Demolition work to clear the site of the existing buildings has begun and will be followed by the building, which is expected to take about 18 months.

The new base will replace the existing sound outside broadcast base at Whiteladies Road and the television base at Whitchurch Airport; it will be the headquarters of the BBC teams which cover the whole of the west and south west of England.

The vehicles used for sound broadcasts consist of recording cars for news and topicality programmes and a mobile control room for live contributions to the sound services.

### Fifth Jamboree on the Air

FROM 00.01 hours G.M.T. on October 20th until 23.59



The latest radio novelty from America; a receiver in a pair of sunglasses.

hours G.M.T. on October 21st Scout radio enthusiasts all over the world were once again trying to contact each other during this year's two-day Jamboree-on-the-Air.

Stations were set up in many parts of the country with the help of local amateur radio clubs, one of the biggest being at Baden-Powell House in South Kensington, where, under the call sign GB3BPH, five separate transmitters were sending out the international call sign for the event, "CQ Jamboree".

For radio-minded visitors to Baden-Powell House during the event, communication receivers enabled them to "listen in". Other items of interest were on show, with licensed radio amateurs available to answer questions.

#### Change of Third Programme Frequency

ON November 1st the frequency of the Third Programme / Network Three transmitter at Les Platons (Channel Islands) was changed from 94.45Mc/s to 94.75Mc/s in accordance with international agreement (the revised Stockholm Plan of 1961). This means that the station appears at a slightly different position on the tuning dial, probably between  $\frac{1}{2}$ in. and  $\frac{1}{4}$ in. from the old one.

Listeners who have v.h.f. receivers on which the three sound programmes are selected by a switch or push-button (such as some combined television and v.h.f. receivers) need to have the pre-set tuning adjusted inside the receiver for reception of the Third Programme and Network Three. This is a simple matter which a radio dealer can deal with in a few minutes.

#### Improving Acoustics of a Large Church

A SOUND reinforcement system has been supplied and installed in the Church of St. Peter, Rugby, by the Sound Equipment group of the AEI Electronic Apparatus Division to overcome the poor acoustics in the building.

Members of the congregation seated between the middle and



Dr. Kenzo Nagai and Dr. Shun-ichi Iwasaki of Tokyo University, Japan, inspecting a tape recorder during their recent visit to an EMI factory.

back of the lofty nave have found it very difficult to hear clearly because of reverberation and echo. AEI engineers have now overcome the problem by siting six reinforcement loudspeakers at a number of points down the length of the church.

Microphones are mounted on both pulpit and lectern, ribbon types being selected for pick-up sensibility and sensitivity. Signals from the microphones are amplified by means of a two-way transistorised mixer unit and a conventional dual-channel power amplifier, each channel providing 10W of audio power to feed the loudspeaker units.

#### Radio Telecommunications Project Nearing Completion in Angola

NOW nearing completion in Angola is an extensive multi-channel network of trunk radio-telephone and telegraph channels connecting all the main centres of population in the territory.

The initial contract was awarded to the Marconi Co. and Automatic Telephone and Electric Co. Ltd. in late 1957 and subsequent contracts for the entire scheme were also placed with these companies.

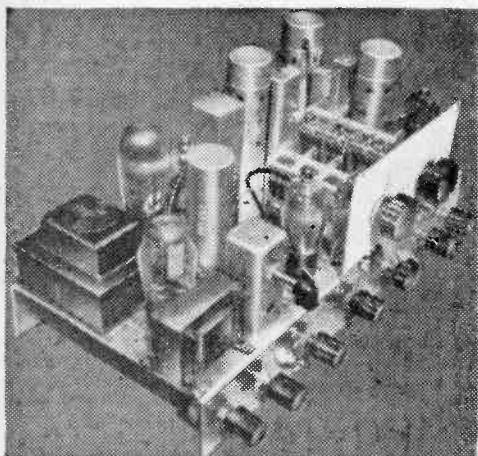
The main artery of the system connects Luanda, the capital, with Lobito, a main port, whilst other spur connections link Villa Marechal, Carmona, Malange, Benguela and Sa Da Bandeira.

All the links with one exception use Marconi v.h.f. terminal and repeater stations in duplicate, with automatic changeover to standby in the event of failure of an operational unit. The exception is the connection from Lobito to Benguela, for which a higher traffic capacity was demanded and which uses u.h.f. equipment.

#### Japanese Visitors

DR. KENZO NAGAI, professor at Tokyo University, where he is director of the Research Institute of Electrical Communication, was accompanied by Dr. Shun-ichi Iwasaki, of the same institute, when he recently visited the Hayes plant of EMI Electronics Ltd.

Demonstrations were given of the company's range of professional tape recorders and the visitors were able to inspect experimental sound recording equipment in the EMI development laboratories.



# General Purpose COMMUNICATIONS RECEIVER

by R. F. Graham

**T**HIS is a 10-valve receiver (including rectifier) and covers approximately 19Mc/s to 550kc/s (16 to 550m) in four wavebands. A long-wave band may readily be added, if required. Bandspread tuning is included, and is very useful on the congested short wave frequencies. There are also noise-limiter, beat-frequency oscillator, and frequency marker stages as these features are often of aid in a communications type receiver.

It is recommended that the inexperienced constructor should test the receiver with coils installed for one band only. It is then easy to add the other coils, and this system avoids errors in band switch wiring.

The receiver uses octal valves, because of their low cost, easy availability, and general robustness. Building costs can be much reduced by using cheap, surplus components, and this is in order, for such items as capacitors, resistors, valveholders, mains transformer and choke, and similar parts. Doubtful components should, of course, be tested before use.

## Complete Circuit

This is shown in Fig 2. V1 is an r.f. amplifier, and V2 the frequency changer. VC1A, VC2A and VC3A are the usual 3-gang tuning capacitor, which is operated by a ball drive. It is employed for general tuning, and also for band-setting. VC1B, VC2B and VC3B are a low-capacity 3-gang capacitor, used for band-spreading, and also operated by a ball drive. Accurate tuning over a narrow band of frequencies is possible with this capacitor. VC1C is a panel mounted aerial trimmer, and VC2 is a similar frequency changer trimmer, the oscillator circuit using the fixed trimmer TC1. This arrangement avoids the need for the twelve preset capacitors, which would otherwise be necessary, and also assures maximum efficiency on all parts of each band. In practice it is extremely difficult to obtain exact ganging throughout a band with fixed trimmers, so the use of panel

trimmers avoids inefficiency from this reason and also allows the aerial circuit to be trimmed to suit any aerial which may be connected.

Separate oscillator and mixer stages were not found to be justified in this circuit. The r.f. stage helps to increase sensitivity and reduces 2nd channel interference.

Two i.f.t.'s are used as an i.f. filter between valves V2 and V3, and this circuit gives good selectivity. Two further i.f.t.'s are used in the following stages and a tuning meter can be plugged into the anode circuit of V4 if required. The screen grid of V4 is fed from the potential divider R14 and R15 in order to secure a greater change in anode current for a given a.v.c. voltage, to increase meter readings.

V5 provides a.v.c. and audio amplification, a small a.v.c. delay voltage being obtained across R22. V6 acts as detector and noise limiter. The noise limiter is very effective in reducing static type noise, but causes a slight deterioration in audio quality, so this stage can be cut out by means of the noise limiter switch S2. The limiter itself is of the type which automatically adjusts to carrier level.

V6 is the output stage, and V10 is the rectifier. A standby switch is provided. With the receiver in the standby position, all valve heaters are on, but h.t. is removed, R35 and R36 acting as a bleeder. This allows instant switching on and off (without waiting for heaters to warm up) and is also useful when working the receiver in conjunction with a transmitter.

V8 is the beat frequency oscillator, which is switched in when c.w. morse is to be received. It will be appreciated that if there is no interest whatever in c.w. morse, then this stage can be omitted. The b.f.o. is not required for ordinary reception of speech and music, so its h.t. supply is interrupted by the b.f.o. switch.

## Crystal Marker

V7 is a crystal marker, using a similar circuit to those found in the more expensive communica-

tions receivers. When the marker is switched on, h.t. is applied to V7, and the marker signal is taken to the aerial circuit through C34. This allows exact calibration of the bandspreading and bandsetting capacitors, and also allows a narrow band of frequencies to be tuned with great accuracy, by adjusting the bandsetter knob to the marker signal.

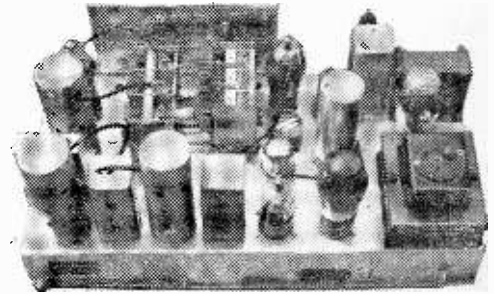
VR1 is a manual control of sensitivity, connected to the cathode circuits of V1, V3 and V4, and the a.v.c. switch S3 allows the a.v.c. system to be rendered inoperative, so that gain may be controlled manually by VR1. This is sometimes necessary for c.w. reception, or in other circumstances. VR2 is the usual audio gain control.

In addition to the a.v.c. switch and mains on/off switch S5, two combined function switches are provided. The switch for the marker and noise limiter (S2) has three positions: (1) marker on, (2) noise limiter in, (3) noise limiter out; the marker being off in positions (2) and (3). The remaining switch (S4) also has three positions: (1) receiver on and b.f.o. off, (2) standby, (3) receiver and b.f.o. on. Position (1) is for "Phone" (speech and music) reception, and position (3) is for "c.w.".

**Chassis**

This should be of stout gauge aluminium, and can be about 8½ in. x 16 in. x 2½ in. The layout of the major components is shown in Fig. 1, and all large holes for valvholders and other parts should be drilled before mounting any components.

The two 3-gang variable capacitors are mounted so that their spindles are at the same height. An aluminium plate 7 in. x 5 in. is bolted to the front runner of the chassis, and has two holes to clear the ball drives. The lugs of these drives are bolted to this plate. The capacitor sections are wired in parallel, as in Fig. 1. These leads are taken to the



General view of the receiver top viewed from the back.

lower tags of the capacitors, but are clear of the chassis. The trimmer TC1 is soldered to a tag bolted to the capacitor frame. Leads from VC1A, VC2A and VC3A pass directly from the lower tags, through the chassis, to the band switch.

The 3-gang bandspreading capacitor is of about 20pF to 30pF maximum capacity. This can be made by removing plates from an ordinary 3-gang capacitor, as these are available cheaply. Low capacity 3-gang components are also sometimes available as surplus. Three small capacitors with extended spindles, ganged with couplers, could also be used. A 2-gang bandspreading capacitor, wired to VC2A and VC3A is also feasible, the panel trimmer VC1C then being used for adjustment of the aerial circuit, which does not tune sharply. A new gang capacitor of low value is relatively expensive.

Positions of the controls under the chassis will be seen from Fig. 3. A piece of aluminium about 2½ in. x 8½ in. is bent to form the screen which also supports the frequency changer (V2) trimmer VC2C, and band switch S1. Both panel operated

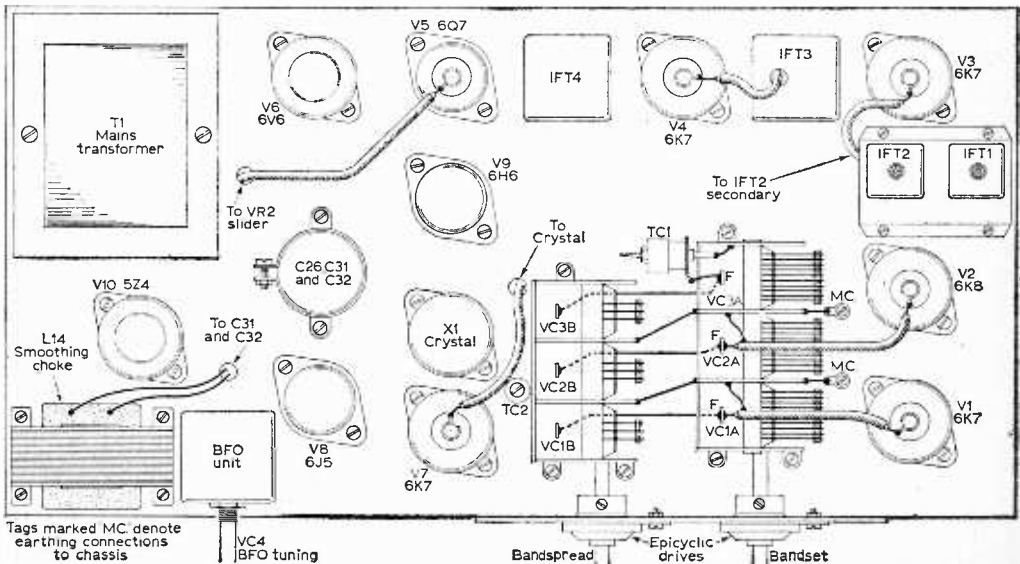


Fig. 1: Top of chassis layout showing location of components.



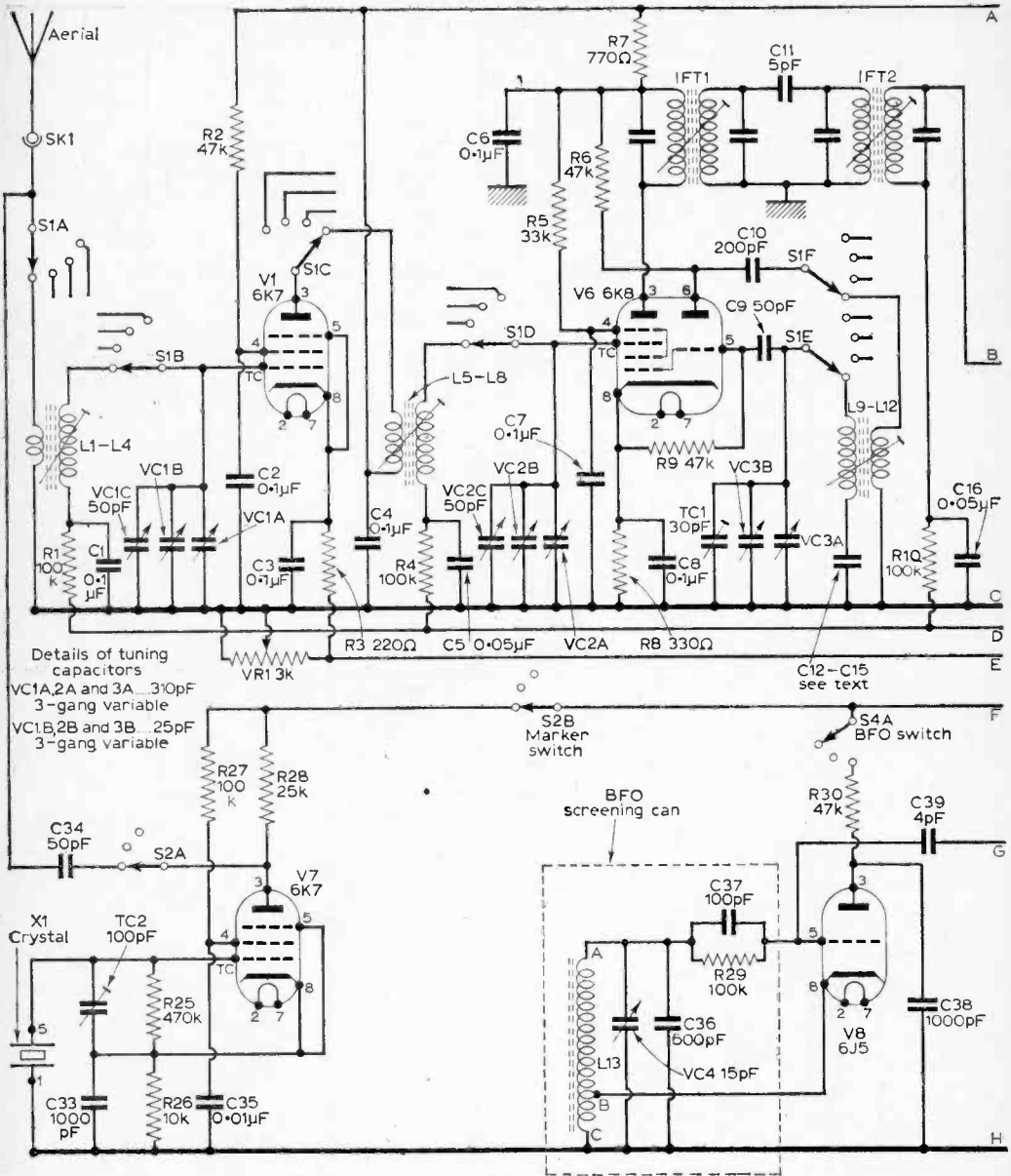


Fig.-2.

trimmers are miniature air-spaced variable capacitors, and about 40pF to 60pF will be suitable. The frequency changer stage trimmer requires an extension spindle, coupling, and bush.

**Band Switch**

The band switch S1 can best have an individual wafer for each circuit, that is, six wafers in all. These items will also be found from time to time

in surplus lists, as a new switch of this kind is relatively expensive. Only 4-ways are required, for the four bands. If long waves are to be added, each wafer should be 5-way. Surplus 6-way and similar switches are suitable, unused contacts being ignored. The switch is dismantled so as to pass its spindle and rods through holes in the screen mentioned. This screen is bolted to the chassis, and makes the switch rigid.

In order that actual wiring can be as straight-

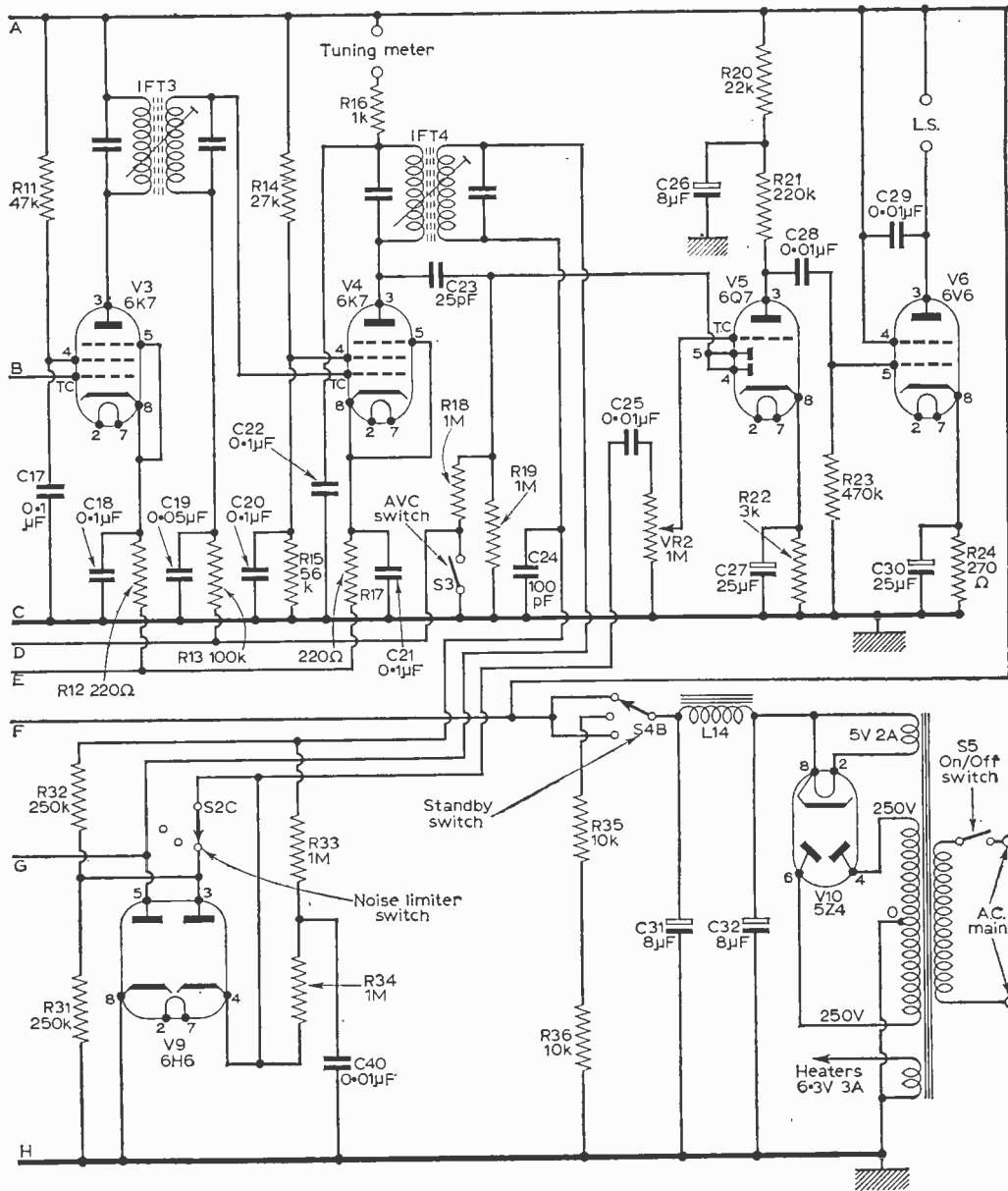


Fig. 2: The drawings on these two pages show the complete circuit diagram of the general purpose communications receiver. A complete parts list is given overleaf on page 800.

forward as possible, it will be found convenient to deal with one stage at a time. The more experienced constructor may, of course, prefer to wire the whole receiver, before testing it. If not, work may proceed in the order described.

**Power Circuit**

The mains transformer, rectifier (V10) and smoothing circuit (choke L1 and C31 and C32) may be wired first. At the same time, all the heater wiring can be completed, because these leads should

be run close in contact with the chassis. Heater circuits are completed through the chassis. A tag should be secured under each nut, when mounting the valveholders, to form earthing points, marked MC. Keep heater wires clear of tags 3, 4 and 5 of V9, to avoid hum.

The h.t. section of the standby switch may be wired at this stage, if preferred. Connections to this switch are shown in Fig. 4. If a check is to be made, test that 6.3V a.c. is available at tags 2 and 7 of each valveholder, and that a d.c. h.t. voltage of roughly 250 is obtained across C31, with the switch in the standby position.

## Frequency Changer

V2 is the frequency changer. Wafer 4 of S1 is used to select the coil primaries, and wafer 3 is wired to VC2A fixed plates, and to the frequency changer trimmer. The switch is turned to the appropriate position, and the M.W. coil L8 is connected. Wafers 5 and 6 are used for the oscillator coils, and L12 is the M.W. oscillator coil, with 470pF padder C15. A lead passes from wafer 5 to VC3A.

*The description of the circuit will be continued in the next issue.*

## COMPONENTS LIST

### Resistors

R1 100k $\Omega$	R13 100k $\Omega$	R25 470k
R2 47k $\Omega$	R14 27k 1W	R26 10k
R3 220 $\Omega$	R15 56k $\Omega$	R27 100k
R4 100k $\Omega$	R16 1k $\Omega$	R28 25k
R5 33k $\Omega$	R17 220 $\Omega$	R29 100k
R6 47k $\Omega$	R18 1M $\Omega$	R30 47k
R7 770 $\Omega$	R19 1M $\Omega$	R31 250k
R8 330 $\Omega$	R20 22k $\Omega$	R32 250k
R9 47k $\Omega$	R21 220k $\Omega$	R33 1M
R10 100k $\Omega$	R22 3k $\Omega$	R34 1M
R11 47k $\Omega$	R23 470k $\Omega$	R35 10k 2W
R12 220 $\Omega$	R24 270 $\Omega$ 1W	R36 10k 2W

All 10%,  $\frac{1}{2}$ W except where otherwise stated.

VR1 3k wire-wound potentiometer.

VR2 1M potentiometer with switch (S5).

### Capacitors:

C1 0.1 $\mu$ F 150V	C13 4500pF mica
C2 0.1 $\mu$ F 350V	C14 2500pF mica
C3 0.1 $\mu$ F 150V	C15 470pF mica
C4 0.1 $\mu$ F 350V	C16 0.05 $\mu$ F 150V
C5 0.05 $\mu$ F 150V	C17 0.1 $\mu$ F 350V
C6 0.1 $\mu$ F 350V	C18 0.1 $\mu$ F 150V
C7 0.1 $\mu$ F 350V	C19 0.05 $\mu$ F 150V
C8 0.1 $\mu$ F 150V	C20 0.1 $\mu$ F 350V
C9 50pF mica	C21 0.1 $\mu$ F 150V
C10 200pF mica	C22 0.1 $\mu$ F 350V
C11 5pF mica	C23 25pF mica
C12 4700pF mica	C24 100pF mica
C25 0.01 $\mu$ F tubular paper	C35 0.01 $\mu$ F 350V
C26 8 $\mu$ F 350V	C36 500pF mica
C27 25 $\mu$ F 12V	C37 100pF mica
C28 0.01 $\mu$ F mica	C38 1000pF mica
C29 0.01 $\mu$ F tubular paper	
C30 25 $\mu$ F 25V	
C31 8 $\mu$ F 350V	
C32 8 $\mu$ F 350V	
C33 1000pF mica	
C34 50pF mica	
C39 4pF ceramic (see text)	
C40 0.01 $\mu$ F tubular paper	

VC1A, VC2A and VC3A: 310pF or 500pF 3-gang variable

VC1B, VC2B and VC3B: 25pF or similar 3-gang variable

VC1C 50pF miniature variable

VC2C 50pF miniature variable

VC4 15pF miniature variable

TC1 30pF air-spaced beehive trimmer

TC2 100pF trimmer

### Aerial Coils:

L1 Band 1	16 to 35m	QA2	} (Osmor)
L2 Band 2	33 to 85m	QA3	
L3 Band 3	75 to 210m	QA4	
L4 Band 4	200 to 550m	QA8	

### Mixer Coils:

L5 Band 1	QHF2	} Osmor
L6 Band 2	QHF3	
L7 Band 3	QHF4	
L8 Band 4	QHF8	

### Oscillator Coils:

L9 Band 1	Q04	} Osmor
L10 Band 2	Q03	
L11 Band 3	Q04	
L12 Band 4	Q08	
L13	B.F.O. coil—see text	
L14	L.F. smoothing choke 5H 100mA	

### I.F. Transformers:

IFT1 } Miniature I.F. transformers, 470 kc/s.

IFT2 }

IFT3 } Standard I.F. transformer, 470 kc/s.

IFT4 } Standard I.F. transformer, 470 kc/s, for detector stage

T1 } Mains transformer: Tapped Primary.

Secondaries: 250-0-250V 100mA; 6.3V 3A; 5V 2A.

### Switches:

S1 6-wafer switch. Each wafer 1 pole, 4-way

S2 3-pole, 3-way miniature rotary switch

S3 On/off toggle switch

S4 2-pole, 3-way wafer switch

S5 On/off toggle switch (combined with VR1)

SK1 coaxial socket

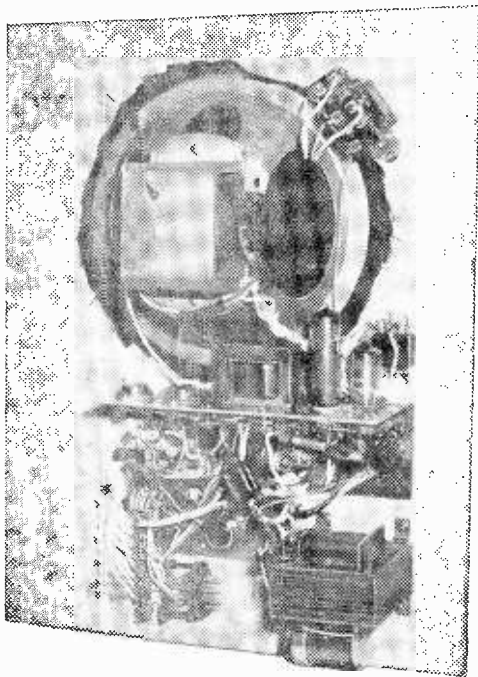
X1 100 kc/s crystal (see text)

### Valves:

V1 6K7	V6 6V6
V2 6K8	V7 6K7
V3 6K7	V8 6J5
V4 6K7	V9 6H6
V5 6Q7	V10 5Z4

### Miscellaneous:

Eleven octal valveholders. Extension coupling. Knobs. Two ball-drives. Two 2-way socket strips. Loudspeaker with output transformer to match 5,000 $\Omega$ . Valve screens, and cap clips. Chassis 8 $\frac{1}{2}$  x 16 x 2 $\frac{1}{2}$ in. approx. Aluminium for screen, etc.



# Central Control Amplifier

By E. McLoughlin

## A MASTER CONTROL UNIT FOR AN AUDIO INSTALLATION

(Continued from page 705 of the December issue)

AS already mentioned, this stage is not intended to give further voltage gain except for a very slight increase of final output voltage to compensate for line losses on the way to the distant loudspeakers in the other rooms. The output voltage is designed to be, apart from this last consideration, a true replica of the voltage at the speech-coil of the internal loudspeaker. But the line voltage is designed to be largely maintained, regardless of the exact number of loudspeakers switched on to the line. Thus, the transistor stage gives a *power-gain* of amount according to the number of loudspeakers operated on the line at

any given time. Power gain without voltage change represents impedance step-down function, which is thus the ultimate function of this stage, in common with all circuits of the "cathode-follower" class, to which this circuit belongs.

Looking at the theoretical circuit of this stage in Fig. 2 it is apparently very simple indeed, needing few parts in all, and one might think that construction would be quite non-critical. But, upon experimenting in the course of designing this circuit in the author's workshop, a number of rather critical factors were discovered. These are basically threefold. Firstly, the setting of a suitable *operating point* for the transistors was very critical, and as the transistors are designed to run very *hot* (quite normal for this kind of transistor) during operation measures must be taken to counteract thermal-drift of the operating point as well as to ensure adequate cooling of the transistors. Secondly, the precise design of the transformers T4 and T5 was found to be highly critical and some considerable experimenting, involving repeated re-winds and comparative measurements, was needed until the factors involved were clearly understood and a fully satisfactory final design could be wound. Fig. 6 gives summarised details on this work on T4 and T5. The third critical point is connected with obtaining sufficient i.t. supply voltage at the required current and sufficient audio shunting of all internal impedances of the power supply and the biasing arrangements, even at the lowest frequency to be passed (nominally 35c/s). This involved the ultimate necessity for quite large capacities for C4, 5, 6, 7. Most particularly is C7 important and this has the largest capacity of all—5,000 $\mu$ F. This is because here the working impedance is lowest of all and insufficient capacity for C7 causes *considerable* loss of low-frequency power across R1 and the internal impedance of the power supply. For this reason, too, C6 and C7 have been returned to *chassis* and not placed directly in parallel with the operative bias resistors VR1 and R1, so that effective capacities are not reduced by virtue of C6 and C7 otherwise being in series with C5 of the power supply for audio purposes. This arrangement has the added advantage that a greater total D.C. voltage exists across C6 and C7, enabling the dielectric to form itself easily and properly.

It must be *stressed* that C7 *must* have at least the specified capacity. Use a greater capacity by all means if available—this is likely to give even better low-frequency performance when *many* loudspeakers are on the output line, but the specified value of 5,000 $\mu$ F was found to be the best compromise between satisfactory performance and tolerable price. It would, at a pinch, be possible to use 9V working capacitors to save expense, but these might under certain circumstances break down.

If C7 has insufficient capacity the internal source impedance of the output will rise so much that most of the constant-voltage benefits may be lost and performance then be little better than feeding the line direct from the EL84 output. The same great fall in performance results if T4 and T5 are not of optimum characteristics and therefore a discussion follows now on these items.

Reckoning a nominal output power of some 10W from a stage, and a nominal differential current gain of 50 for the particular type of transistors specified, some 200mW drive are required to be supplied through T4. If the presence or absence of T4 is, therefore, not to affect matching at the EL84 to any appreciable extent, then T4 must never demand more than about 10% of the total power delivered by the EL84.

The primary inductance of T4 must be just large enough not to consume too much current from the EL84 at the design low-cut-off frequency (35c/s). The 10% maximum condition would demand an effective load of about 40 to 50Ω, which may be halved at the low-cut-off frequency. Consequently the primary of T4 should have an impedance of some 20 to 30Ω at 35c/s, which is satisfied by an inductance of about a tenth of a Henry.

It is then necessary to find out how many turns will give this inductance on the core of an old loudspeaker transformer stripped of all original windings. As no net d.c. now flows, the E/I stampings should be stacked on alternate sides in the new design, giving higher inductance per turn.

Wind on roughly some 200 turns of about 0.5mm diameter wire and insert the stampings. Then connect the windings to a 6.3V a.c. supply, measure the current drawn with an a.c. ammeter in series, and calculate the effective impedance at 50c/s through Ohm's Law. Neglecting the d.c. resistance, and dividing the impedance value thus obtained by 300, we get the inductance value in Henrys for the trial winding.

Divide value by the desired inductance value (one tenth of a Henry), and take the square-root of the result. Multiply this factor by the number of turns on the trial-winding to obtain the correct number of turns on the proposed core for the sible wire diameter should be primary of 74. The largest used: 0.3 to 0.4mm diameter enamelled copper should be satisfactory.

The choice of turns-ratio is now governed by the requirement to make simultaneous maximum use of the full linear range of the characteristic of the EL84 and the transistors under the given operating conditions.

#### Linear Range

A steady 1V is dropped across R1 under the specified conditions. The minimum collector to

emitter voltage for maintenance of "pentode" characteristics in the earthed-collector circuit for the 2N257 is stated at 1.5 to 2V (called "knee-voltage"). Thus, with 7.5V supply voltage, some 4.5V peak linear swing at the emitter-loads are realisable, representing some 3V r.m.s. requiring a drive of 3.25V r.m.s. at the bases.

The EL84 delivers some 3W into 4Ω, thus developing an r.m.s. voltage of 3.5V. Consequently T4 must have a step-down ratio of 3.5 to 3.25. Thus each half of the secondary must have 13/14 of the number of turns of the primary.

Use the same diameter wire throughout. The primary comes first on to the bobbin, in neat

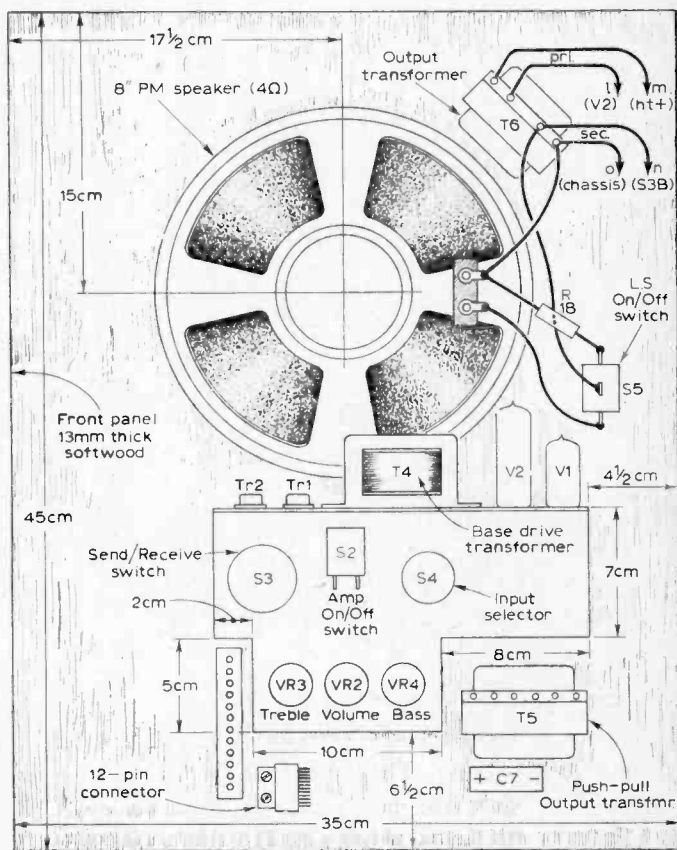


Fig. 4: The component layout diagram of the lid-unit.

layers. Then the secondary, wound right through in the same direction, and accurately centre-tapped. If a mistake is made in the precise total number of turns, that does not matter much as long as the error is not more than one or two turns, but if the centre-tap is not at the exact numerical centre, consequences could be serious.

The performance would not be affected up to some 4W total output from the stage, for which the stage remains in class A (neither transistor



cuts off on peaks), but at greater drive, when transition to Class AB takes place, with transistors cutting off on alternate peaks, severe distortion can start if the drive is asymmetric due to a falsely-positioned centre-tap on T4 (or T5, for that matter!). For the same reason, a *matched pair* of transistors should be purchased.

The present unit is designed for a reasonable compromise of 1A standing current per transistor, giving Class A operation up to quite considerable volume, going over to AB only for the final drive up to high volume, where "lower-bend distortion" plays less of a role in comparison to the already-present large undistorted signal level. The final tone quality of the unit is very fine indeed—though, of course, true high-fidelity in every respect would be got only with pure Class-A operation, requiring even higher standing transistor current.

#### The Output Transformer, T5

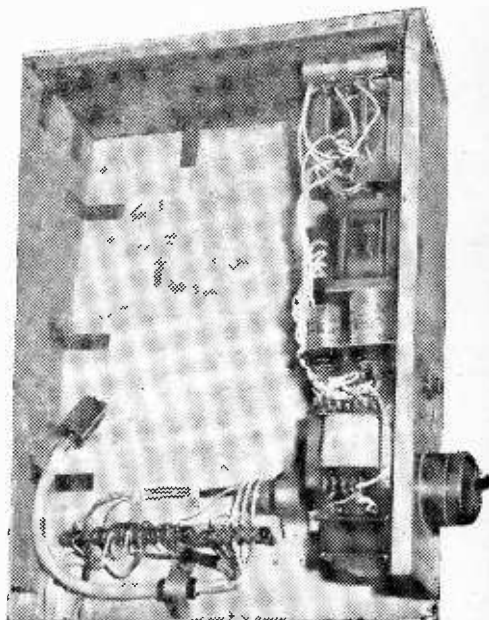
Design considerations are here as follows: On account of the, roughly, 1:1 ratios throughout the source impedance at T5 (neglecting the additional component from the bias and power supply circuits) will be roughly the EL84 output  $4\Omega$  divided by the differential current gain of the 2N257, representing roughly a tenth of an ohm.

This value is the correct one on which to base a design for T5 primary, even though almost the same impedance again adds in series from the other named sources to give the final source impedance seen by the line, which is then about a quarter of an ohm.

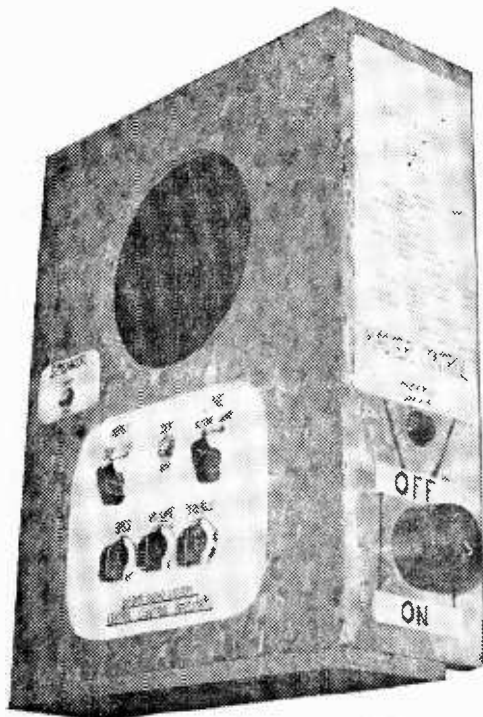
We want the primary to have just sufficient inductance on each half so that it presents ten times the source impedance at least—i.e., at least an ohm. A very generous safety margin at the low-frequency cut-off of T4 is obtained by making the primary inductance of each half on T5 equal to about a hundredth of a Henry.

The exact number of turns needed are experimentally determinable as described for T4. A substantial core is needed on account of the higher power.

Regarding the turns ratio, this is fixed in the



The interior of the cabinet.



The finished amplifier.

following manner: We see that we get a maximum swing of 3V r.m.s. from the emitter loads. We want, however, the same 3.5V back again which prevailed at the internal speaker direct from the EL84, plus about half a volt extra to compensate line losses.

Thus we want to step up the 3V to to 4V and the secondary of T5 must be given  $4/3$  as many turns as are found to be required for one half of the primary. Use very substantial enamelled copper wire as large as can be accommodated on the bobbin. As all windings taken together will require normally less than a total of 100 turns, wire of 1.5—2.0mm diameter should be able to be accommodated.

Really careful and thorough experimenters may like to go one stage of perfection further. They can wind an experimental version of T5 first, having taps on both primaries and secondary at 10% and 20% above and below the calculated number of turns. An experimental version of T4 can be wound similarly.

Feeding a pure sinewave into the Mullard amplifier from an audio signal generator and monitoring the EL84 output and the T5 output

## COMPONENTS LIST

### Resistors:

R1	$\frac{1}{2}\Omega$ 5W w.w. (see text)	R10	2.2M $\Omega$
R2	25 $\Omega$	R11	560K $\Omega$
R3	100K $\Omega$	R12	10K $\Omega$ 2W
R4	100K $\Omega$	R13	1K $\Omega$
R5	25 $\Omega$	R14	150 $\Omega$
R6	25 $\Omega$	R15	1M $\Omega$
R7	100K $\Omega$	R16	680 $\Omega$ 2W $\pm 5\%$
R8	4.7M $\Omega$	R17	4.7K $\Omega$ $\pm 5\%$
R9	100 $\Omega$		

R18 4 $\Omega$  5W w.w.  $\pm 5\%$   
Carbon  $\pm 20\%$  1W (unless individual details otherwise stated)

VR1	60 $\Omega$ 5W w.w. Lin. Preset
VR2	500K $\Omega$ Log. Volume Control
VR3	500K $\Omega$ Lin. Potentiometer
VR4	50K $\Omega$ Log. Potentiometer

### Transformers, Chokes:

T1	Mains Transformer 6.3V 1 $\frac{1}{2}$ A & 260V 60mA
T2	Mains Transformer 7 $\frac{1}{2}$ /0/7 $\frac{1}{2}$ V 2 x 2 $\frac{1}{2}$ A
T3	Mains Isolation Transformer 1 : 1 250 watt
T4	Base-Driver
T5	PP-Output
T6	EL84/4 $\Omega$ Output Transformer
L1	Mains r.f. Choke
L2	H.T. Choke 10 Henry 60mA
L3	L.T. Choke $\frac{1}{10}$ Henry 0.15A

### Switches:

S1	Mains Lighting Toggle Switch
S2	1-pole On/Off QMB Toggle Switch
S3	Rotary Ceramic Switch, 4 pole 2 way
S4	Rotary Ceramic Switch, 1 pole 2 way
S5	Single-Pole Double-Throw QMB Toggle Switch

### Capacitors:

C1	500pF 1000V.W. Super-Insulation
C2	Electrolytic 32 $\mu$ F 450V.W. (Can-type)

C3	Electrolytic 32 $\mu$ F 450V.W. (Can-type)
C4	Electrolytic 2500 $\mu$ F 12V.W. (Can-type)
C5	Electrolytic 2500 $\mu$ F 12V.W. (Can-type)
C6	Roll-Electrolytic 1000 $\mu$ F 12V.W.
C7	Electrolytic 5000 $\mu$ F 12V.W. (Large Roll and Clip)
C8	250pF 500V.W. Ceramic
C9	0.027 $\mu$ F 500V.W. Paper
C10	0.15 $\mu$ F 500V.W. Paper
C11	0.1 $\mu$ F 500V.W. Paper
C12	Roll-Electrolytic 50 $\mu$ F 80V.W.
C13	Roll-Electrolytic 8 $\mu$ F 450V.W.
C14	1000pF 500V.W. Ceramic
C15	0.1 $\mu$ F 500V.W. Paper

### Valves, Diodes, Transistors:

V1	EF86 and Ceramic Noval Holder
V2	EL84 and Ceramic Noval Holder
TR1	} Matched Pair 2N257 Power Transistors
TR2	
D1	Selenium Bridge Rectifier 260V a.c./60mA d.c.
D2	Fullwave Copper-Oxide Pair for 6V 3A d.c. output (approx.)

### Sundries:

1	Panel Fuse Unit (insulated)
1	12-pole RAF-Connector Pair
1	8in. Speaker, 4 $\Omega$
	Aluminium, Wood, Bolts, Screws, Tagstrips, etc.
	$\frac{1}{2}$ yd. 14-core Cable
	Connecting Wire
	Screened (Coaxial) Cable, low capacity, approx. 1 yd.
	3-core Power Cable
	4-core Power Cable to T3
	Mains Plug
	5 Pointer Knobs

with an oscilloscope (to show onset of distortion), as well as observing power with a d.c. voltmeter across known load resistors, a judicious selection of tappings can be found experimentally to give optimum performance consisting of:

- Onset of distortion *simultaneously* in the EL84 and the transistor output at the same drive maximum. This should be checked for load resistors simulating 1, 2, 3, 4 and 5 loudspeakers in parallel on the output line and at least the following three frequencies: 50c/s, 1kc/s and 7.5kc/s.
- Line output voltage off-load some 10 to 20% higher than the voltage on the EL84 load, both equal when a line load equivalent to about three loudspeakers is connected.

### Operating-Point Stabilisation

It is just in the emitter-follower arrangement of transistors that operating-point stabilisation can be particularly elegantly achieved, making use of the inherent total negative-feedback characteristic of any "cathode-follower" device. We choose R1 such that a suitable voltage drop appears across it at the desired standing current and set VR1 such that the voltage across its upper section is just above this design-voltage drop on R1.

Provided the resistance of VR1 is not too high

this gives a very high measure of stabilisation of the total standing collector-emitter current through R1 regardless of whether the transistors are still cold or have warmed up. If R1 were omitted it would certainly be possible to set any desired operating point at a suitable different setting of VR1, but this would then be rather critical and unstable and subject to large drift. Adjust VR1 for 1V drop measured across R1.

### Cooling

Finally a word about the measures to be adopted for adequate cooling of the transistors. The substantial cast-casings of the 2N257 form the collector connections and are ideally clamped hard against the chassis surface. To allow this in the present circuit and still maintain correct polarity it was necessary to earth the negative pole of the l.t. supply, having the positive insulated from chassis.

Also note in Fig. 4 that the transistors are mounted at the opposite end of the chassis from the EL84, with the transformer T4 as heat screen in between. This avoids unnecessary radiation heating of the transistors from the valves.

Note that the 2N257 are each rated at a total maximum dissipation of 12 watts when clamped to the chassis and will tolerate a temperature rise up to about 110deg F. to dissipate this heat power. ■

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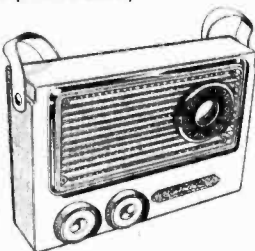
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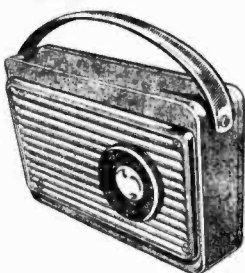
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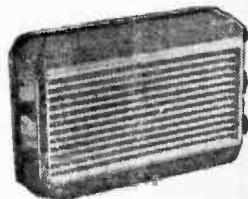
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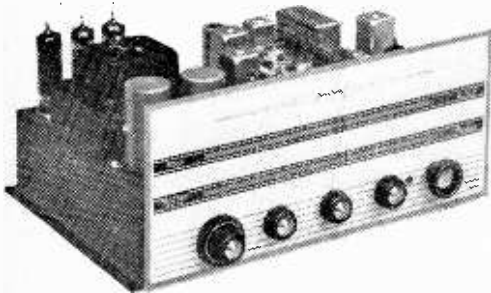


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Charger Transformers, 200-250 v. input:	
MT3AT, output 0.12-15-20-24-30 v. at 2 Amps.	25/6
MT2AT, as above at 4 amps.	38/-
MT1AAT, output 24 v. at 5 Amps.	38/6
Step-Down Transformers, auto wound, MT4/AT, 0.115-200-230-250 v., 150 watts each	25/6
P.P. 5/- each.	

Unless specified otherwise, please add 2/6 in £ for packing and postage, subject to a minimum of 1/6.

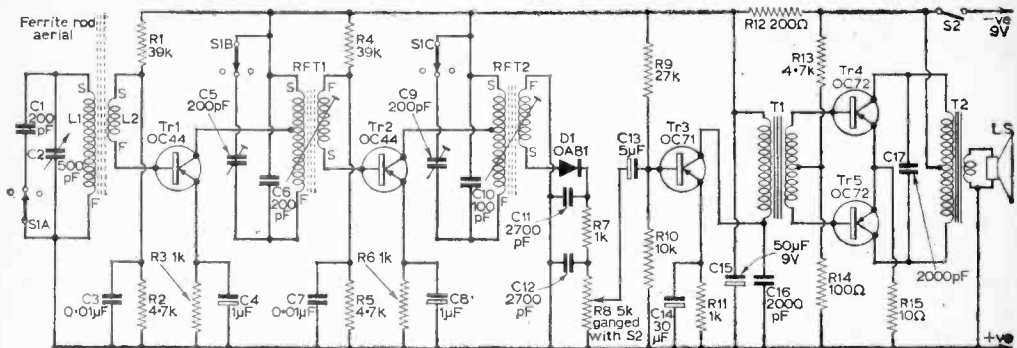


Fig. 1: The circuit.

# T.R.F. TRANSISTOR PORTABLE

A FIVE TRANSISTOR RECEIVER

By G. G. TURTON

**T**HE unit to be described is a five transistor portable receiver of high sensitivity which, compared with some other types of transistor portable, gives above-average quality of reproduction. Reaction is not employed, and two or three stations are pre-tuned and selected by means of a switch. Selectivity is good and there is a marked absence of background noise and interference.

The aerial coil is externally tuned and one section of the station selector switch merely shunts extra capacity across it, bringing it approximately to the frequency of the station selected. The external tuner is then used for final trimming, and is extremely useful for making adjustments under conditions of poor signal reception or when surrounding objects have a damping effect upon the aerial.

In the original receiver a 7in. by 4in. elliptical speaker was used in order to take full advantage of the reproduction available. H.T. is derived from 9V battery and total current consumption of the unit from 5 to 6mA under "no signal" conditions.

### The R.F. Amplifier and Detector

The R.F. section comprises two r.f. amplifiers and a diode detector. The diode used in the prototype was an OA81 but other types such as the OA71 are suitable. The transistors used were

OC44s but here again equivalents are suitable.

In order to provide tuning of the entire medium-wave band, the value of the variable capacitor or trimmer C2 must be 500pF and is adjusted externally. The values of the fixed capacitors C6 and C10 are 100pF and with S1 position one make it possible to tune the r.f. transformers, by adjusting their dust-cores, to the frequency of any station between 200 and 270m. With S1 in position two the trimmers C5 and C9 will extend the range to about 350m. The switch in this position also shunts the aerial coil with a fixed

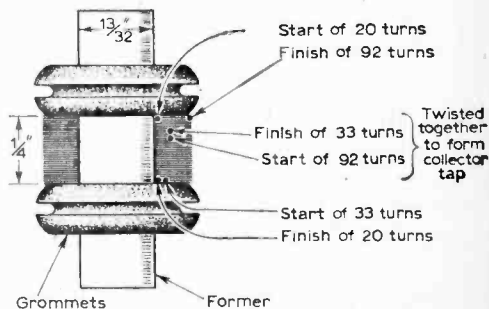


Fig. 2: Details of one of the r.f. transformers.



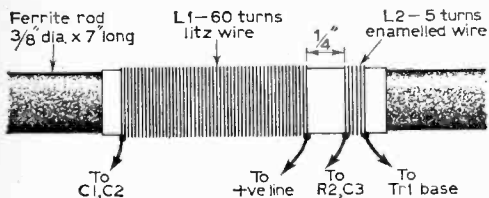


Fig. 3 (above): Details of the aerial.

capacitor C1. The values of these capacitors are 200pF.

With S1 in position three a further trimmer may be switched across each R.F. transformer primary and a fixed capacitor across the aerial coil in order to select a third station.

#### The A.F. Amplifier

The A.F. amplifier is a standard 200mW type using an OC71 as driver and a matched pair of OC72's in push-pull output. The constructor may wish to use another amplifier more suitable to the components he has available or in order to obtain greater output.

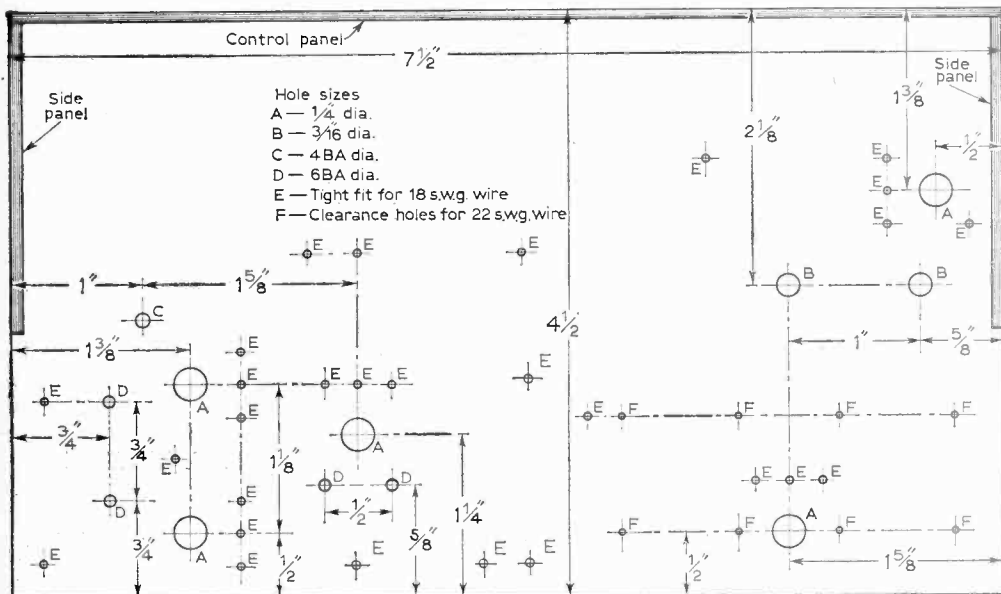
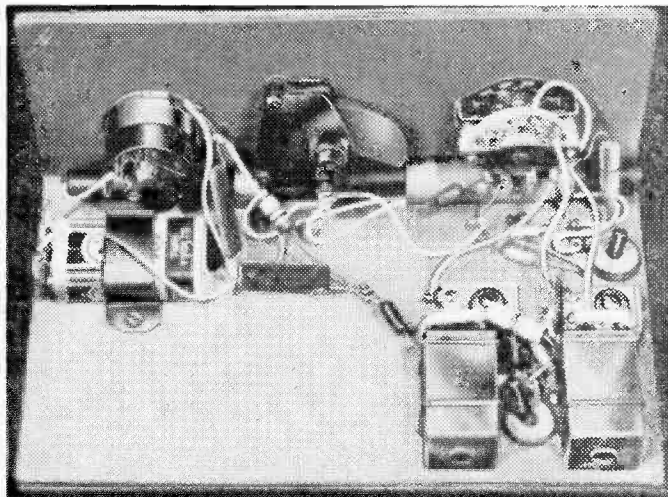


Fig. 4: The chassis drilling dimensions.



A rear view of the receiver.

There are several sets of matched driver and output transformers on the market, and supplied with some of these sets is a suggested circuit for their use. It is well to point out here that not all of the output transformers in these sets are suitable for matching to a standard  $3\Omega$  speaker and it is advisable to enquire on this matter when making any purchase.

If headphones or an ear-piece is used, the output stage may be omitted entirely, the three remaining transistors will provide more than adequate power. The r.f. stages alone make an admirable tuner unit for feeding into a high quality amplifier.

The values of coupling and decoupling capacitors in this

section are not critical. The decoupling capacitor across the h.t., that is, from the primary of the driver transformer to earth must be at least 50 $\mu$ F. In general it is best to keep the value of all these capacitors as high as possible.

**R.F. Transformers**

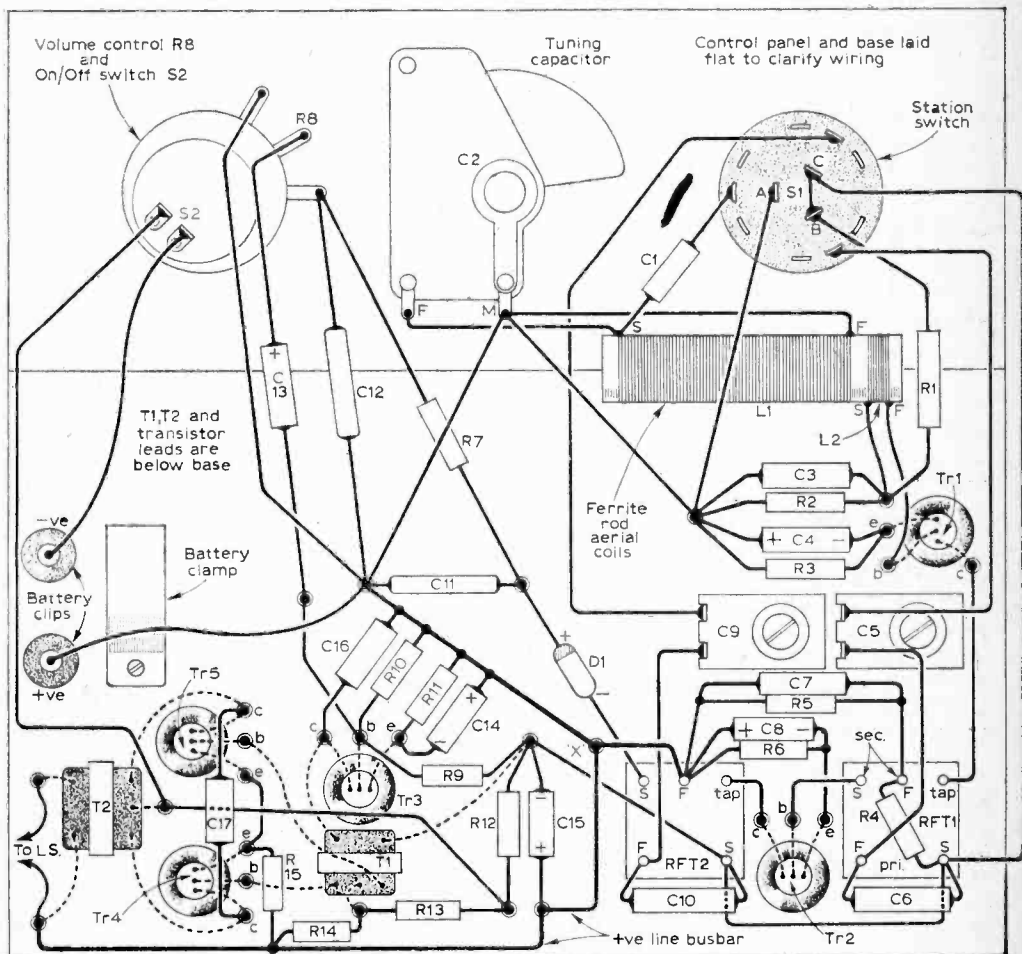
The r.f. transformer coils are home-wound on  $\frac{1}{8}$  in. dia. formers using 7/45 Litz wire. They must be fitted with variable dust-cores and screening cans. Standard i.f. formers and cans are ideal.

First a single layer of 20 turns is wound on to the former. This should be about  $\frac{1}{4}$  in. in length and spaced by grommets or other suitable spacers. Mark the ends of all windings "start" and "finish". Now wind on top of this first layer a further 33 turns forming another layer and the commencement of a third. Finally 92 turns are added in single layers remembering to wind all

coils in the same sense. The "finish" of the second coil of 33 turns and the "start" of the third coil of 92 turns must be twisted together to form the collector tap.

The entire operation requires less time than one may imagine and is quite simple to carry out, the only difficulty being the removal of the enamel insulation from the Litz wire. The following method, although not the speediest, is certain to ensure that all the strands are clean and undamaged.

The cotton or silk is removed from the wire and the strands played out fan shape. They are then drawn along fine flour paper until the copper appears through the enamel. The wire is then turned over and the treatment repeated until all the strands are clean. Finally the strands are counted to ensure all seven are intact, twisted together and tinned.



Transistors are secured through grommets mounted on base

Fig. 5: The wiring diagram.

All the coil ends are then soldered to the wire pillars fitted in the transformers, remembering to note pin connections before finally closing the screening can. The coils may be waxed or doped on completion to prevent damp entering.

#### Coils on Ferrite Rod

The aerial and coupling coils L1 and L2 are wound on to a  $\frac{3}{8}$  in. by 7 in. ferrite rod using 7/45 Litz wire for L1 and 40s.w.g. enamel covered wire for L2.

A paper tube is made to fit freely over the rod and on to this is wound 60 turns of Litz wire to form L1. The coupling coil L2 is five turns of 40s.w.g. spaced  $\frac{1}{4}$  in. from the aerial coil. Both windings are close-wound, and must slide easily on the paper tube along the ferrite rod in order to allow adjustment during alignment.

Before winding the coils it is advisable to insert two straight lengths of wire between the paper tube and the rod opposite each other. On completion of the coil these are removed and the coil will slide freely. For the wiring details of L1 and L2 see diagram.

#### Construction Suggestions

The chassis used in the prototype consisted of a paxolin base with an upright panel at one side for the mounting of controls. Holes are drilled where pins are required and small lengths of 16s.w.g. tinned copper wire are pushed through. Owing to the close proximity of the ferrite rod aerial to the upright panel, the material used for its construction must not be metal.

In order to reduce the overall thickness of the receiver case, the r.f.t. cans are laid on their sides and held secure to the chassis by lengths of 22s.w.g. wire which is passed through holes in the paxolin base and soldered. The thickness of the

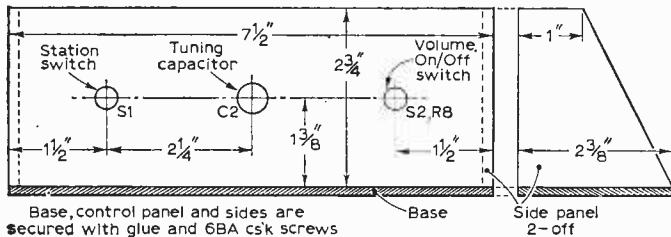


Fig. 6: The front and side panel dimensions.

finished case is finally decided upon by the depth of the loudspeaker magnet and the size of battery decided upon.

C6 and C10 are mounted directly on to the pins of the r.f. transformers and S1 is located at the r.f. end of the chassis in order to prevent instability due to r.f. leads being too long.

With the receiver standing on its base the controls appear at the top panel of the case.

#### Alignment

Firstly the stations required to be selected by S1 must be decided upon by the constructor. Of the stations required, the one situated at the lowest end of the medium-wave band should be

#### COMPONENTS LIST

##### Resistors (All $\frac{1}{4}$ W, 10%):

R1 39k $\Omega$	R3 1k $\Omega$	R5 4.7k $\Omega$
R2 4.7k $\Omega$	R4 39k $\Omega$	R6 1k $\Omega$
R7 1k $\Omega$	R8 5k $\Omega$ potentiometer with S2	R15 10 $\Omega$
R9 27k $\Omega$	R12 200 $\Omega$	
R10 10k $\Omega$	R13 4.7k $\Omega$	
R11 1k $\Omega$	R14 100 $\Omega$	

##### Capacitors:

C1 200pF	C4 1 $\mu$ F
C2 500pF tuning capacitor	C6 200pF
C3 0.01 $\mu$ F	C8 1 $\mu$ F
C5 200pF trimmer	C10 100pF
C7 0.01 $\mu$ F	C15 50 $\mu$ F 9V
C9 200pF trimmer	C16 0.002 $\mu$ F
C11 2700pF	C17 0.002 $\mu$ F
C12 2700pF	
C13 5 $\mu$ F	
C14 30 $\mu$ F	

##### Transistors:

Tr1 OC44	Tr4 OC72	} Matched pair
Tr2 OC44	Tr5 OC72	
Tr3 OC71		

**Coils and transformers:** see text. **Diode, D1,** OA81 or equivalent. **Switch, S1,** 3-pole, 3-way. **Ferrite rod,**  $\frac{3}{8}$  in. x 7 in.

aligned first. In the case of the original receiver this station was the BBC Light Programme.

A length of wire to form a temporary aerial is connected via a capacitor to the top end of the aerial coil L1 and C2 is set to near its minimum capacitance, or to approximately 100pF. With S1 switched to position one and the r.f.t. dust-core at mid-position, it may be possible to receive the Light Programme.

The coils L1 and L2 must be situated near one end of the ferrite rod with the base coupling coil L2 on the inside. They may now require some adjustment by sliding them along the ferrite rod. If the station is not yet audible or the gain is low, slowly turn the core of RFT2 until results are achieved. RFT1 is then adjusted and C2 turned for maximum gain.

The whole process is repeated with the temporary aerial removed, until further improvement is not possible. Owing to the directional quality of ferrite rod aeriels the receiver must be rotated for best results, on each station tuned.

S1 is then switched to position two and the trimmers C5 and C9 treated in a similar manner to that of the RFT cores in order to select the second station required. C2 is permanently variable and may need some adjustment but the cores of the r.f. transformers must not be moved after selection of the first station. Coils L1 and L2 are finally adjusted for best results on both stations and then permanently fixed. ■

# An Advanced GEIGER HEAD

By E. DEXTER

(Continued from page 730 of the December issue)

**T**HE radioactivity of substances present in rainfall is principally of a completely different kind, because much lighter elements are involved. The emission again contains gamma-rays, the second component being mainly beta-rays, which are simply electrons hurled out of the atoms with an effective energy of several million volts.

The MX124/01 probably responds to both these components, so one would expect a much higher sensitivity in theory. But in practice this is not so, because of a number of other complicated factors, so that the effective sensitivity for this type of radioactive substance is much less.

Using a test-sample prepared from London snow, and making comparative measurements with this in the MX124/01 and in the author's calibrated standard Geiger-Head, it was found that one count per minute with the head described in this article corresponded to some 50 to 100pC of rainfall-type substances present in the 8 c.c. contents, representing a sensitivity some five to ten times poorer than for thorium and uranium types.

As a matter of interest, the test sample mentioned was prepared from  $\frac{1}{2}$  of a pint of melted London snow from the fall in the winter of 1961/2, using the procedure described in the "Digital Counter" articles, and making the final volume 8 c.c. to suit the MX124/01.

The counting-rate increase observed was about nine per minute, representing an absolute activity in the region of 1,000pC per pint in the original snow, which is quite high! On the other hand, measurements on rainfall on the Continent some days later showed only about a quarter of this activity, whereas even higher values were observed in rainfall early in December 1961.

Conditions fluctuate greatly, therefore, and can be studied in detail with the head described here. If samples are prepared from a quart or two of original water, large signals are easily obtained, needing only some 30 to 60 minutes counting for an accuracy of 10%. Even tap water gives appreciable signals when treated in this way, values of 100 or 200pC per quart having been measured in some samples.

## Rapid Counting

The head here described can be operated up to many hundreds of counts per second. For such cases the output may be connected direct to the "Direct-Reading Audio Frequency-Meter" (March, 1962) adjusting the preamplifier gain for maximum and stable reading on the meter (which

will still fluctuate at the statistical distribution rate of the pulses).

A solution of thorium nitrate containing some 3 to 4 grams of the substance in 8 c.c. gave a reading of about 200c/s on the 0 to 500c/s range. Multiplication of the meter reading in c/s by about 80 will give the activity in pC contained in the fill of the Geiger-Tube. A solution of uranium nitrate containing 1 gram of the substance in the 8 c.c. fill gave a meter reading of about 300c/s.

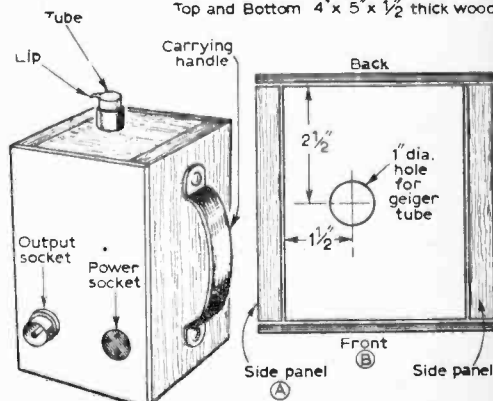
Curiously enough, if these pulses are amplified and passed to a loudspeaker, no 300c/s note is distinguishable, the sound is merely a crackling hiss, because of the random sequence of the pulses in spite of a more or less definite average frequency.

If this unit is intended for anything but very occasional rapid counting, it would be advisable, in the interests of good tube life, to pay further attention still to keeping the stray tube capacities, and consequently C1, down to the smallest possible values.

## Decontamination

After completing rapid-counting experiments with the prototype, and rinsing three times as usual, the count refused to return to the normal

Cabinet dimensions: Sides 8" x 5" x  $\frac{1}{2}$ " thick wood  
Front and Back 8" x 5" x  $\frac{3}{16}$ " plywood  
Top and Bottom 4" x 5" x  $\frac{1}{2}$ " thick wood



Fix cabinet together with brass countersunk screws, then rasp and sandpaper flush. Re-open cabinet, insert geiger tube and build up wiring on base and panels (A) and (B). Do not make cabinet smaller, in spite of ample room, to avoid internal build-up of heat from EC92 which could damage geiger tube.

Fig. 3 (a): The construction of the cabinet.

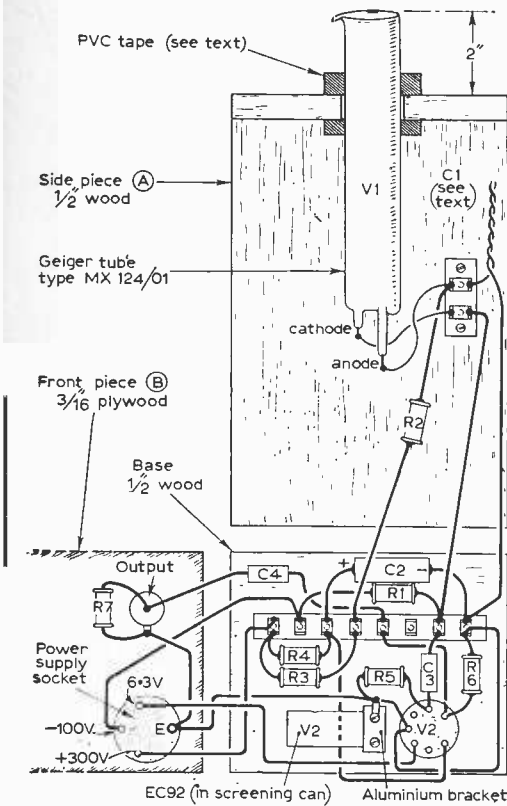


Fig. 3 (b): The component layout and wiring diagram.

(approx.) 40 per minute background, remaining at over 100 per minute, however much washing or soaking with pure water was undertaken.

A cure was effected by using dilute nitric acid as cleansing agent (one part acid to four of water). After three separate quarter-hour soaks with a fill of this acid, with threefold-rinsing in between each, the count returned to the normal background of about 40 per minute.

This form of contamination was clearly due to small precipitates of basic oxides, etc. forming a film on the inner tube, insoluble in water but soluble in nitric acid. To avoid such contamination right from the start, all liquids to be tested should be made strongly acid with at least 25% of the above-mentioned dilute nitric acid.

After completion of measurements, particularly if these involved rapid counting, a check should be made of the background count. If this is not normal, the above decontamination-procedure should be used. If this is not done immediately, and the contaminated tube is left standing even overnight, the deposits may harden and become impossible to remove even by the procedure outlined.

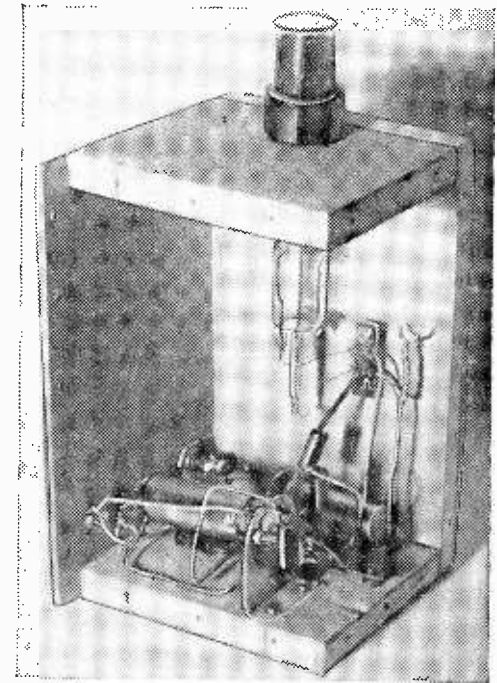
Whilst not rendering the tube fully useless, this will nevertheless reduce accuracy greatly, on account of the permanent worsening of the signal-to-noise ratio.

It is desirable to purchase the nitric acid ready-

diluted with four parts of water, as this is then much less dangerous than the concentrated acid. Nevertheless, due respect and care is needed, as even the dilute acid is highly corrosive.

Prolonged experiments with this apparatus revealed the extreme importance of these considerations, which the author feels to be of far greater impact, for the purposes here intended, than the electronic error-sources connected with dead-time, plateau-slope, capacitive loading, etc. Whilst never having had any trouble from such electronic questions, over thousands of operating hours, the contamination question needed repeated attention, even for normal slow counting experiments, as progressing experiments soon revealed.

Some prolonged experiments were undertaken regarding the initial very high activity levels of fresh rain, lasting only a few hours or much less, so that no time was available for concentrating a sample or suitably acidifying it. The average



Inside the completed instrument.

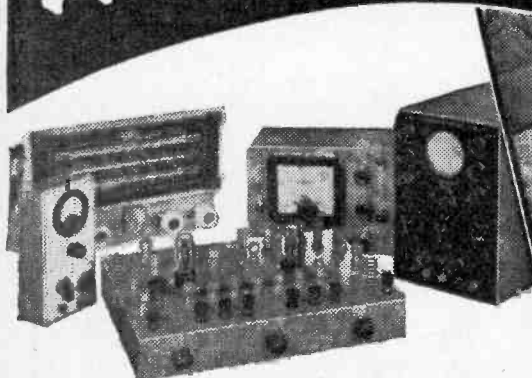
count-increases thus measured from these effects, by filling the untreated rain direct into the head, amounted to some 10% or more increase of the background-count or more at the initial peak, and often remained unchanged present if the water was any appreciable length of time in the Geiger-Tube and then poured out.

This meant that virtually all the active material in the rain was absorbed out on to the glass of the tube. There it remained, and no amount of swilling with distilled water would remove it appreciably, yet a fill of dilute nitric acid removed it entirely within a few minutes in all cases.

Furthermore, samples acidified strongly with nitric acid in the manner described have never as

(Continued on page 815)

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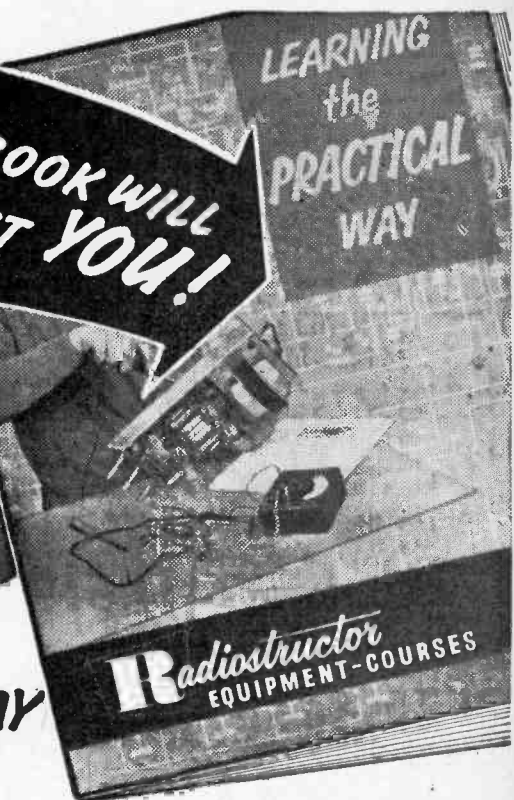
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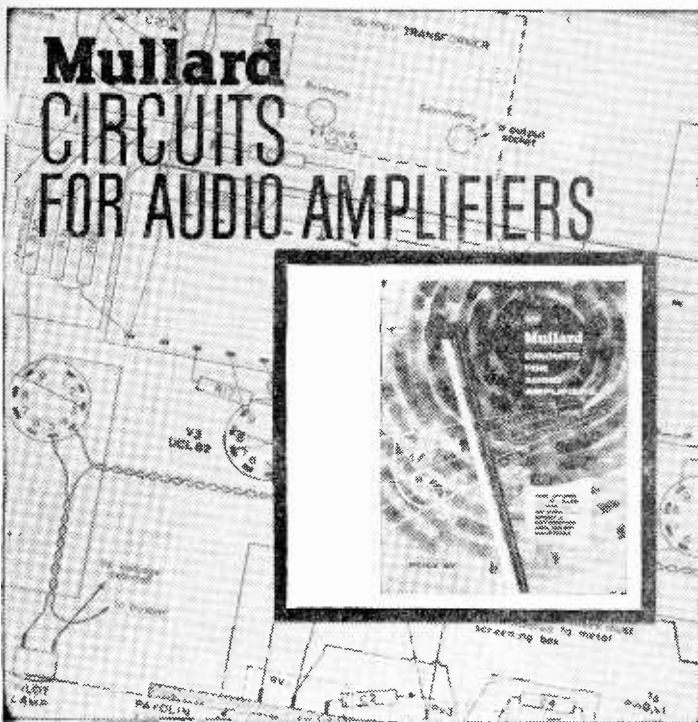
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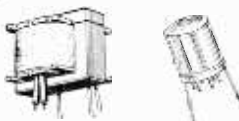
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(Continued from page 812)

yet been observed to give rise to this contamination effect. The basic principle behind this demand for the generous use of nitric acid is that virtually all nitrates are highly soluble bodies in water, and thus nitric acid strongly hinders mineral deposits on glass.

Regarding the course of these short-life peaks of activity, they are connected with natural radium and thorium emanation present in normal air, rain washing down portions of this or products thereof. The effect probably has nothing to do with atomic bombs or any other man-made devices, being a purely natural phenomenon.

Out of numerous experiments conducted by the author in past months, none failed to show an initial high activity peak in rains, snows, etc. This always seems to be present, whatever time of day rain fell, whatever the quantity of rain, etc. Peaks, some 20-100 times as powerful as the strongest atomic bomb fallout recorded at the author's station are always present in the initial half hour after rainfall, in the water.

**Registration**

The output of this Geiger-Head Unit is designed for use with author's Digital Counter described in February. This combination is suitable for counting rates up to at least 100 or 200 per minute, which is adequate for measurements with rainfall samples.

Much faster counting rates are achieved when solutions of thorium or uranium salts are filled into the Geiger-Tube, and in such cases the *Direct-Reading Audio-Frequency Meter* (PRACTICAL WIRELESS March 1962) forms an excellent registration-unit. The meter on this unit, reading cycles/second, gives pulses-per-second direct. It will be found that, for stable triggering, the pre-amplifier gain on the unit should be set about midway.

Amateur constructors will almost certainly be unable to obtain, or have difficulty in obtaining, uranium and thorium salts, and may indeed have difficulty in obtaining a Geiger-Tube of the specified type. But schools, clubs and institutions should normally have no difficulty, so that there is certain to be a sufficiently large circle of people actually able to put the subject of this article into practice.

The possibilities of educational work in radioactive tracer-chemistry analysis, using thorium and uranium salts in the apparatus described, are suggested to keen Sixth Forms and their teachers. Some quantitative details of the signals obtained in such experiments with the author's prototype are given below, as well as other relevant data on the sensitivity and use of the unit.

**Construction and Layout**

Fig. 3b shows the wiring and layout diagram. It is advisable to keep strictly to this arrangement which gives good results in the prototype. The whole unit is about the size and shape of a tall coffee-pot.

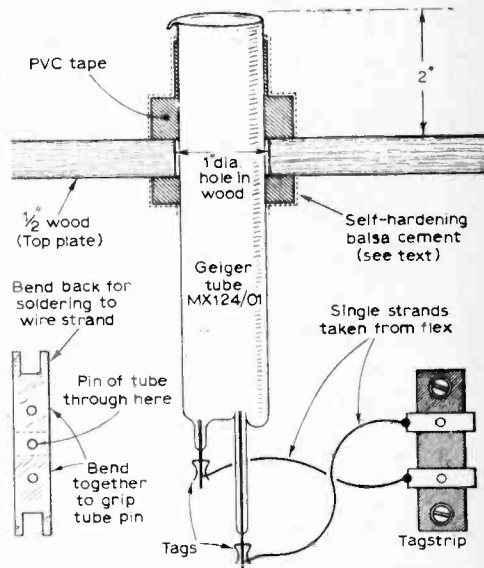
A handle is fixed at one side, and the protruding spout of the Geiger-Tube is arranged to be at the top front, so that pouring-operations are possible in the same way as with a coffee-pot. It is merely necessary to remove the power and output

plugs from the side to free the unit for filling and emptying of test-liquids. Note particularly the arrangement of C1 in Fig. 3b.

**Geiger-Tube Mounting**

The Geiger-Tube is extremely fragile, and must have a resilient but firm mounting. The author found the arrangement sketched in Fig. 4 to be very satisfactory. A hole of 1in. diameter is drilled in the front of the top-piece of the case, as shown, and the Geiger-Tube then fixed in a position such that about 2in. protrude at the top, using a pile of P.V.C.-adhesive tape wound on to the tube each side of the hole through the case, to a greater diameter than the hole.

The P.V.C.-Tape is smooth plastic one side, and



Solder wires to tags before pushing on to geiger tube pins  
 Fig. 4: The Geiger-Tube mounting details and connections.

adhesive on the other, making a neat job with very high insulation. Ordinary insulating tape could be used, but is likely to be messy. The wound-on P.V.C.-Tape piles alone would creep with time and the Geiger Tube gradually falls into the case. To avoid this, and to make a really neat finish, the tape-windings are coated with a self-hardening transparent mass of the "Uhu-Plus" type. This is purchasable in packages containing two tubes, a binder and a hardener.

Equal quantities are mixed before use, and painted on with a nail or matchstick. The mass runs smoothly within a few minutes and dries hard in about 10 to 30 hours. The coating should run from the glass of the tube, over the P.V.C.-Tape, and on to the wood of the case.

**Connections to Tube**

The normal method of connection intended by the manufacturers for industrial use of the tube is to arrange for the two protruding pins to dip

(Continued on page 819)

# Crystal controlled Top band 'phone Transmitter

By F. G. RAYER

**I**N the 1-8-2Mc/s band, transmitter power is limited to 10W, so the equipment used is quite small, and no large or high voltage power pack is required. Many top band transmitters can, in fact, be run from a receiver type power pack.

If crystal control is employed, the circuits are even more simplified, and working with one or two crystals is feasible. Crystal control does, of course, provide excellent frequency stability, and avoids the difficulties associated with a variable frequency oscillator. The main disadvantage of crystal control lies in the fact that the transmitter

can only be used on frequencies for which crystals are available. It is, however, possible to build a V.F.O., to replace the crystal, at a later date.

The circuits described here have been found to give good results, and are intended for speech transmission. They may be used for C.W. by keying the R.F. section in any usual way. The range obtained naturally depends upon conditions, type of aerial, etc., and is about usual for this type of equipment. That is, generally up to a range of several hundred miles, with 10W. Very much longer distances are sometimes covered.

## Modulated Oscillator

A crystal controlled oscillator can be modulated

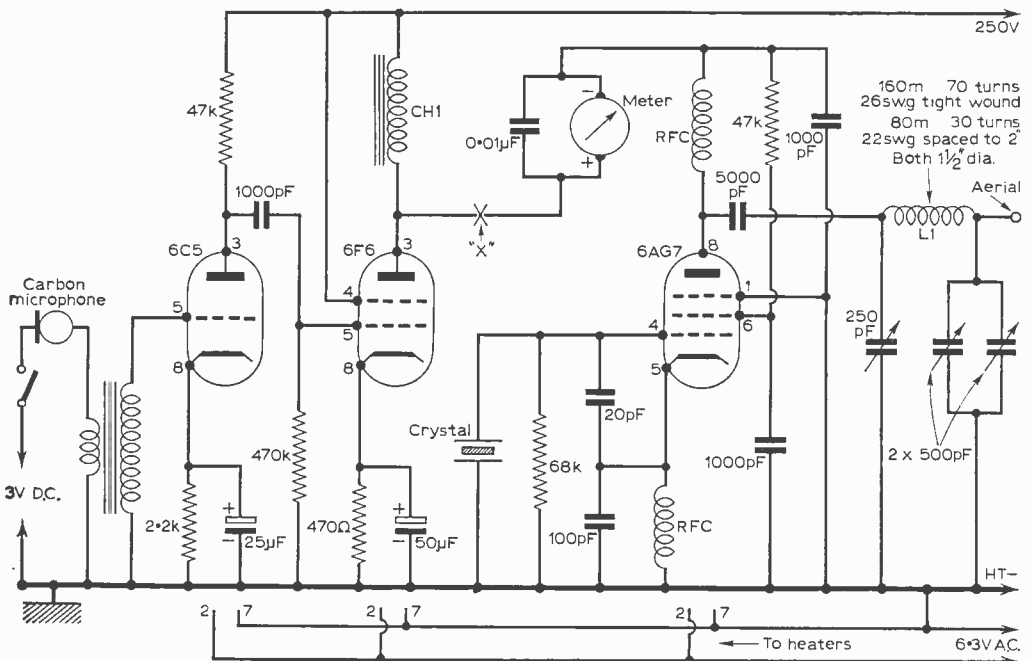


Fig. 1: Circuit diagram of the three-valve speech transmitter.

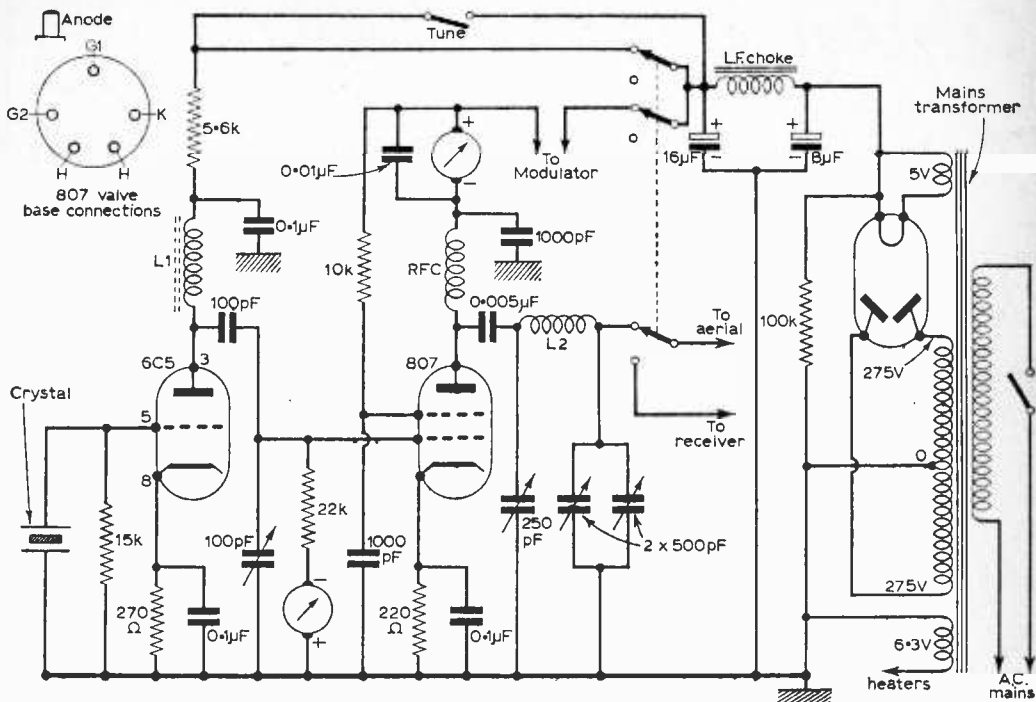


Fig. 2: Two-stage transmitter with switching and power pack.

quite deeply, and the circuit in Fig. 1 shows a complete speech transmitter using only three valves. The 6C5 and 6F6 form the speech amplifier, and many other valves of somewhat similar type may be used here. Surplus carbon microphones vary considerably in sensitivity and if this is too great the microphone battery voltage can be reduced. If a crystal type is preferred, the double-triode stage in Fig. 4 may replace the 6C5.

The 6AG7 is the crystal oscillator, with a pi output circuit to permit loading into almost any aerial. The anode tuning capacitor may be 150pF to 300pF, while the aerial loading capacitor is a two-gang or three-gang 500pF component, with sections in parallel.

The aerial loading capacitor is initially closed, and the anode tuning capacitor is adjusted until the meter shows a dip in current. If the current shown by the meter is too low, the aerial loading capacitor is opened, the anode tuning meanwhile being re-adjusted for minimum current.

This is continued until the meter shows the required current. The crystal oscillator should not be too heavily loaded. With a 250V anode voltage, 20mA will be 5W input, which is about the maximum recommended for this circuit.

The transmitter can be tested by wiring a lamp from the aerial terminal to chassis, and loading into this, as if into an aerial. Speech should sound clear and reasonably modulated. A carbon microphone and transformer of efficient type may easily overload the modulator, so the microphone should be kept at a reasonable distance. Gain can be reduced, if necessary, by removing the 25µF bias capacitor, or fitting a 500kΩ volume control.

**Two-stage Transmitter**

The two-stage transmitter in Fig. 2 will easily load up to the full 10W input, and can be fully modulated. The 6C5 is a simple crystal oscillator. A small medium wave coil with adjustable core can be arranged to cover 1.8-2Mc/s, the 100pF capacitor being used for tuning.

Tuning with this capacitor is adjusted until the grid meter shows between 2-4mA, corresponding to 40-80V bias developed across the 20kΩ grid resistor. Tuning should be slightly off resonance in the usual way, so that the crystal oscillator starts when switched on.

For aerial loading and tuning, the pi output circuit is the same as in Fig. 1. The actual anode voltage of the 807 will depend on voltage drop in the power pack smoothing choke, etc., but should be around 250V. At this voltage, loading the 807 until it draws 40mA will give an input of 10W.

In practice, signal strength reports are about the same if loading is to only 8W or 9W so exact adjustment is not needed. The input must not exceed 10W, unless the transmitter is used on the 3.5Mc/s or other bands, as mentioned later.

**Cathode Bias**

Some cathode bias is provided for each stage and this keeps the H.T. current to a safe level if the crystal stage does not oscillate, due to wrong tuning or any other fault. Initially, the "Tune" switch is closed, and the grid circuit tuned to produce 2mA to 4mA grid current, as described. This also allows the frequency to be found on a

receiver before transmitting. The "Tune" switch is left open when operating.

Send/Receive switching is incorporated. With the switch in one position, both stages are on, and the transmitter output is taken to the aerial. With the switch in the receive position, the aerial is taken to the receiver, and the transmitter is switched off. No external relay or similar arrangement need be used.

The circuit will give reasonable results with the modulator in Fig. 1, but near 100% modulation cannot be obtained with this modulator. Quite good modulation will be achieved if the 807 is loaded to some 5W or 6W input.

The advantage of the Class A modulator, in Fig. 1, is its simplicity, and the fact that over-modulation is practically impossible when using it. Attempts to increase modulation too far will simply cause speech distortion.

To secure deep modulation with the simple Class A modulator, a capacitor and resistor may be wired in parallel, and included at the point "X" in Fig. 1. (This should not be done when modulating the crystal oscillator.) The capacitor can be  $1\mu\text{F}$  to  $4\mu\text{F}$  and the resistor may be about  $1\text{k}\Omega$   $2\text{W}$  or such a value as will permit nearly 100% modulation, with the 807 loaded to the required input.

### Harmonic Oscillator

If the 6C5 is replaced by a harmonic type oscillator, output may be obtained at multiples of the crystal frequency. The transmitter can then be used on other bands.

An oscillator of this type is shown in Fig. 3. The anode circuit can be tuned to the same frequency as the crystal, or to multiples of this frequency. In Fig. 3, a two-way switch allows working on 160 or 80m bands, with crystals having a fundamental frequency in the 160m band.

When doubling frequency, the crystals must be chosen to allow operation in the higher frequency band. For example, a 1850kc/s crystal would give operating frequencies of 1850kc/s and 3.7Mc/s. But a 1950kc/s crystal would do for top band only, as its harmonic would be 3.9Mc/s, which is outside the 3.5-3.8Mc/s band.

Small, dust cored coils may conveniently be used, as they can easily be adjusted to give coverage of the required bands, with the 100pF tuning capacitor. It is also possible to use a trimmer across one or both coils, setting this when first testing the equipment. The 807 grid current meter will show correct tuning, and indicate whether the 6AG7 anode coils are satisfactory for the bands required.

If preferred, the 20pF capacitor can be replaced by a 30pF trimmer. This allows adjustment of the oscillator, which may be helpful with doubtful surplus crystals, or crystals which have been ground by hand. The remainder of the circuit is the same as shown in Fig. 2.

When working in the 80m band, the 10W limit does not apply, so the anode current can be increased. An input of 20W or 30W can easily be achieved, with a higher H.T. voltage, but with the lower voltage supply the anode current is best kept down to about 70mA, or about 17W input. At this input, R.F. output should be sufficient to light a 15W domestic lamp well. Input may be increased

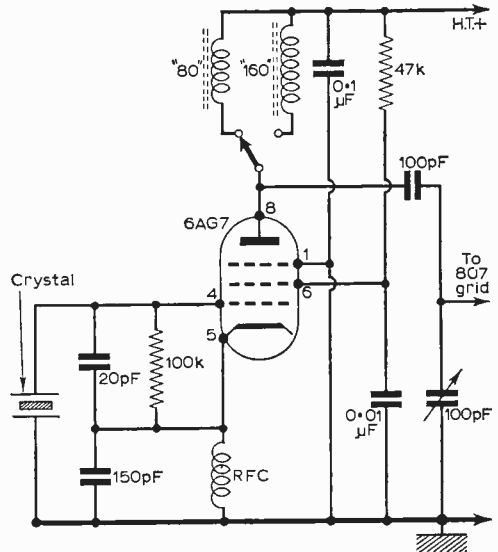


Fig. 3: Oscillator with output on fundamental and harmonics.

slightly by omitting the  $220\Omega$  resistor and  $0.1\mu\text{F}$  by-pass capacitor, taking the cathode of the 807 to chassis.

It is then essential to obtain some 2mA or so grid current, before switching on the 807 anode and screen grid circuit. The pi circuit should also be tuned quickly to resonance, as very heavy anode current will soon damage the valve.

### Push-Pull Modulator

For 100% modulation, the modulator must deliver about one-half the power input of the 807. For example, if the 807 is loaded to 10W input, a 5W modulator will suffice. This means that many quite small amplifiers can be used successfully as modulators. A 10W amplifier, for example, would do well for P.A. inputs of up to 20W or so.

Fig. 4 shows a suitable modulator of straightforward design, and intended for top band use, or where the P.A. input is not much over 10W. If the crystal microphone does not give much output, and a little more gain is required, a  $25\mu\text{F}$  bias capacitor may be shunted across the  $1.5\text{k}\Omega$  resistor.

There is no particular reason for choosing 12A6 valves for the output stage, except that these are available cheaply in some surplus equipment, with transformers to suit. They require a 12-6V heater supply. Other valves are perfectly satisfactory, such as the 6V6, 6BW6, etc.

Audio amplifiers intended for other purposes will generally have a phase-splitter valve, instead of the centre-tapped driver transformer. The use of such a stage, instead of the transformer, is perfectly satisfactory.

For maximum efficiency, the modulation transformer ratio is chosen to suit the push-pull output stage, and P.A. input. The ratio is chosen in exactly the same way as for a speaker matching

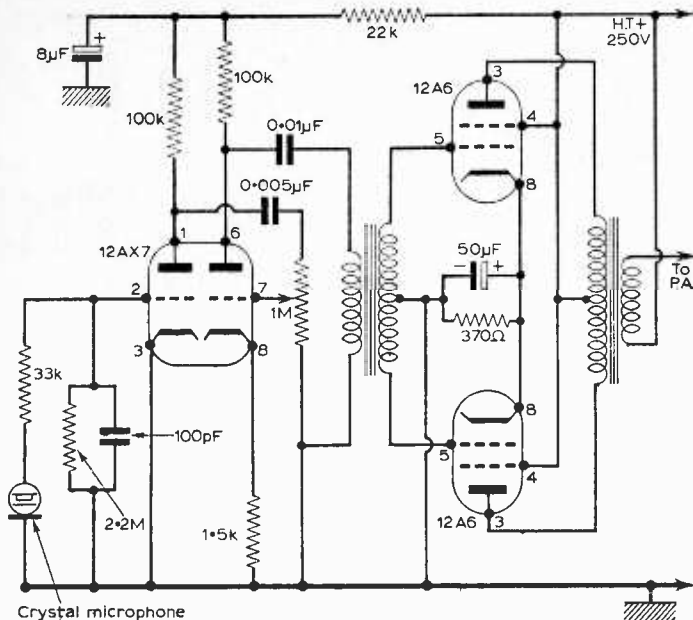


Fig. 4: Circuit of Class B modulator.

transformer, except that the P.A. will offer a much higher impedance load than does a speaker.

The modulating impedance of the P.A. can be found from:

$$Z = \frac{\text{P.A. H.T. voltage}}{\text{P.A. current (mA)}} \times 1000.$$

Assuming that the P.A. draws 40mA at 250V, the impedance will be approximately 6200Ω.

The optimum load of the output stage of the modulator depends on the valves and H.T. voltage. The figure is listed by valve makers. For example, it is 8,000Ω. for a pair of 6V6's, in Class AB1, with 285V. The transformer ratio is found in the usual way:

$$\text{Ratio: } \sqrt{\frac{\text{Optimum load}}{\text{Impedance of load}}}$$

The ratio is thus approximately 1:14:1, in the example. Multi-tap modulation transformers can be obtained, and will allow matching between modulator and P.A. to be easily adjusted. Good results can be obtained without the exact ratio, and results are usually satisfactory even if the P.A. is not loaded to exactly the input for which the modulation transformer ratio was intended. This allows surplus transformers be used with success, if the matching is reasonably good.

**Power Pack**

If a receiver has a generously designed power pack, this can supply enough current for a top band transmitter and modulator. It would then be necessary to switch the power pack from receiver to transmitter by disconnecting the circuit at the

smoothing choke. Heater current for the transmitter should be obtained from a small separate heater transformer, as the heaters are left on.

If a power pack is to be constructed, the circuit can be as shown in Fig. 2. A 5Z4 will provide up to 125mA. This valve has a 5V 2A heater. The 5V4 and 5U4 will supply 175mA and 225mA, if needed, and the latter has a 5V 3A heater. A bleeder resistor (100kΩ in Fig. 2) should be fitted, to discharge the capacitors.

The voltage obtained from the power pack is not very important for top band, and a 250V or 350V secondary can be used. But if a larger input is required, for other bands, a 350V or 450V h.t. supply may be used.

**AN ADVANCED GEIGER HEAD**

(Continued from page 815)

into suitably-placed mercury cups in the industrial holder. The author considers this arrangement to be unsuitable for general amateur and school use, for several reasons.

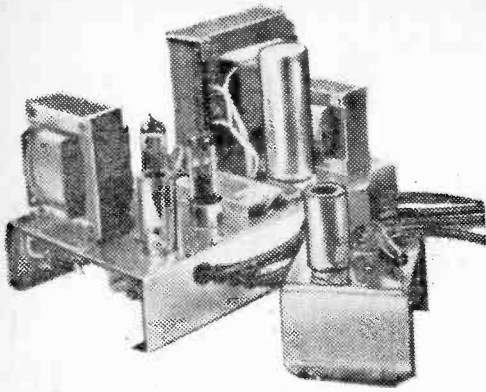
Firstly, it would mean removal of the bare tube alone each time for filling and emptying or cleaning, with consequent increased repeated danger of breakage each time. A permanent fixture arrangement, where the delicate parts of the tube are exposed only during initial construction of the unit, is considered to be more suitable for amateur use, and has been adopted here.

Secondly, mercury is far more dangerous than many people believe, and thus undesirable for amateur use. Small balls of spilled mercury lodged in crevices in floorboards of a badly ventilated room can cause mental defects, blindness, etc., over a period of many years to a constant occupier of such a room.

The method of making connections to the tube shown in Fig. 4, should be adopted. The author used solder-tag inserts from the type of tagstrip with removable inserts. These, when bent together, form very secure clips for pushing on to the tube wires, the central holes being of the correct diameter.

Prior to pushing these clips on to the tube wires, a single thin strand of bare wire from a piece of flex is soldered on to each clip, and wired to the nearby tagstrip, from which then ordinary connecting wires proceed to the rest of the circuitry. This arrangement very effectively removes all strain from the tube which would otherwise result from the connecting wires.





# Quality A and

THE FIRST TWO UNITS OF A  
COMPLETE HI-FI SWITCH-TUN

This series of articles will describe a switch-tuned a.m.-f.m. sensitivity and stability, high-fidelity reproduction and large reserve. If required, the audio-amplifier can provide sufficient power to 6 speakers distributed throughout a small dance-hall, at high volume.

**T**HE equipment incorporates a power pack and audio-amplifier chassis together with its "flying-panel" containing all controls and connections. Apart from constituting a three-stage 15W push-pull amplifier (200mV r.m.s. sensitivity for full output) with all power supplies, this chassis also provides three independent and highly-smoothed h.t. outputs of 150 to 200V on 25mA loading each, and a heater output at 6.3V 4A. These outputs can feed tuner, tape-deck circuits and/or preamplifiers. The Radio/Gram switch on the flying-panel switches all these h.t. and l.t. supplies "on" in the "radio" position and "off" in the "gram" position. On the same switch another wafer switches a mains supply for a gramophone or tape-deck motor. The unit may thus certainly be used in conjunction with other apparatus than the particular tuner and record-reproducer to be described and can be built by itself as a general-purpose amplifier and power pack.

The four-station switch-tuned M.W.-L.W. tuner is of very high sensitivity and also has a continuously-tunable v.h.f.-f.m. band with automatic frequency regulation. Emphasis on the a.m. section is on high gain, permitting powerful a.g.c. This tuner may if required be built alone for use in conjunction with other existing apparatus. While the gain of the amplifier alone is certainly ample for high-level pick-ups, such as crystal types, it is not quite sufficient for most high-class types which give a much lower output voltage under true high-fidelity conditions. Thus the final stage of the tuner chassis is also used as audio-preamplifier for the specified record reproducer chassis (Collaro Studio TX88). This pick-up gives an output of some 100 to 125mV, which would only load the amplifier to some 3 to 5W output without a pre-amplifier. While this would be ample for normal room listening it does not exploit the full capabilities of the amplifier. Thus, constructors build-

ing the amplifier and power pack chassis alone should provide a suitable preamplifier, or use a slightly lower quality pick-up unit of at least 250mV output.

#### Final Assembly of Radiogram

There are some excellent reasons for separating the equipment into two chassis, instead of using a single larger chassis. The least important (technically speaking), yet mechanically very useful, is the benefit of greater latitude in disposition of components, which gives a greater choice of cabinet type and shape.

A high power audio amplifier and a power pack both produce heavy surges of current at low frequency, contain large iron-cored components with stray magnetic fields, and components which

Load	Max. power	Corresponding to
2.5Ω	10.5 W	A pair of 5Ω speakers in parallel, receiving about 5 W each
5Ω	13.2 W	A single 5Ω speaker receiving about 13 W
7.5Ω	14.2 W	A pair of 15Ω speakers in parallel receiving about 7 W each (Optimum)
15Ω	10.1 W	A single 15Ω speaker receiving about 10 W

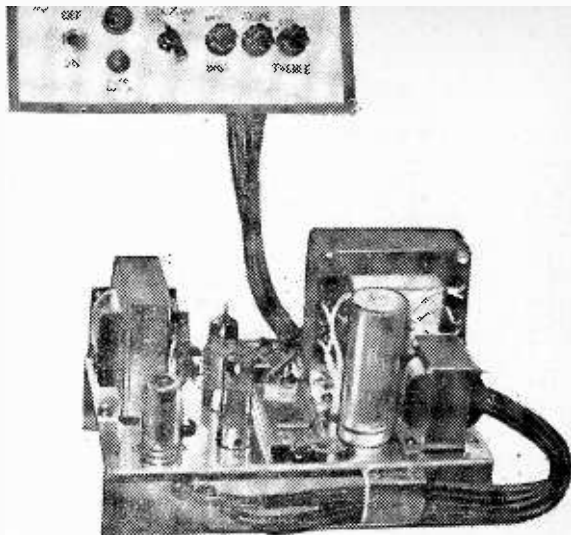
Measurements made at 50 c/s, 1 kc/s and 5 kc/s showed no significant differences. Saturation current into a.c. ammeter across output transformer secondary, amplifier over-driven hard at 50 c/s mains frequency: 2 amps.

Table 1: Power output for 1.5% distortion, measured with an oscilloscope on the prototype, using load resistances of stated values on specified output transformer secondary.

# Amplifier Pre-amp

## RADIOGRAM

Diagram of high  
power output pre-amp  
for several loud-



by A. Cole

get very hot indeed. Also, such equipment is very heavy.

The best position for such equipment is with the chassis standing horizontally on the floor of a much larger cabinet. The weight is then properly carried, and heat can be dissipated by strong upward convection currents. Valves can be mounted upright, which is always the best orientation of valves which get very hot during operation.

A tuner is concerned with low-current high-frequency signals, normally produces only moderate or little heat in its components, and is mechanically quite light. It is thus of advantage to mount a tuner chassis upright, with the valves horizontal and accessible through the rear of the cabinet, thus enabling controls to be situated inside the top of the cabinet, where they are more conveniently operated than at the front bottom of the cabinet.

The weight of a tuner chassis, once the power supply and audio-amplifier is removed, is small enough for hanging the chassis in this fashion, whereas this would give considerable mechanical complications if the heavy transformers were on the same chassis. For an audio-amplifier it is easy to mount all controls on a small "flying-panel" connected to the main amplifier chassis by almost any reasonable length of cables required.

It is thus ideal to build a high-quality radiogram in four portions. Firstly, the main amplifier and power pack chassis, standing well clear and secure on the floor of the large cabinet space. This can be immediately below the gramophone mechanism forming the second item. The third item is the flying control panel for the amplifier and power pack, which can be mounted at any convenient position on the horizontal inside-top panel of the cabinet. Finally, the tuner chassis, slung vertically with the controls projecting upwards through the inside-top panel of the cabinet.

### Loudspeakers

Measurements made on the completed proto-

type amplifier chassis, given in Table 1, show that the output is reasonably tolerant of loudspeaker impedances, giving reasonable performance with virtually any speaker combination. The optimum load specified is  $7.5\Omega$ , yet available power losses are less than a third, even when using gross mismatches.

It is recommended that a pair of WB Stentorian HF1016 units be obtained, and connected to the two pairs of output terminals provided, which automatically place the two loudspeakers in parallel. The Stentorian has a universal speech coil, which should be wired for  $15\Omega$  on both units. Take care to phase both loudspeakers correctly relative to each other, so that the cones move in sympathy. This is achieved in identical speakers simply by wiring them in a precisely identical fashion.

### Purpose of two loudspeakers

The purpose of designing for two loudspeakers is to obtain a greater "dimension and body" for the reproduction. One loudspeaker is mounted in the main cabinet, and the other in a separate housing placed a good distance away within the same room. The listener should have both loudspeakers in front of him, the relative positions being roughly those of a good stereo installation.

It is advantageous to make the acoustic characteristics of the main cabinet and the second loudspeaker cabinet rather different. The same cabinet air volumes should be used, but completely different dimensions: i.e., the second loudspeaker cabinet is of the bass reflex type, but the main radiogram cabinet is conventional.

Such a two-loudspeaker installation on a mono channel is able to run at much higher volume without discomfort to the listener, giving a great dimension to the sound, more in keeping with the

Continued over page

true characteristics of an orchestra. Furthermore, for a given power fed into such a system, the apparent subjective volume observed by the listener is considerably greater than for the same total power fed into a single loudspeaker—when properly dimensioned and adjusted.

Under good conditions, such an installation can give a performance on a mono channel closely approaching the performance of a cheap stereo outfit, as far as the "dimension" is concerned. The musical expert, of course, will not be fooled by this but it will certainly separate instruments which have different character, and many musical laymen will be unable to tell the difference between this and true stereo. Furthermore, the constructor can later duplicate the amplifier and run true stereo.

**Power Pack and A.F. Chassis**

Fig. 1 shows the complete theoretical circuit of this chassis and its flying control panel. The circuit is reasonably conventional apart from some unusual features in the power supply.

**Amplifier Circuit**

V1a, half an ECC83, is used as a simple straight-forward voltage amplifier with a gain of some

50 to 60. The other half is used as anode loaded cathode-follower phase-splitter, probably the simplest of the "transformerless" types, and certainly extremely easy to balance, balance being quite automatic, regardless of valve condition. If the anode and cathode loads, R16, R18, are equal

This circuit gives no gain of voltage, in common with all cathode-followers, but that is a reasonable price to pay for simplicity and reliability over long periods. The use of the normal bias resistor R17, to the bottom end of which the gridleak R13 is returned, ensures true class-A operation, so that both polarities of signal half-cycles are passed on without distortion.

Correct value of R17 is important to avoid distortion at high output power which can originate in this stage before the output stage itself start overloading. The correct value of R8 is equally important. R16 and R18 should be a pair of equal resistors. C13 prevents unbalance at the cathode of the phase-splitter results, although such unbalance is not as serious in this design as in many similar amplifiers running the output stage in Class AB or Class B because here strict Class-A is employed throughout. This is unusual for this kind of amplifier, and places heavy demands on the power supply, as the no-signal standing current is well over 100mA in the output stage. Thus D2 is somewhat over-rated in voltage and

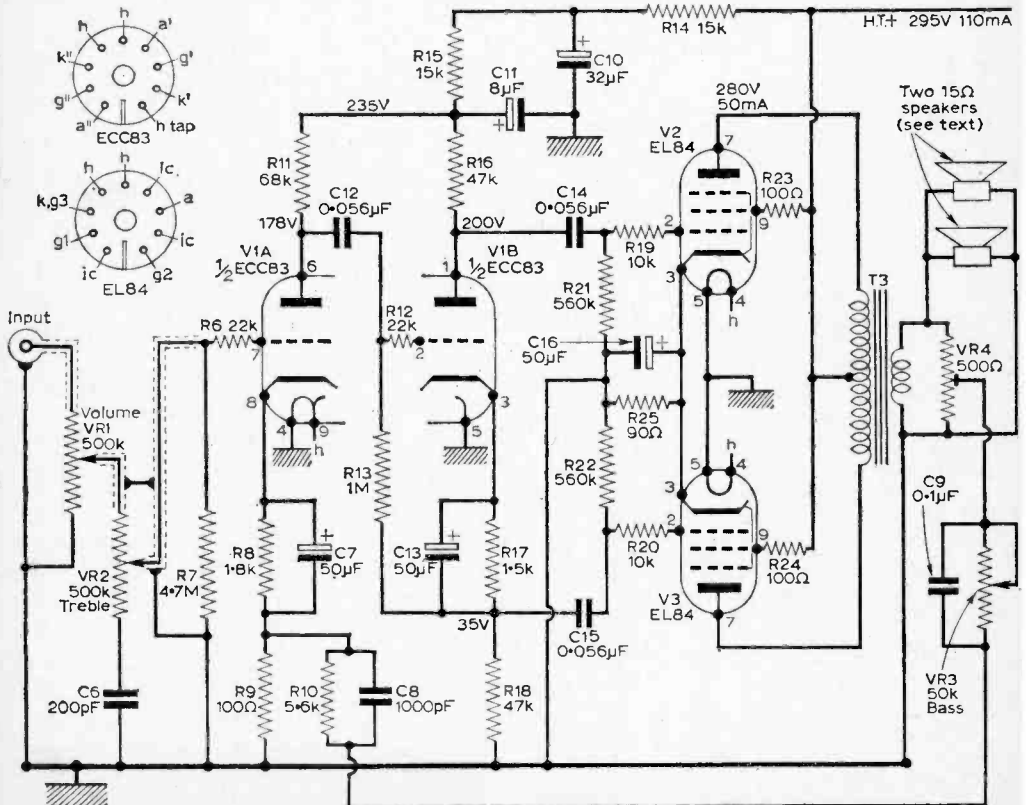


Fig. 1a.—The amplifier circuit.

current, to be certain of tolerating the high surges, and the smoothing electrolytics are in the form of a large chassis-mounting can of ample voltage-rating and surge-rating. It is undesirable to use small tubular electrolytics in this position, as these will probably sooner or later overheat and fail, on account of the surges.

A strict Class-A push-pull stage is very tolerant to mains ripple left on the h.t. However, V1 would most certainly not tolerate such ripple, hence the large amount of extra smoothing there obtained by means of R14, R15, C10, C11.

**Grid-stoppers**

It cannot be over-stressed how important grid-stoppers are with modern high-gain miniature valves, and it is probably true to say that the

shifts in a poor type of output transformer can give supersonic instability in the whole negative feedback loop with the same disastrous effects on the output valves. Such shifts in T3 are capable of being compensated by the arrangement of R10 and C8, which are adequate for a good quality transformer. If the anode-voltages on V2 and V3 show any tendency to unbalance as VR4 is adjusted, the effect of increasing or decreasing C8 could be tried, but if serious modifications are necessary, it is better to obtain a better output transformer. The "makeshift" practice of using a heater transformer for 110-220V mains as primary, and 6.3V as secondary, as a push-pull output transformer, is most strongly discouraged. Such heater transformers give very poor performance other than at mains frequency and may lead to incurable instability of the types discussed.

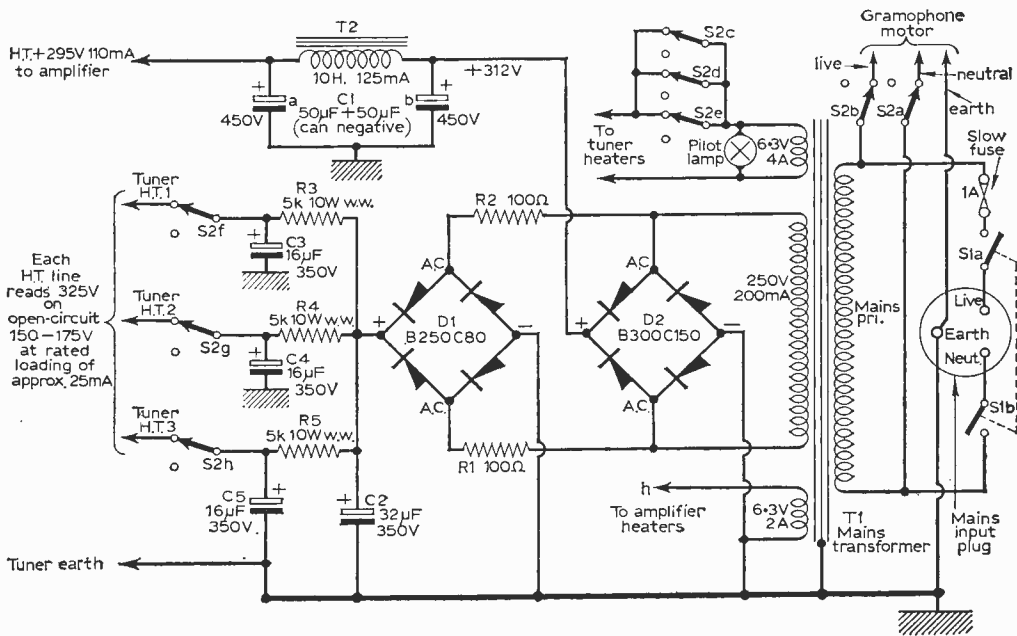


Fig. 1b—The power pack circuit.

great majority of failures in amplifier designs nowadays are the result of insufficient attention having been paid to the direct or indirect effects of parasitic oscillations.

If some or all of the grid-stoppers R19, R20, R23, R24 are omitted, or incorrectly wired (grid-connection too long), the whole amplifier can go unstable, and V2 or V3, or both, can suddenly run bright red-hot and burn out. This could also lead to the destruction of components in the power supply. If an output stage goes into parasitic oscillation on account of improperly wired grid-circuits, the resulting grid-current often produces a monostable multivibrator action between the two valves as a by-product. This results in one of the EL84 valves being cut off, and the other running up to huge anode current, which rapidly destroys it.

Even with grid-stoppers it is possible that phase-

The need for a really good item of reliable manufacture for T3 cannot be over-emphasised.

Even V1, in spite of its low slope, is provided with very substantial grid-stoppers. All six grid-stoppers in this amplifier must be wired very close to the grid-pin they are to protect, and nothing else must then be connected direct to this grid-pin.

**Tone Controls**

This circuit uses a popular form of tone control which does not waste available power, nor give rise to dangers of overloading.

One of the poorest methods of tone control, from design points of view, is to connect a 10-50kΩ potentiometer and 0.1μF capacitor in series from the anode of the output valve to chassis.

(To be continued)

# A Simple Filter Network

by  
J. HASKELL

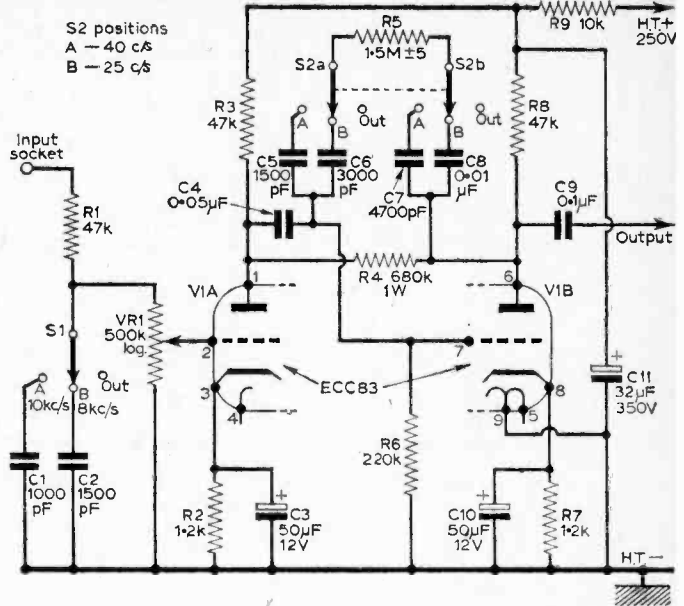


Fig. 1: Circuit of the filter network.

SAVE for treble, bass, volume and equalizer controls, scratch and rumble filters are rarely, if ever, found on average amplification equipment. These controls are necessary for the modern hi-fi amplifier, which has a good frequency response and is thus likely to reproduce record scratch and turntable rumble frequencies.

A scratch filter is also useful when playing records with a high transient content, and whose

centre hole is essentric. With the former, tracing distortion would be more predominant and a high frequency cut is necessary. The scratch filter is also useful for A.M. broadcasts where 10kc/whistles and side-band interference are also present.

Rumble filters are useful for cutting out the low frequency rumble present in record changers, and for eliminating the modulating tone of a medium wave broadcast.

For real high quality reproduction, filter "out" positions are given; and a good frequency response is maintained at low distortion.

### Scratch Filter

The scratch filter shown in Fig. 1, is nothing but a simple treble-cut circuit comprising the resistors R1 and capacitors C1 and C2. Due to the attenuation arising from a network of this type, some amplification is necessary, and this is provided by the first section of the double-triode ECC83.

A low anode load and negative feedback provided by R4 give good stability and adequate high frequency response. The two positions A and B (Fig. 1) of the switch SW1 give a 10dB cut beginning from 10kc/s and 8kc/s respectively. Although the network is simple, nevertheless it is still very effective.

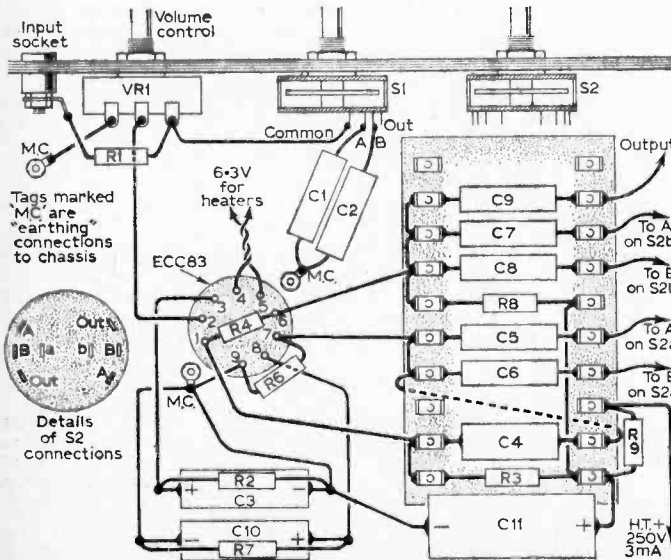


Fig. 3: General layout of the filter network.

An alternative circuit for a scratch filter is given in Fig. 2. This is the cascade type, giving different degrees of cut at a fixed frequency. Both the networks have a filter "out" position when the signal is fed direct to the volume control VR1 through R1.

**Rumble Filter**

The rumble filter is based on the negative feedback principle. There are two advantages to this method—firstly it is very effective and secondly it improves the quality of the output of this stage.

Application of feedback from the anode of the second stage, back to the grid of the same stage, effectively lowers the input impedance, resulting in a low frequency cut. The values calculated are for cut at 40c/s and at 25c/s. There is also a filter "out" position.

If rumble still remains, even in the "A" position of the switch SW2, then C10 may be

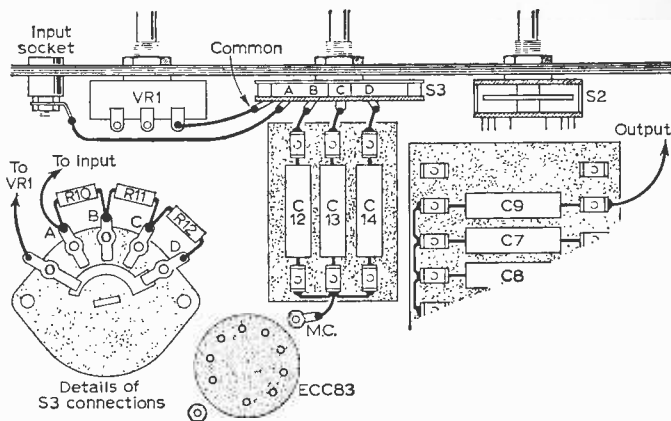


Fig. 4: Alternative arrangement when using the scratch filter of Fig. 2.

**COMPONENTS LIST**

**Resistors**

(All fixed resistors 10%, 1/2W, unless otherwise specified)

R1 47kΩ	R7 1.2kΩ
R2 1.2kΩ	R8 47kΩ
R3 47kΩ	R9 10kΩ
R4 680kΩ, 1W	R10† 22kΩ
R5 1.5MΩ, 5%	R11† 22kΩ
R6 220kΩ	R12† 22kΩ
VR1 500kΩ, log.	

**Capacitors**

C1* 1000pF ceramic or mica
C2* 1500pF ceramic or mica
C3 50μF, 12V electrolytic
C4 0.05μF 350V paper
C5 1500pF ceramic or mica
C6 3000pF ceramic or mica
C7 47000pF ceramic or mica
C8 0.01μF, 350V paper
C9 0.1μF, 350V paper
C10 50μF, 12V, electrolytic
C11 32μF, 350V, electrolytic
C12 750pF ceramic or mica
C13 750pF ceramic or mica
C14 750pF ceramic or mica

**Switches**

S1* 1 pole, 2 way
S2 2 pole, 3 way
S3† 1 pole, 4 way

**Valve**

VI ECC83

\*These components are used only in the circuit of Fig. 1.  
†These components are used only in the circuit of Fig. 2.

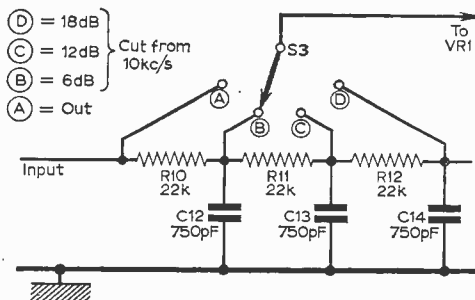


Fig. 2: Alternative circuit for scratch filter of the cascade type giving different degrees of cut at a fixed frequency.

removed. This provides a gradual low frequency roll-off as well as current feedback to the second section of the valve. The high frequency response, however, will also suffer, so this should be tried only in extreme cases.

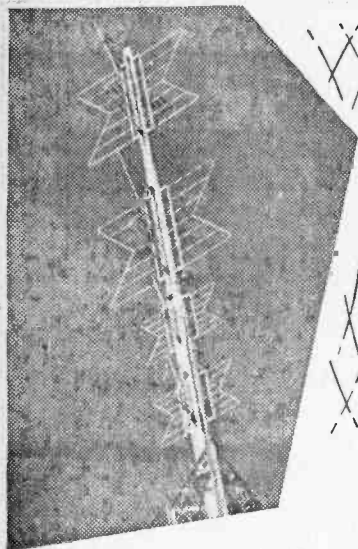
**Requirements**

The circuit requires approximately 3mA of current at 250V, and is adequately decoupled by R9 and C1. An input voltage of 100mV results in an output of 600mV. The valve requires i.t. of 6.3V at 300mA.

**Layout**

The layout is by no means critical. Usual good wiring practice should be employed. Heater wiring should be tightly twisted and tucked close to the chassis. All signal leads should be kept away from a.c. wiring. Either a tag-board or separate tag-strips may be employed. The layout for tag-boards is given in Fig. 3. The circuit is very stable, and will give satisfaction to even the most critical of listeners.





# On Your Wavelength

By THERMION

calculated by doubling the d.c. resistance. I wonder if any readers have short-cuts of their own which might be of interest? One item, for instance, concerns the inductance, either of coils or iron-cored components. I have received one method of accurately calculating the inductance of an iron-cored choke, simply with an ordinary d.c. meter.

Now come on, you enthusiasts, how can you arrive at this? It seems quite an interesting idea, and I am sure there must be many such dodges in more or less common use in experimental labs, or workshops.

## Ribbon Speakers

Some years ago the ribbon (or velocity) microphone was very popular, and quite a number of constructional articles appeared in many papers and magazines on how to make these. Usually the large magnets were obtained from ex-Government apparatus, and ordinary wrapping foil was crinkled for the essential element.

I have been experimenting with a similar idea for a ribbon loudspeaker, but I am afraid without much success. Either the instrument was too delicate and would only carry a very weak signal, or it was too robust and did not give much output above 12,000 or so cycles. I cannot remember seeing any articles in any magazines on the construction of this type of loudspeaker, and can only find a single one on the English market.

Of course, the efficiency is rather low, and there appears to be only one commercially made loudspeaker which incorporates one of these with a standard moving coil unit to give the complete frequency range. I have also been looking through complete receiver specifications and can only find one really high-quality radiogram which has this type of loudspeaker incorporated in its output, and this, I understand, is now being discontinued.

Why is this, I wonder? Modern tweeters are certainly very efficient, but one would have thought that the ribbon instrument, could have been developed to form a very strong competitor for these.

**A**FTER all that has been said about the electronic games business in past issues, I have now received from a Mr. Massey of the Planet Instrument Co. of Leeds some most interesting data of a machine designed to play the game of Noughts and Crosses.

These details have been duplicated and apart from a very precise description of how the machine functions, there is a complete list of parts needed (with prices) and it would appear that here, at last, there is a really good electronic game available to those who are interested in this country.

Among the many details sent to me by readers were dozens of cuttings from American magazines showing that this hobby is apparently much more developed in the U.S.A. than over here, and I cannot imagine whether this is due to the Americans being more technically minded, or that commerce is more able to sell anything as long as it has a selling point or gimmick.

But this little noughts and crosses game appears to have most interesting possibilities and when I get time I must make one up. There are no complications so far as I can see, and no expensive relays—merely switches, bulbs and a little mechanical work for the casing or box. Thank you Mr. Massey for letting me see these details.

## Short Cuts

I am often asked how such and such details can be calculated with only a single meter—the details required being those normally only found by using expensive or complicated bridges. There are, of course, well-known short cuts which are often employed by servicemen in their work, and which for all practical purposes are sufficiently accurate to enable a fault to be diagnosed, but not sufficiently accurate to enable one to say that a particular part is outside the normal working tolerance.

For instance, the impedance is often roughly

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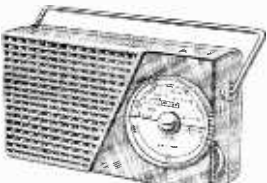
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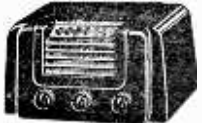
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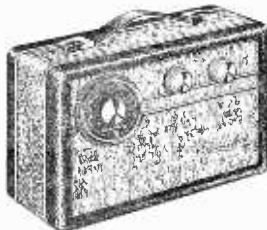
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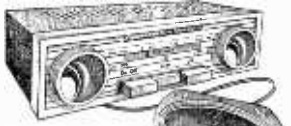
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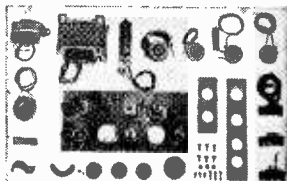
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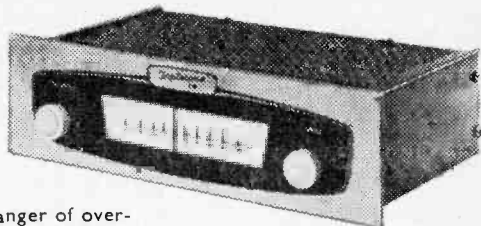
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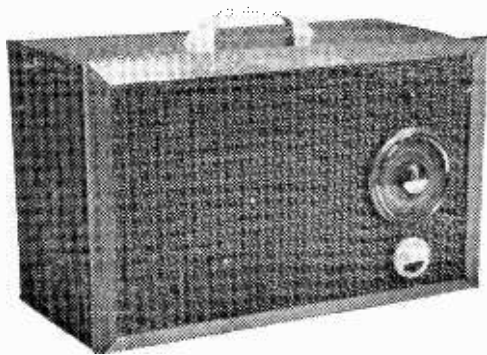
By V. E. HOLLEY

(Continued from page 746 of the December issue)

**T**HE aerial is mounted in an aluminium bracket, details of which are given in Fig. 4. Rubber grommets should be inserted in the two  $\frac{3}{8}$ in. holes and the ferrite rod passed through them. The metal can then be closed up to obtain a good tight grip. Take care in closing up that the edges of the metal do not meet or the equivalent of a shorted turn will be formed around the rod and its inductance will be reduced.

The second tuned circuit, L3, L4, is mounted above chassis in a screening can. Some manufacturers supply coils in aluminium containers which can be used for this purpose but any seamless container of suitable shape and size will do. Do not forget to remove any paint, paper labels, etc., from the lid before bolting it to the chassis.

The coil used in the prototype was designed to plug into a B9A valve base which was fitted below the chassis on the 6B.A. bolts used to secure the lid of the can above.



The author's completed receiver.

## Components and Wiring

No special components are needed but it is advisable to use good quality mica capacitors for C2 and C5 because their insulation is important. Resistors can be mostly  $\frac{1}{2}$ W or  $\frac{1}{4}$ W; where higher ratings are required they are specified in the list of components. Capacitors should be 350V working for C12 for which 25V will suffice.

A complete wiring diagram for the two-stage receiver is given in Fig. 3 (last month). In order to make the connections clear, the positions of the components are only approximate and the wiring has been opened out. In construction, components should be fitted in the most convenient positions and wiring should be no longer than necessary.

Tinned copper wire of 22s.w.g., covered with sleeving is suitable for all the wiring. The "earthy" end of L2 is taken to chassis on the

aerial supporting bracket and is consequently not shown in Fig. 2.

## Testing

When construction is complete, test with a meter between C14 and chassis to see that there are no shorts in the H.T. wiring. All being well, switch on and check that voltage is present at the anodes and screens of the valves. Measure the H.T. line voltage. It should be between 200 and 220V and if it is not, it must be brought within this range by altering the value of R16.

## Alignment

Set the tuning capacitor near the fully open position, switch to Medium-wave and fix the aerial coil L1 temporarily in position about  $\frac{1}{4}$ in. from the end of the ferrite rod. Tune in a station at the high frequency end of the band and peak it with the trimmers TC1 and TC2.

If a high resistance voltmeter or a "magic eye" tuning indicator is available, connect it across VR1, positive to chassis; it will give a more accurate indication of optimum response than can be obtained by ear.

The next operation is to match the inductances of the two tuned circuits. Tune in a station at the low frequency end of the band and adjust the position of L1, at the same time moving the gang capacitor back and forth a little till the optimum combination of settings is found. Adjust the core of L3 for maximum signal. Repeat the adjustments at each end of the band, after which L1 can be fixed in position with a little beeswax. The final adjustment should be to the trimmers at the high frequency end of the band.

Now turn the switch to the long wave position and adjust the position of L2 and the setting of the tuning capacitor for optimum reception of the Light Programme on 200kc/s. Fix L2 in position. Do not make any alteration to the trimmers.

## Tuning Arrangements

The conventional slow motion drive and tuning scale are dispensed with in favour of a direct drive on the tuning capacitor, using a 2 $\frac{1}{2}$ in. transparent "knob" with a rudimentary circular scale behind it, as fitted in some transistor sets. This gives adequate control but requires a little care to obtain accurate tuning. It is therefore supplemented by a simple selector assembly which enables the commonly used programmes to be found easily and accurately.

The spindle of the tuning capacitor carries a 2 $\frac{1}{2}$ in. drive drum, fitted back to front. Below it, bolted to the chassis, is a tinplate bracket carrying the desired number of phosphor bronze selector fingers, each carrying at the the upper end a  $\frac{3}{16}$ in. ball bearing which bears firmly on the surface of the drive drum.

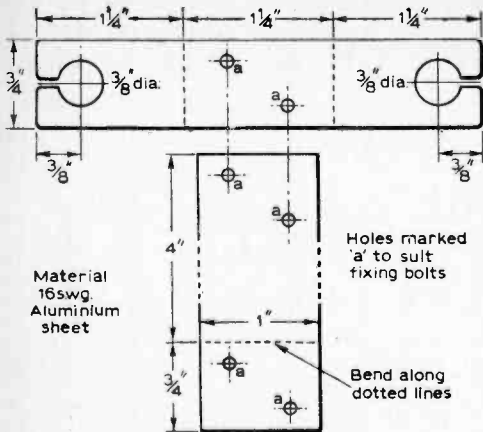
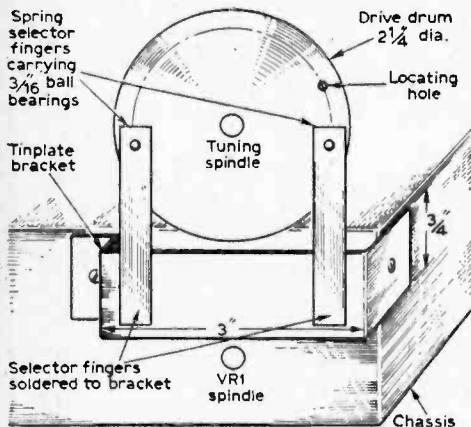


Fig. 4 (above): The ferrite aerial mount.

Fig. 5 (below): The selector turning assembly.



As the drum is rotated, the balls locate in holes drilled for the purpose in the drum and spaced radially so that each can be engaged by only one selector. Fig. 5 shows the arrangement in detail with two selectors in position: up to four could be accommodated. For a  $\frac{3}{16}$  in. ball bearing, holes in the drum made with a 6B.A. clearance drill will be satisfactory; the holes in the selectors in which the balls are carried should be of a size just too small to allow the ball to pass through. It is important for accurate location that the holes should be round and sharp drills should be used.

To set up and align the assembly, place the drive drum on the capacitor spindle and fit the tinplate bracket to the chassis below it as in Fig. 5. Set the first selector in a convenient position on the bracket and mark and drill the locating hole in the drum. The selector with its ball located in the hole should then be held firmly in position on the bracket and soldered to it. With the drum stationary, rotate the tuning capacitor till the desired transmission is accurately tuned and then tighten the drum on the spindle.

For the second and subsequent selectors, tune in the desired transmission, mark and drill the locating hole and solder the selector to the bracket as before. This should be done with the set working and preferably with a meter connected across VR1 so that any inadvertent movement of the drum during the operation can be detected. This assembly gives very accurate location without requiring great precision in construction.

### Cabinet

The cabinet is made very simply from four pieces of  $\frac{1}{4}$  in. ply wood having an oak, walnut or other suitable facing. To obtain a symmetrical appearance, the height must be adjusted to suit the spacing of the volume and tuning controls and the pilot light.

In the prototype, the tuning control was  $3\frac{1}{2}$  in. above the bottom of the chassis so the cabinet was made  $6\frac{1}{2}$  in. high internally, which, with  $\frac{1}{4}$  in. ply requires an overall height of  $7\frac{1}{2}$  in. Rebates,  $\frac{1}{4}$  in. deep and  $\frac{1}{4}$  in. wide are required at the top and bottom of each side. The depth of the original cabinet is  $5\frac{1}{2}$  in. but this may need some adjustment depending on the shape and size of the loud-speaker.

When the four pieces are ready, make a trial assembly, using two or three panel pins driven half-way home at each corner. Square it up and fit temporarily on the front a piece of  $\frac{1}{4}$  in. ply or hardboard, cut to size.

A satisfactory fit having been obtained, mark all the joints for indentification, and dismantle; then coat the mating surfaces with glue and reassemble, driving the panel pins right home and punching the heads below the surface. Fill in the resulting indentations and any other blemishes with plastic wood of the colour in which the cabinet is to be finished. When the glue is hard, mark and cut apertures for the controls, pilot light and loud-speaker, not forgetting the wavechange switch in the right-hand side.

The loudspeaker should be sited at the top of the cabinet in any convenient position clear of the receiver. Half a dozen  $\frac{1}{4}$  in. holes should be made in the bottom of the cabinet for ventilation.

### Finishing

The top and sides of the cabinet should now be given a good rub down with glasspaper and french polished, painting or stained and varnished according to reference. Fit the loudspeaker with 4B.A. countersunk bolts, putting a little impact adhesive under the heads so that they will not rotate if it should be necessary to remove the speaker at a later date.

The front must then be completely covered with fabric secured with adhesive. It is not necessary to spread the adhesive over the whole surface but special attention should be paid to the edges and surrounds of the apertures. The front is finished off by fitting picture moulding round the edges, again using impact adhesive. The moulding can be of any desired shape so long as it is wide enough to hide the edge of the hardboard front. Appearance is improved if it is finished in a shade considerably lighter than that of the cabinet.

Four rubber buffers should be fitted to the bottom so as to raise the cabinet from the surface

(Continued on page 842)

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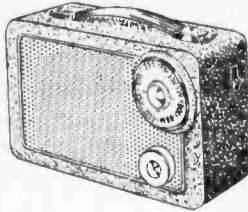
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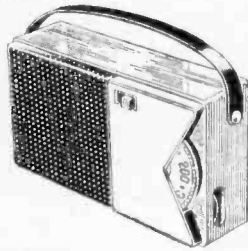
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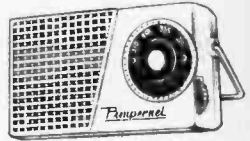
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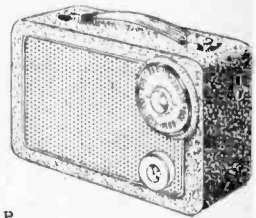
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# A Transistorised Audio Oscillator

## A SIMPLE MORSE PRACTICE OSCILLATOR

By K. Berry

**J**HIS circuit was developed to meet a requirement for a simple low-level audio oscillator for the purpose of Morse practice. The design employs a balanced armature earpiece as a combined loudspeaker and inductance. It can also be used as a fixed frequency audio tone source for testing audio equipment.

### Circuit Description

The circuit of the oscillator is shown in Fig. 1. It is a simple common-base oscillator. The tuned circuit comprises the inductance of the earpiece L1 and the capacitors C1 and C2. These capacitors form an impedance tap on the tuned circuit and

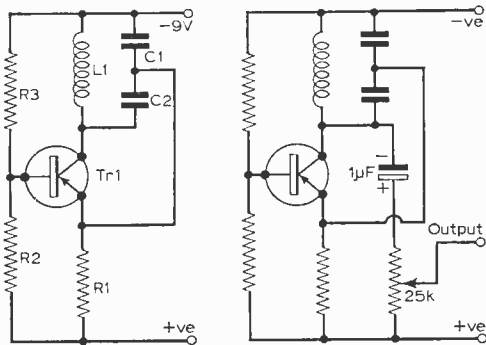


Fig. 1 (left): The circuit of the oscillator.

Fig. 2 (right): A circuit modification to use the oscillator as a tone source.

the voltage from this tap is fed back to the emitter of the transistor.

The base is supplied from the potentiometer formed by R2 and R3. It will be seen that the base supply is not decoupled by a capacitor as is usual. This was found to be unnecessary with the transistors which were tried in the circuit and was accordingly omitted.

If it is desired to use the oscillator as a tone source for testing audio equipment an output may be taken from the collector circuit as shown in Fig. 2. The maximum output voltage from this circuit is 1 volt R.M.S. into a load of 10k $\Omega$ .

If the oscillator is used as a Morse practice oscillator the output waveform is unimportant, but for other purposes where an electrical rather than acoustic output is wanted a pure sine-wave may be desired. A sine-wave of low distortion (though reduced in level) may be obtained by replacing R3 with a variable resistor (about 50k $\Omega$ ) and reducing its resistance until oscillation just commences. The resultant output will then be completely undistorted.

### Construction and Operation

No difficulties should be encountered in making this unit. The capacitors C1 and C2 should, as shown in the components list, be paper capacitors. Although a Mullard OC71 is specified for X1, most types of transistors, including "surplus" ones, should prove suitable.

The supply voltage is not critical—any voltage from 3 to 12 volts will operate the device, though a supply of 9 volts is recommended. The current consumption is 4mA at 9 volts. The oscillator frequency with the component values given is 1,250c/s.

The actual earpiece used was an Insert, Telephone, Balanced Armature No. 5, marked ITBA No. 5. These are low-resistance (30 $\Omega$  D.C.) earpieces and are readily obtainable on the Government surplus market either singly or in pairs as headphones.

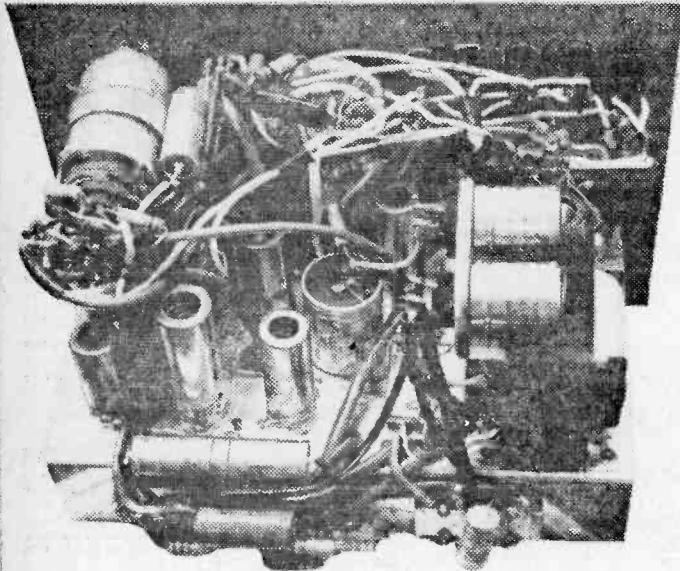
The original unit was mounted in a small Eddystone die-cast box of size 4 $\frac{1}{4}$  x 2 $\frac{3}{8}$  x 1 $\frac{1}{8}$  approximately, the battery being mounted externally. If a larger box is used the battery could be incorporated.

The oscillator should work as soon as the supply is connected. If it fails to oscillate the transistor may have a rather low gain. In this case a capacitor of 0.5 $\mu$ F connected across R2 should right matters. The original circuit operated with a transistor the gain of which was 35, so it is unlikely that any transistor, other than a defective one, should fail to oscillate.

### COMPONENTS LIST

R1	1k $\Omega$ $\frac{1}{2}$ watt
R2, R3	5-6k $\Omega$ $\frac{1}{2}$ watt
C1, C2	1 $\mu$ F paper
X1	OC71
L1	Balanced Armature Earpiece

# THE AUDITRON



By M. L. Michaelis, M.A.

contacts and adequate spacing, be obtained for S5, i.e., a type well-established for successful use in timebase circuits, etc.

### Function Switching

It is seen that the timebase circuits are completely dead in the position 1 of the function switch, giving "Signal Tracer" operation alone, i.e. allowing only the signal amplifier and valve-voltmeter to operate. S1d breaks h.t., and S1a the heaters to the timebase-circuit, in this setting. Position 2 gives normal operation of the oscilloscope function and timebase. Position 3 is the "Bridge" setting, where the phase-shifted 50c/s mains sinewave is used as timebase.

Here only h.t. is switched off for the proper timebase, and the heaters left operating, giving "standby" operation for the timebase. The reason for this is that normal use of the Auditron will often require repeated switching between "scope" and "bridge" functions, during experimental work.

The resulting repeated switching of the heaters of the timebase valves is neither good for the valves, nor good for working, as it would repeatedly waste time waiting for the valves to warm up, and would cause drifts in the timebase-calibrations, as the valves never then reach the proper stable operating conditions.

### Calibrating the Timebase

The Auditron should be switched on once everything is complete and working properly, and left running for at least 10 minutes on "scope" function before any attempt is made to calibrate the timebase. This allows the valves to reach the final operating state.

Now for the calibration procedure with normally available equipment. A preliminary is to be certain that the capacities of C25, C26, C27 are as closely as possible in the ratios 1:10:100. If necessary, trim with suitable parallel capacitors across those which are "low" in value. The actual capacities are far less important than the ratios, and the simple method for getting the ratios exact as required is described below.

Having satisfied the above, switch to the fastest range, maximum sync., and feed in a signal at

(Continued on page 837)

(Continued from page 715 of the December issue)

**T**HE use of normal germanium diodes of the r.f. or low-voltage types, is not permissible in the Auditron, and likewise, it is not permissible to use normal silicon rectifiers, even though these will stand the voltage, because their capacity is too high. The specified type of diode is rated for a cut-off frequency of 0.5Mc/s, and has about 10pF capacity. Current rating is not important and 5-10mA forward current is ample rating.

### Flyback Tailing

Only at the last small portion of the highest speed range is a part of the flyback faintly visible. This is caused by the actually slightly exponential nature of the sharp downward-kick of the screen voltage at V6 at the end of the timebase-run, due to the very short time constant of stray capacities and the screen-impedance of V6.

This very short time constant means that the negative stroke of the blanking wave at the CRT-grid arrives about 5 microseconds late after the end of the timebase-run, and thus 5 microseconds of flyback are always visible.

However, if the effect is found to be excessive, the stray capacities in the region of V6 pin 1 are probably too high, which can most likely have resulted from an unsuitable switch S5. It should be observed that a small switch, with small spoon

# Just a few of our BARGAINS



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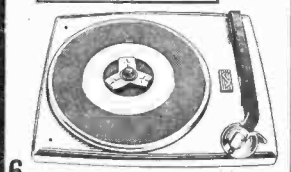
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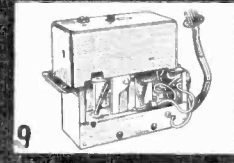
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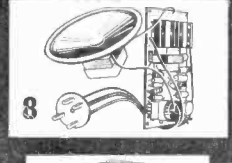
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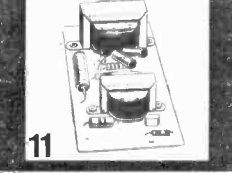
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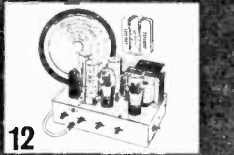
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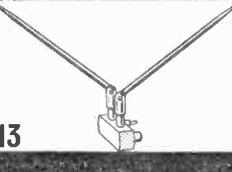
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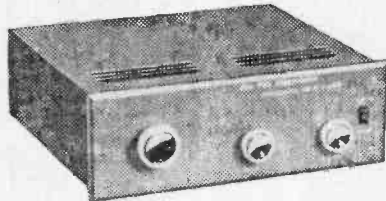
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**TECHNICAL DATA**—Power Output: 10 watts into 3 ohms. Negative Feedback: 60dB in main amp. Output Impedance: 0.23 ohms. Harmonic Distortion: less than 0.25% total at 10 watts output. Frequency Response: (—3dB, tone controls central) 30 c/s-20,000 c/s. Bass Control: ± 12dB at 30 c/s. Treble Control: +12dB, —16dB at 15,000 c/s. Signal/Noise Ratio: —70dB ref. max. output. Input Selector: (i) Gram., high imp. crystal or mag. fully compensated, 100 mV; (ii) Radio, tape, etc., high imp. 150 mV. Power Consumption: 18 watts at 240 v. Size: 8½ x 3 x 7in. Weight: 4 lb. Finish: grey wrinkle with gold front panel. PRICE: 16 gns.

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# COIL PACKS

CP.3/370 pF and CP.3/500 pF. These 3 waveband Coil Packs are available for use with either 370 pF or 500 pF tuning condensers. The coverages are: Long Wave 800-2,000 metres. Med. Wave 200-250 metres, Short Wave 16-50 metres. Designed for use with "MAXI-Q" glass scale type S2. Retail price of each unit: 32/- plus 10/8 P.T.—total 42/8.

CP.3/G. As above but with Gram. position, suitable for use with 500 pF tuning condenser: 39/- plus 13/- P.T.—total 52/-.

CP.3/F. This Coil Pack is for use with a 500 pF tuning condenser and covers the standard, Long, Med. and Short wavebands with the addition of the band 50/160 metres. This covers the Trawler band, Aeronautical and the 80 and 160 metre Amateur bands: 49/- plus 16/4 P.T.—total 65/4.

CP.3F/G. As CP.3/F but with Gram. position: 57/- plus 19/- P.T.—total 76/-.

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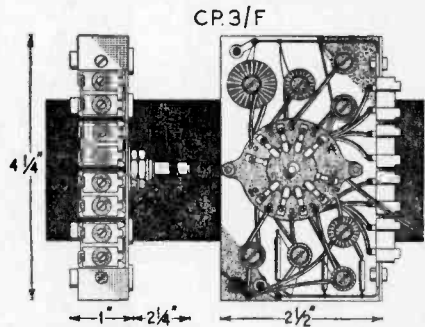
CP.4L/G and CP.4M/G. As CP.4/L and CP.4/M but with provision for Gram. position. 31/- plus 10/4 P.T.—total 41/4.

See Technical Bulletin DTB.9 for details of all Coil Packs, 1/6.

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(Continued from page 834)

100kc/s from an r.f. signal generator on the long wave range. One complete cycle of this frequency is 10 microseconds in duration. It should be possible to synchronise such that about one cycle appears stationary on the trace, and note its length against the centimetre lines engraved on the perspex-window to be placed in front of the c.r.t.-screen.

Thus calculate, in direct proportion, what time is represented by one centimetre of trace, and make the appropriate mark against the setting of the time-base fine-speed control.

Now slow-down the timebase speed by means of operating the fine control, until two waves appear stationary on the screen. Each cycle is 10 microseconds, thus the new time per centimetre can be read off in proportion. Carry on in this way, for increasing numbers of complete cycles stationary on the trace, until the slow-end of travel of the fine speed control is reached, when about 25 cycles should be visible.

From the 25 calibration marks prepare a properly-divided scaleplate, and affix to the fine-speed control. This will carry markings from about 12 to 25 $\mu$ , labelled "microseconds per centimetre", and should hold true, multiplied by 10 or 100 respectively, in the two slower settings of the coarse control S5, provided the ratios of C25 and C27 have been properly trimmed.

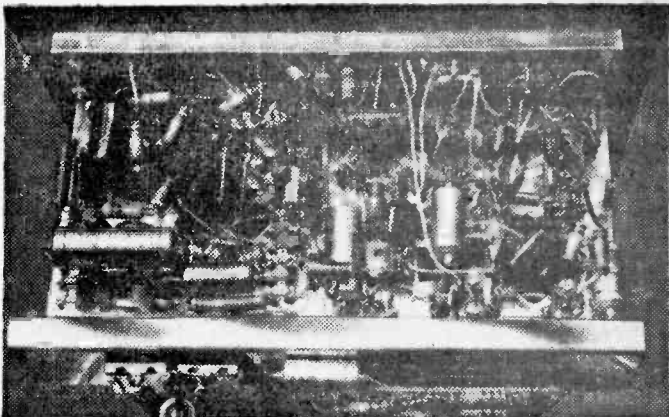
Check against the mains on the lowest speed range. One cycle of the mains frequency should occupy 20 milliseconds. If this is not observed, then something is wrong either with the accuracy of the 100kc/s from the signal generator, or with the ratio-trimming of C25-C27.

The signal-generator should be checked initially by feeding the output into the aerial terminal of a radio receiver switched to long waves and tuned to the BBC Light Programme on 200kc/s. The generator should be tuned around the 100kc/s mark on its scale until zero-beat is heard between the second-harmonic and the Light-Programme carrier. This assures an accurate 100kc/s input to the Miniscope for the calibration.

#### Ratios of C25 to C27

The circuit of Fig. 2b should be connected up neatly in experimental form. Ra should be about 100 $\Omega$ , and Rb about 1k $\Omega$ . Whatever the exact values, they should be exactly 1:10 ratio in nominal values, and  $\pm 1\%$  tolerance. Alternatively, lengths of resistance wire may be used, the one for Rb cut off exactly ten times as long as the one for Ra, from the same reel of wire. Using a thin resistance wire having at least 100 $\Omega$  per yd. reasonable lengths suffice.

Various small capacitors are tried in parallel with either Ca or Cb until minimum sound is heard in the headphones, representing true 1:10 ratio of the final combinations for Ca and Cb. Use



A view of the underside showing the wiring.

good-quality capacitors for C25 and C27 and any trimmers for these, of reputable make and stability.

It is well worth while to take some trouble to perform all steps of the timebase-calibration very carefully and methodically, as the final result will be a frequency-meter of surprising accuracy, for any frequency from about 25c/s to several hundred kc/s. Any waveform can be dealt with, but irregular sequences, such as a Geiger-Counter output, cannot have their frequencies measured in this way.

#### Power Supplies

A 6.3V heater supply at about 3A is required, and two h.t. lines, the one at about 240V 40mA and the other at about 600V 1mA (e.h.t. for the c.r.t.). A normal heater winding, and a 250V 50mA a.c. winding, feeding a conventional voltage-doubler circuit using the two contact-cooled metal rectifiers D1 and D2, supply these needs from an ordinary mains transformer.

In addition, a fully isolated 110V winding is required. The exact voltage is not critical, anything between 80 and 150V will do, though R1 will have to be altered in the same ratio as the available transformer voltage differs from 110. Also, R17 and R18 will have to be altered to give a trace of convenient length if the transformer voltage differs from 110. If it is not possible to obtain a transformer with such an extra isolated winding a small heater transformer giving 6.6V from a 110V supply should be run in reverse from the heater line of the Auditron. This heater transformer can be mounted at any convenient position within the instrument, but far enough from the c.r.t. so as not to influence it with any stray magnetic field it may have.

Although electrically suitable, the procedure of connecting the mains neutral to chassis and using the 110V tap on the mains primary for the 110V line is to be strongly discouraged for reasons of safety. If such an arrangement were used, and the mains plug connected the wrong way round, the chassis and all coaxial sockets would go live at full mains voltage. Apart from the dangers of



shock, this could lead to *serious* short-circuits across equipment connected to such a universal instrument as the Auditron, and possible destruction of valuable equipment.

### The H.T. and E.H.T. Supplies

Note the smoothing arrangements of R5, R6, R7 and C1-5 in Fig. 4. These are arranged to give maximum smoothing with the specified normal components, for simultaneous loading as required at the single and the doubled voltage. C6, being a good metallised-paper capacitor, gives an additional measure of stabilisation against small "flimmerings" of electrolytics on the e.h.t. line, thereby making the trace on the c.r.t. more steady. If the electrolytics used are very good, it can be

the mains frequency is locked or not, if not removed.

### Choice of Cathode Ray Tube

The tube used in the prototype is the Telefunken DG3-12A, a medium persistence miniature 1½in. electrostatic tube for about 500V e.h.t. operation and 6.3V heater, for connection into a normal heater circuit. This is a fine precision tube, and should be readily obtainable in Britain from Telefunken representatives.

Any surplus tube, or tube of other origin, having similar electrical characteristics is directly usable in the Auditron.

The tube used must have a sensitivity such that 100 to 150V peak-to-peak is sufficient to deflect the spot right across the usable region of the

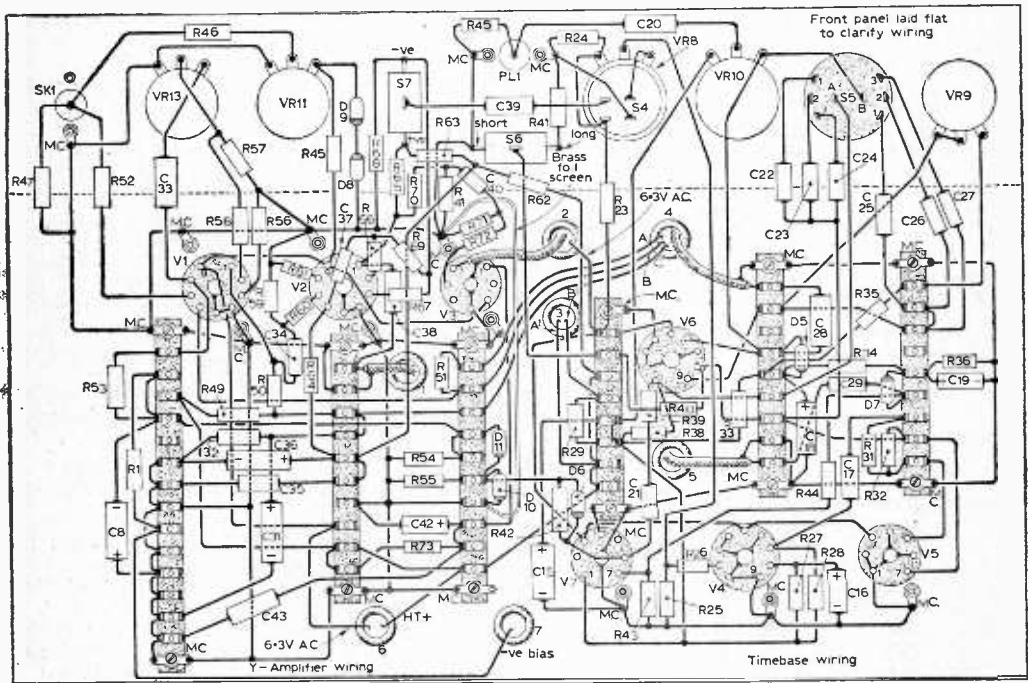


Fig. 11—The Y-amplifier and timebase wiring diagram.

omitted. Also, placing it in parallel with C11 instead of in the position shown could be tried. R8 serves as load for the e.h.t. line in the "tracer only" function, where the "scope" is off, thus preventing unnecessary peaking of the voltage. Most of the e.h.t. current consumed in the "scope" and "bridge" settings flows through the bleeder R14 down to VR1, which is operative immediately upon switching on, before the c.r.t. is warm. Thus initial switching-peaks are avoided.

Note the inclusion of C11, a high voltage electrolytic from final anode of the c.r.t. to chassis. This was found to be absolutely essential, connected in this way, to remove distribution hum between the e.h.t. line and the signal feeds from the Y-amplifier and the timebase. Such hum would give a widened or-wiggly trace, depending whether

screen, and if this condition is satisfied (see data for the tube it is proposed to use), the timebase and signal amplifier outputs for the here-published form are ample. If the sensitivity is greater, then outputs may be reduced by decreasing R65 suitably for the signal amplifier, and tapping the anode-load of the timebase by using a fixed resistor and potentiometer in series in place of VR10, but keeping to 100kΩ total resistance. One end of the potentiometer should still be connected to h.t., and the X-deflection fed from the other end.

### Other E.H.T. Voltages

If the tube it is proposed to use satisfies these specifications in every way except that it needs a somewhat higher e.h.t. than 500V, then proceed  
(Continued on page 841).

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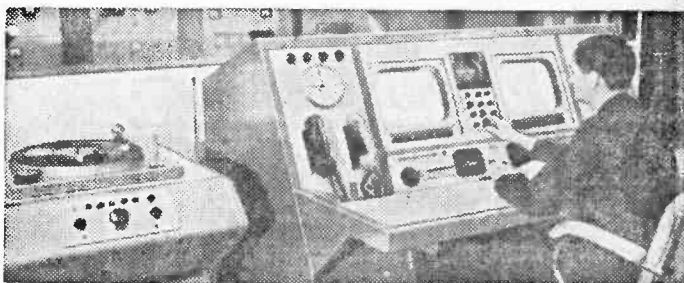
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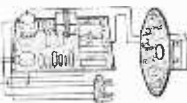
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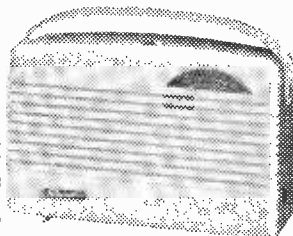


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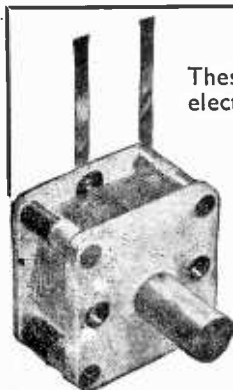
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(Continued from page 838)

as follows. Obtain a transformer with a 300, 350 or 400V a.c. winding, tapped at 250V. The end "0" still goes to C2, and D1 is unchanged, and fed from the 250V tap. Use a 1,000V a.c. input rating e.h.t. metal rectifier, of 2 to 5mA, in place of D2,

and feed from the full voltage end of the transformer winding. The required full winding voltage will be about half the desired e.h.t. voltage, and is not critical. Remember that it is nearly always possible to run a c.r.t. at less than the rated e.h.t., at a slight sacrifice of focus and brilliance, but

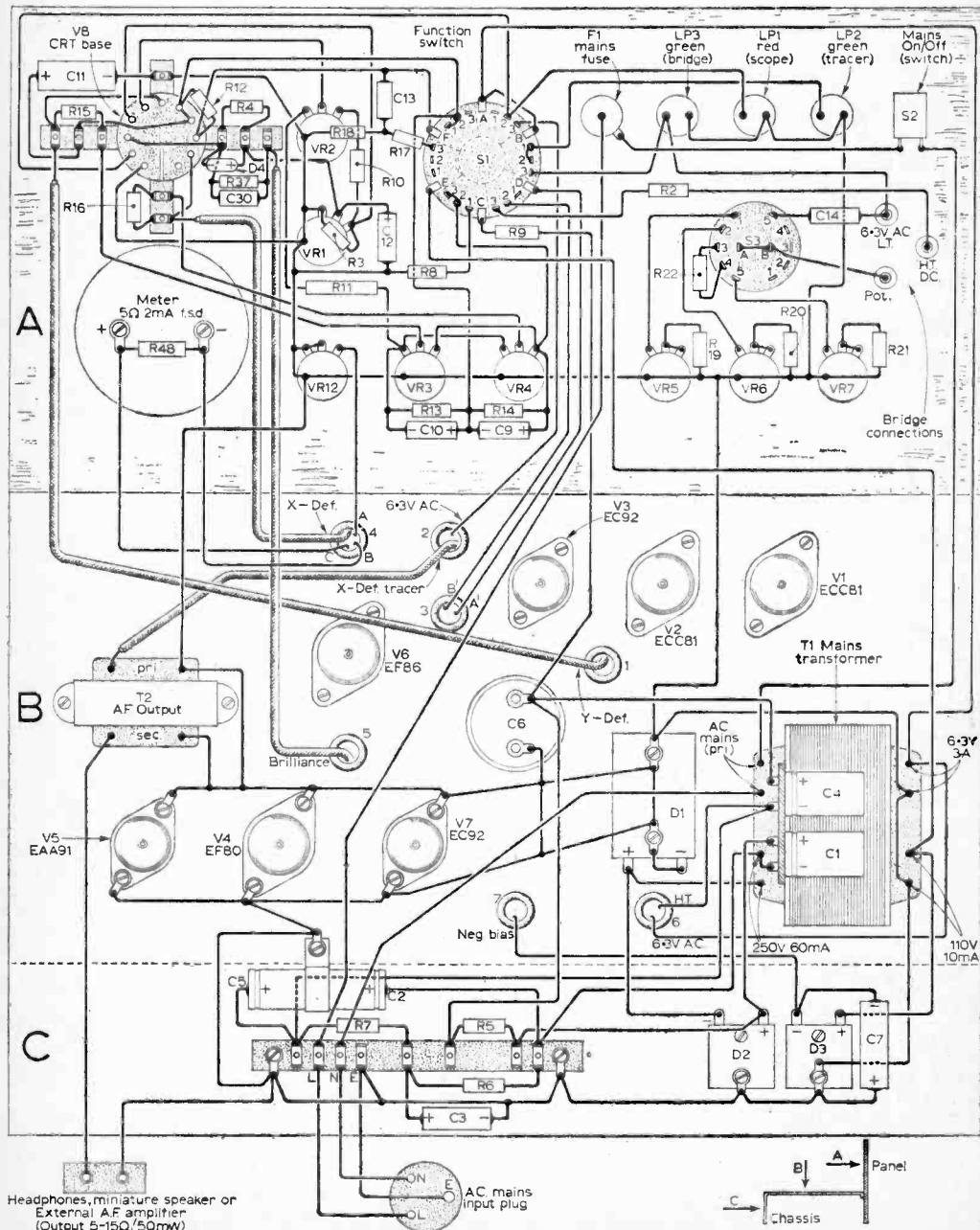


Fig. 12—Above-chassis and panel wiring.

increased deflection sensitivity, which latter may be very useful in adopting an available tube for use in the Audiron.

Remember to modify the voltage ratings of C1, C4, C6, C11 and possibly C12, C9, C10 if using other e.h.t. voltages. Use a pair of well insulated electrolytics in series, with a  $1M\Omega$  2W resistor in parallel with each, in each position where a single electrolytic of the required rating is unobtainable. All resistances in the e.h.t. bleeder network, including potentiometers, will need modification if other voltages are used. The values of potentiometers should not be changed, but additional fixed resistors added, one on each side, for VR2, each equal to 125 times the e.h.t. increase ratio, in  $k\Omega$ . If the resulting bleeder does not give the correct settings quite in the centres of the ranges of the controls, final adjustments should be made by trial and error, using common sense to determine the necessary direction of corrections from observation of the effects.

### C.R.T. Mounting

If the proper mumetal screen and fixtures for the proposed tube are not to hand, and cannot be procured, then the following method of screening and fixture should be adopted. The tube should be enclosed by winding strips of sponge-rubber, or similar material, round all parts of it except the screen and base. This should be held in place by slipping a suitably shaped screen made of galvanised iron sheeting over it (a simple tube in the case of the Telefunken DG3-12A, a tube with conical end in the case of the VCR139A, etc.). A suitable angle-bracket is fixed to the panel on the inside, and the tube assembly clamped down on to this by means of a metal strap round the screen and fixed by means of two bolts to the bracket. Any other method of fixture giving rigidity and not straining the tube mechanically is equally suitable. The tube should be able to be rotated slightly, by slackening the strap bolts, to facilitate final mechanical alignment to get the timebase trace horizontal.

### Deflection Connections

It is seen that asymmetric deflection is used on X and on Y plates. The slight astigmatism thereby produced is well tolerable, so that the trouble and expense of introducing push-pull amplifiers for symmetric deflection was not considered to be worth while. Thus one X plate and one Y plate is normally connected to the final anode (at earth potential for a.c.), and deflection voltages are applied to the other plates.

To avoid unnecessary capacitive loading of the timebase anode circuit due to switching, etc., the sinewave voltage for "bridge" X deflection is applied to the other X plate, normally "earthed" on "scope" function. This has the added advantage of enabling frequency comparison to be made against the mains frequency.

### Elliptical Frequency Comparison

For this purpose, the function switch is turned to "bridge", and the Y calibration signal turned

up on VR11, to obtain a suitably-sized oblique ellipse on the screen. Any external waveform to be examined may now be fed in at P2, the timebase output in "scope" use, and will "corrugate" the ellipse. The corrugations will rotate if the input waveform is no exact harmonic of the mains frequency, the number of rotations per second giving the number of c/s above or below the closest mains harmonic. For each exact harmonic relation the corrugated ellipse comes to rest, and the number of complete corrugations gives the number of times the input frequency is greater than the mains frequency.

This arrangement can be very useful for a quick check whether or not some circuit or other is locked to the mains or a harmonic thereof, which is required in some advanced experimental work. On the other hand, a very simple use of this arrangement is to check a fullwave h.t. rectifier. Feeding the ripple from the reservoir capacitor in, this should give two corrugations, stationary, and symmetrical in size and position. If asymmetry is noted, or only one corrugation, then one diode of the fullwave rectifier is not operating properly. Excessive ripple, caused by an open-circuited reservoir capacitor, can cause the ellipse to double-up into a distorted figure-of-eight. If this is symmetrical, it is proof that the fault is not in the rectifier valves, or not likely to be there.

*(To be continued)*

## MIDGET MAINS PORTABLE

*(Continued from page 830)*

on which it stands sufficiently to allow the moulding to clear the surface. A plastic carrying handle on top is a useful addition.

### Fitting the Receiver

Reduce the length of the wave change switch spindle to about  $\frac{1}{2}$ in. and cut away the fabric from the front control apertures. Connect the loudspeaker and place the receiver in position, securing it with wood screws through the end flanges of the chassis. It is advisable to earth the metal frame of the loudspeaker or it may be found to affect the aerial inductance. This may be done by connecting it to the "earthy" side of the speech coil.

Fit a brass coupler to the wave change switch and use the sawn-off portion of the spindle to extend the control to the outside of the cabinet. The circular tuning scale can be secured direct to the fabric on the front of the cabinet but it is more convenient to operate if the scale and the "knob" which fits over it are made to stand out about  $\frac{1}{4}$ in. This can be done by interposing a circular piece of hardboard or ply between the scale and the fabric.

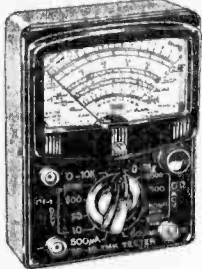
Since the receiver is portable, it is desirable to fit a back to the cabinet. This may be of  $\frac{1}{4}$ in. ply or hardboard with plenty of  $\frac{1}{2}$ in. holes for ventilation. Drive a couple of panel pins into the bottom edge till they project to about  $\frac{1}{4}$ in. and file the heads to points which can be pressed into the bottom of the cabinet. The top can be secured to triangular wooden fillets glued into the top corners of the cabinet. □

**PCR COMMUNICATION RECEIVERS**

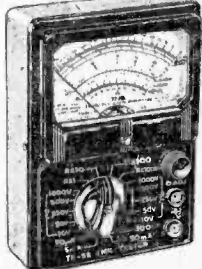
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**30,000 O.P.V. MODEL 500.** Volts to 1,000; D.C. at 30,000 O.P.V. A.C. at 20,000; 12 Amps D.C. Current; 60 Megs Resistance; -20 to +56 Dbs; Internal buzzer short circuit warning. Size 3 1/2in. x 6 1/2in. x 2 1/2in. **£8.19.6**

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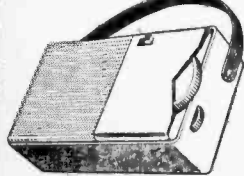
**POWER UNITS TYPE 334.** Primary 200/250 v. 50 cycles. Outputs of 250 v. 100 mA, and 6.3 v. 4 amps. Fitted double smoothing for normal rack mounting (or bench use) having grey front panel size 19" x 7". Fitted Input and Output Voltmeter, 79/6, or model less meter 59/6. (Carriage either type 10/6.)

**AVOMETER MODEL 7 LEATHER CASES,** fitted with carrying handle and long strap. BRAND NEW. **ONLY 32/6** (Post 2/6.)

**20/- CONSTRUCTOR'S PARCEL.** Assorted colours wiring wire, solder, resistors, condensers, volume controls, tag panel. ALL NEW. (Post 2/6.)

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**"P.W. TROUBADOUR 7" TRANSISTOR PERSONAL RECEIVER**



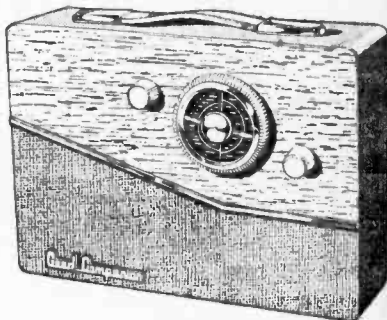
Designed by the technical staff of *Practical Wireless* easy to build, using printed circuit and 1st Grade Matched Transistors and Diode. Full Medium and Long Wave coverage to internal speakers. All parts sold separately (new components only) enabling you to buy as required and full detailed price list will be sent on request. Constructional details 1/6.

**TOTAL COST INCLUDING BATTERY AND CABINET £8.10.0.**  
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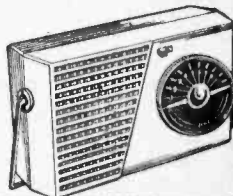


● Internal high gain aerial with car aerial socket. Easy to follow construction data (available separately 3/6). All parts sold separately and full illustrated details will be sent on request. **£9.19.6.**

Total Cost  
With alternative luxury cabinet using 7 x 4in. speaker, £10.19.6. Either type, plus 5/- post and ins. (Battery 3/6 extra.)

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Uses miniature speaker, proper tuning condenser, and volume control. Built-in aerial makes unit efficient and portable. Ideal for the beginner. Full medium wave coverage. All components and case for only 42/6 (p. & p. 2/6). Ten-page constructional book free with parts or separately 1/6. S.A.E. for parts price list.



**HARRIS ELECTRONICS 138 Gray's Inn Road, London W.C.1**  
(LONDON) LTD Phone TERminus 7937

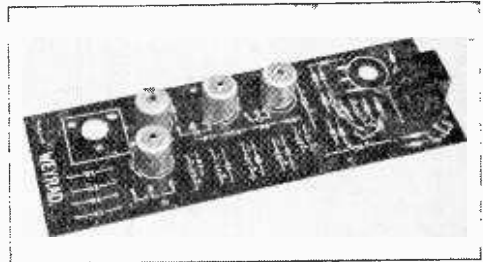
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6 in long, 3/8 in. diameter, connections to tags on Coils. For 208pF tuning capacity. Complete with Car Aerial Coil ... .. 12/6
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In response to many requests we have redesigned the output stages to give 500mW and to enable a standard 3 ohm Speaker to be used. Full details of the simple changes are given on a separate leaflet available on receipt of stamp.

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TAPE RECORDER AMPLIFIER £7.19.6.  
5 Valve, 3.5 w. output. Size 8 1/2 x 3 x 4 1/2 ins. suitable for Cabinet. Ins. Carr. 4/6.

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NEW TRANSISTORS BY MULLARD, OC19, OC26, OC66, 25/-; OC44, OC45, 9/-; OC70, OC71, 6/-; OC72, 7/8; OC72 matched in prs. 16/-; OC74, OC75, OC78, OC81, 7/8; OC82, OC170, 9/6.

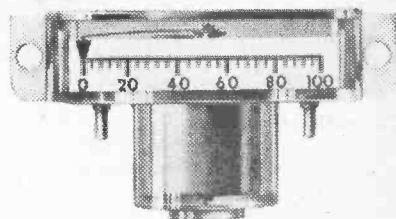
### VALVES MATCHED IN PAIRS

EL34 27/6, EL84 15/-, N709 15/-, 6V6G 15/-, 6BW6 14/- per pair. Push Pull O.P. Transformer for above 3-15 Ω 14/8, P. & P. 1/6. 12in. P.M. Speakers 3 Ω 24/6. Baker's "Selhurst" 12in. 15 Ω 15W, 80/-, 12in. Stereo Model, £77.70.

### SETS OF VALVES

DK91, DF91, DAF91, DL92 or DL94. 19/6  
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1C3, 1F1, 1FD1, 1P1, ..... 27/6  
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Postage and packing 6d. Over £1 post free. C.O.D. 9/6.

# T rade N ews



A Taylor model II Edgewise meter.

## MINIATURE METER

THE model II Edgewise Meter is a Taylor instrument designed for special applications. Its very small dimensions give it obvious advantages over meters of more conventional size, the length of the scale being only 1½ in. The meter is built into a transparent case and a wide range of sensitivities is available, commencing at 50µA.

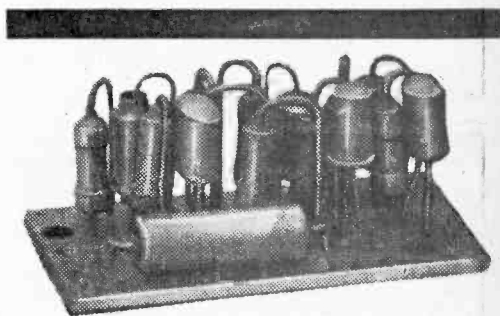
The model II is made by *Taylor Electrical Instruments Ltd., Montrose Avenue, Slough, Buckinghamshire.*

## MINIATURE TRANSISTOR AMPLIFIER

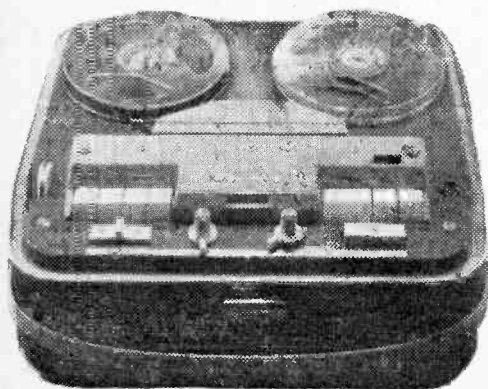
A NEW miniature transistor amplifier has recently come on to the market which has been designed for general use in intercom sets and portable record players and similar equipment. Its actual dimensions are 2 in. x 1 in. x 1 in. and it uses for power a standard 9V battery in a three-transistor circuit.

A feature of this amplifier is that it does not incorporate a transformer although one may be used if a high impedance input needs to be used.

The price of the amplifier (type 125) is 45s. and it is made by *Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London W12.*



A miniature transistor amplifier from Technical Suppliers Ltd.



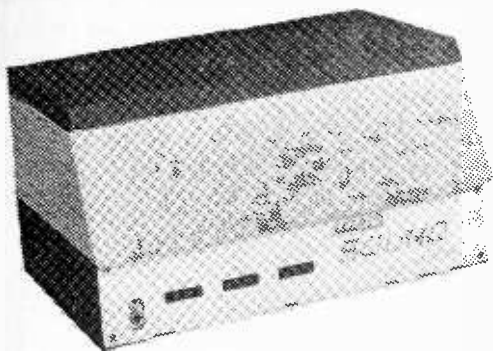
The new twin-track Grundig tape recorder.

## NEW TWIN-TRACK TAPE RECORDER

ONE of the latest model tape recorders from Grundig (Great Britain) Limited, is the TK41. This is basically the twin-track version of their model TK40, but is equipped in addition, with a 7W output stage with separate bass and treble controls. The loudspeaker is fed with a reduced output power to prevent damage to the loudspeaker when the volume control is at maximum.

Inputs are provided for microphone, telephone adaptor, radio extension loudspeaker/gramophone pick-up and radio diode. There are also facilities for the connection of a remote control which can be fitted as an accessory.

The TK41 costs 75 guineas, including the microphone, and is made by *Grundig (Great Britain) Limited, 40 Newlands Park, Sydenham, S.E.26.*



The Sound Stereo Addon Unit.

### STEREO UNIT

A USEFUL extra for owners of 1963 Sound tape recorders, models 42, 44, 38A and 40A, is the Sound Stereo Addon Unit. This unit is connected to any of these recorders by a special lead and enables pre-recorded stereo (four track) tapes to be reproduced.

The Addon unit is an amplifier matched to the tape recorder, and is capable of giving over 3W output. The printed circuit uses one ECC83 and one ECL86 valves. The cabinet has been designed to harmonise with the style of the tape recorders.

The cost of the unit is £14 14s. and it is made by *Sound Tape Recorders (Electronics) Ltd., 784-788 High Road, Tottenham, London N17.*

### POCKET SIZED INSTRUMENTS

TWO radio servicing instruments made by Don Bosco, an American firm, can now be obtained in this country. They are both pocket sized and are carried as a pen, being less than 6in. long and only  $\frac{1}{2}$ in. in diameter and being fitted with a pen clip.

The "Mosquito" signal injector, one of the instruments, provides a signal source (1kc/s with harmonics to 30Mc/s) for various applications. It

generates a signal covering the audio i.f. and r.f. spectrum in any circuit under test.

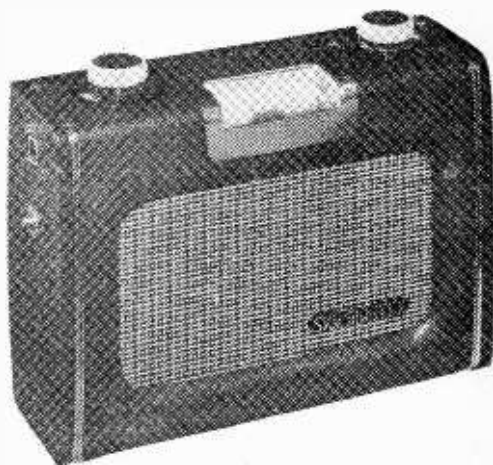
The "Stethotracer" is a multipurpose instrument to be used alone or with a range of accessories as a complete signal tracer.

Both these instruments use a self contained 1½V battery for power. The cost of the "Mosquito" is £5 15s. and the "Stethotracer" is £12 15s. The U.K. suppliers of all Don Bosco equipment are *Unitec, 57 Longfield Road, Harpenden, Hertfordshire.*

### NEW PORTABLE RECEIVER

THE latest transistor receiver to come from the Ever Ready Co. Ltd., is the Sky Master. This is a six-transistor model covering Long and Medium wave bands. It is available in either blue or tan and it operates from a PP7 battery. The price is £17 17s. which includes purchase tax and battery.

*Ever Ready Co. (G.B.) Ltd., Hercules Place, London N7.*



Ever Ready's latest portable receiver.

## International Conference on Satellite Communication

About 500 satellite communication experts, from several countries, gathered at the Institution of Electrical Engineers in London for the International Conference on Satellite Communication held in November, this year.

The Conference, organised by the Electronics Division of the I.E.E. was opened by Sir Ronald German, Director General of the Post Office. Others taking part were Captain C. F. Booth, Mr. F. J. D. Taylor and Mr. W. J. Bray (the British Post Office team responsible for engineering the Goonhilly project) and Mr. E. F. O'Neal, in charge of the Telstar project from the United States side, who was accompanied by other leading U.S. engineers from the Bell Telephone Laboratories and elsewhere.

More than 60 papers were presented and discussed, the object of the Conference being to bring together a representative cross-section of those actively concerned with furthering the science and technology of communications satellites and associated ground stations.

The Conference was divided into 11 sessions. Three dealt with aspects of complete satellite communications systems, and a further three with ground station aeriels.

Projects Telstar and Relay, the first experimental systems involving active civil communications satellites, occupied two sessions devoted to the satellites themselves and the associated ground station equipments.

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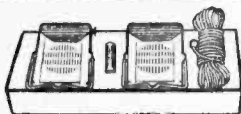
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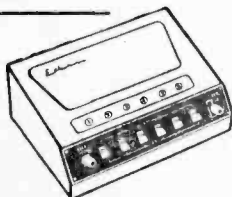


#### MAILPLAN PRICE

**89/6** Incl. PP3 battery, and 25 yds. lead with plugs. P. & P. 3/-.  
(Today's value 8 gns.)

#### 7 Station De Luxe Transistorised Intercom

The very latest in Office and Factory communication. Calling is audio and visual. Battery operated but consumes current only when calling or talking. Neat compact attractive units, up to 8 extensions supplied separately. Battery life 300 hours.

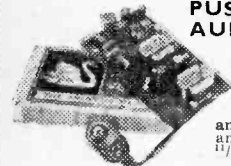


Master **14 GNS.** Post free.  
Extension 2 gns. Post free.

**HALF THE PRICE  
OF OTHER MAKES**

Construct your own Record Player, Intercom,  
Tape Recorder, etc. with the

#### PK.543 SUBMINIATURE 4-TRANSISTOR PUSH-PULL AUDIO AMPLIFIER 52/6



An assembled and wired miniature amplifier incorporating output transformer, and 4 transistors, class B, 200 m. watts. All connections for battery, speaker and volume control. The quality is amazing. Complete with instructions and circuit P217A. Size 3 x 1 1/2 x 1 1/2 in.

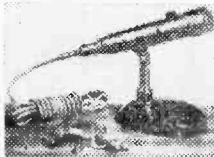
8 ohm speaker to suit above, 21". Flux density, 7,800 gauss. Power, 200 mW. **16/6** P. & P. 1/-

#### M178 CRYSTAL LAPEL MIKE 17/6

100-9,000 cps. 1 1/2 in. diam., 5ft. lead. P. & P. 1/-

#### SLIM CRYSTAL 3-way MICROPHONE

- Hand held.
- Stand mounted, or
- Suspended by lavalier cord.



#### MODEL 100C 39/6 Post Free

Check the spec. and judge for yourself. Response 60-10,000 cps. Built-in ON-OFF Switch. Output Level -52 dB. Omni-directional. Termination above 500 K ohms. Satin Chrome Finish. Accessory Table Top Stand, 8/6.

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**18/9** P. & P. 1/-

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Measures Leakage currents between Collector/Base and Collector/Emitter at any voltage between zero and 25 V. Specially designed for all receivers using PNP Transistors.

Size 5 1/2 x 3 x 2 1/2 in.  
NOV you can carry out fast testing of transistors and miniature transistor receivers without removing transistors from circuit. Self-contained signal tracing oscillator, self-contained variable power supply.

### Miniature Clear Plastic Panel Meters

#### FOR YOUR HOME BUILT TEST EQUIPMENT

DC MICROAMMETERS Model MR.25 0 to 50  $\mu$ A ... 39/6  
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VU METER MODEL VR. 1P. Calibrated and damped in accordance with standard VU Meter Practice. Upper scale reads -20 to +3VU. Lower scale 0-100% modulation. Uses precision carbon film multiplier resistor and full wave rectifiers. 42/6.



### SKANTEST—THE LOWEST PRICED L.O.P.T. TESTER

Tests TV Windings by shorting turns by unique pulse method. This compact instrument can save you pounds. It detects a single shorting turn in a line output transformer, deflector coil or other Windings. The pulses provided by the instrument detect intermittent faults. In position one, the continuity of the Windings is checked; in position two, high impedance coils, and in position three, low impedance coils. Once you have used the Skantest you will regard it as a must in TV Servicing.

Exclusive Mailplan Offer **99/6** P. & P. 2/9

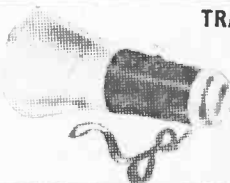
### TRANSISTOR MEGAPHONE

#### MODEL ER304

The smallest ever! Incorporates printed circuit amplifier with current limiting device to give effective battery life. Range up to 1,000 feet. Size 10 1/2 x 6 in. dia.

**12 GNS.**

Complete with batteries and shoulder strap. Post free.



### MULLARD TAPE RECORDER AMPLIFIER

Printed circuit board and set of 27 capacitors ranging from 60 + 50  $\mu$ F at 350 v. to 47 pF. **28/-** P.P.

### MODEL V-7A/F VALVE VOLTMETER

Equal to many higher priced instruments. Gold-plated printed-circuit. High input impedance (11 meg-ohms). The V-7A measures A.C. volts (0-1.5, 5, 15, 50, 150, 500, 1,500) R.M.S. and A.C. volts (0-4, 14, 40, 140, 400, 1,400 and 4,000) pk-to-pk. D.C. volts (0-1.5, 5, 15, 50, 150, 500, 1,500) Ohms (with 10 ohms centre) X1, X10, X100, X1,000, X10K, X100K and X1 megohm.

**£19.18.6** Complete with 32-page handbook.



MODEL V-7A (in kit form). **£13.18.6**

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## 1/2 WATT 3 TRANSISTOR AMPLIFIER READY BUILT



**45/-** Plus 1/6 P. & P.

- 1/2 w. Peak output.
- Output to 3 ohmspeaker.
- Push-pull output stage.
- 9 volt operation.

A printed circuit high gain amplifier. Size 5" x 2" x 1". Three Newmarket Transistors (two NKT 251 and NKT 252). Ideal for intercom or as record player amplifier.

## 2 WATT 4 TRANSISTOR AMPLIFIER READY BUILT

A 2 watt 4 transistor amplifier with 2 driver and push-pull stage. Size 5" x 2" x 1 1/2". Plus 1/6 P. & P.

**62/6**

Please send S.A.E. for full details of these and other transistor designs

# MEL ELECTRONIC CO.

REAR OF 240 HIGH STREET  
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# THE NEW TRANSISTOR 6 PANDORA

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# some further notes on the *Regency*

SOME OBSERVATIONS AND  
RECOMMENDATIONS BY THE AUTHOR  
OF THIS POPULAR P.W. RECEIVER, FOR  
THOSE WISHING TO BUILD IT.

By D. B. Pitt

SINCE the publication of the *Regency* in the April 1962 issue of PRACTICAL WIRELESS, a fair amount of correspondence has taken place with readers, and it is the purpose of this article to summarise the main points raised.

Among readers who experienced difficulties with the receiver, there were three main complaints: (1) insensitivity (2) difficulty in following the "adjustment" procedure (p.1129) (3) instability. These three subjects will be dealt with in order, the last mentioned at some length.

Owing to the exigencies of printing, the writer did not have an opportunity of reviewing proofs prior to publication and a few small changes passed uncorrected.

## Insensitivity

(1) The *Regency* was designed around two SB305 transistors (surface barrier type) and two OC72 transistors. Since SB type transistors are manufactured by only one company (Semiconductors Ltd.) and are not very widely retailed at present (though generally available by post) OC45 transistors were editorially substituted in the blueprint.

Ordinary junction type R.F. transistors such as the OC45 and OC44 are very widely retailed and the Editor felt that these would be likely to give reasonably satisfactory reception in most areas.

Correspondence since this date has revealed that many readers are *not* able to obtain sufficient volume in this way, and the writer therefore strongly recommends the use of the surface barrier types employed in the prototype. The SB078 transistor is, incidentally, a perfectly good substitute for the SB305 in this circuit.

This does not mean that *only* surface barrier transistors may be used for Tr1 and Tr2 to give good sensitivity. Any of the new diffused-base types (OC169, OC170, OC171 and equivalent type transistors) may be used *in principle*, especially for Tr1, but owing to the very high gain of these transistors, it may be found necessary to include a resistor in the *emitter* lead, especially of Tr2, in order to obtain stable performance. The value of such resistors can best be found by experiment, other component values not being affected.

## Adjustment Difficulties

(2) The writer's semi-profile drawings of the volume controls appeared on the blueprint in "plan" view. Since the controls are symmetrical in form, the "plan" view is capable of two interpretations and some beginners to radio construction unfortunately chose the wrong sense. This error resulted in the reversal of the terms "clockwise" and "anti-clockwise" in the portion of text headed "Adjustments" and caused some confusion.

Looking at the front of the receiver, full *clockwise* rotation of the sensitivity control should be arranged, of course, to produce *maximum* resistance between points 26 and 27.

## Instability

(3) During the two months following publication of the *Regency*, a number of readers reported instability in the receiver and these have been carefully analysed.

Instability often occurs in receivers through irregular coupling of the stages by reason of a shared battery resistance. This is most common at high supply voltages. Since the *Regency* uses 4½V instead of the more usual 9V, and the battery is by-passed by a 100µF capacitor, instability from this cause is hardly likely to occur and may safely be ignored.

Reflex receivers run the risk, however, of a special type of instability peculiar to their design. This arises from the presence of inductive elements in both collector and base circuits.

For efficient performance, the R.F. choke inductance must be kept high, especially if reception on the long wave band is required. The impedance presented by the choke at the higher frequencies (200-300m) may now be so great as to react with the inductance of the medium wave coupling coil so as to set up an audible oscillation. The inductance of this coupling coil must therefore be kept *as low as possible* consistent with reasonable transfer of signal.

The aerial rod assembly specified (Repenco FR2) has medium-wave coupling *within the required limit*. Likewise, the hand-wound coil and frame-aerial described (p.1129) are "tapped" at a point *well within the limit of safety*.



The Editor was kind enough to allow the writer to examine a *Regency* receiver submitted by a reader who complained of unstable performance.

Of the five inductors used, *none* were of the specified type, so that instability could have arisen in a number of ways. Nevertheless, the receiver functioned perfectly as soon as a suitable medium-wave coil was substituted.

The aerial assembly employed by this reader, although a near enough substitute for use in a superhet receiver (for which most of such commercially supplied "aerials" are intended) was *not* a near enough substitute for use in a reflex receiver of high R.F. gain such as the *Regency*.

The inductance of the coupling coil rises with increased rod diameter, with increased number of turns, and with increased wire diameter. In the case of the receiver examined by the writer, the increase was due to *all three causes* together.

This defect can, of course, be readily cured by simply removing a few turns from the medium-wave coupling-coil.

To a few readers who had purchased an unsuitable aerial assembly and who did not care to tinker with an expensive component, the writer suggested placing a small resistor (typically 100 $\Omega$ ) across the medium-wave coupling-coil so as to shunt part of the signal. This has the desired effect at the cost of some slight loss in sensitivity.

A resistor (typically 1,000 $\Omega$ ) placed across the R.F. choke, gives a similar effect but, of course, needlessly reduces the efficiency of the long-wave band.

#### Loudspeaker

Details of the loudspeaker were unfortunately omitted from the blueprint. The speaker used by the writer was an Elac 7in. x 4in. and this, or a similar type, is recommended. The *Regency* circuit will drive *any* large-diameter, high-flux speaker of from 2 to 5 $\Omega$  impedance.

#### Short-wave Reception

The frame-aerial described on p.1129 is for the medium-wave band. If the Surface-Barrier transistors preferred by the writer are used, reception up to at least 5Mc/s may readily be obtained by simply reducing the number of turns on the frame aerial. The tapping, as before, should be after the first turn.

The hand-wound ferrite-rod aerial described does not offer quite such good possibilities owing to losses within the ferrite at high frequencies. Nevertheless, good "top band" and trawler band *at least* may be expected by reducing the number of turns.

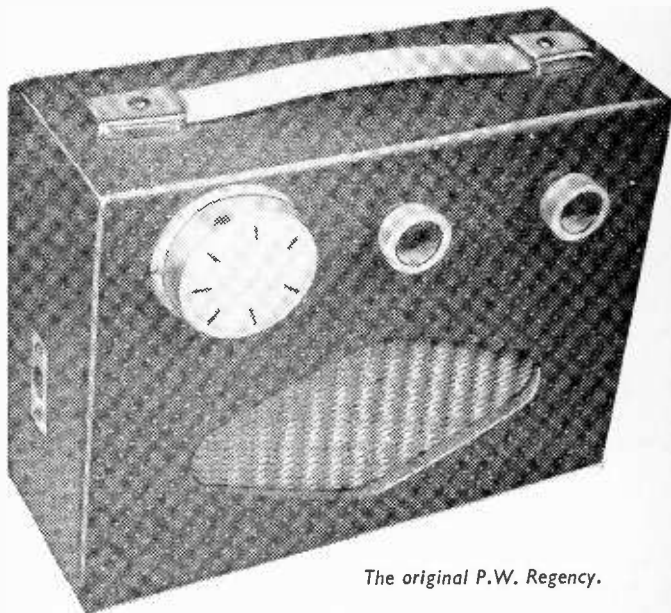
#### Car Aerial

A number of readers have requested details of how to make the *Regency* work inside a car, using a standard "whip" type rod aerial.

For this, a length of co-axial cable is required. The outer braid is attached at one end to the frame of the car (preferably at the whip aerial's fixing screw). The other end of the outer braid goes to point "Y" in the receiver. The inner conductor of the cable is attached at one end to the metal of the "whip" itself and at the other end *either* directly to point 29 of the receiver *or* via a 47pF capacitor to the side-tag of the tuning condenser.

#### S.B. Transistors

The S.B. transistors used by the writer in the



The original P.W. Regency.

prototype receiver may be obtained from many advertisers in this magazine.

In case of difficulty they may be ordered directly from "Semiconductors Ltd.", Cheyney Manor, Swindon, Wilts. Types SB305 and SB078 are about equally suitable. ■

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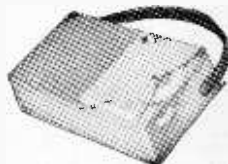
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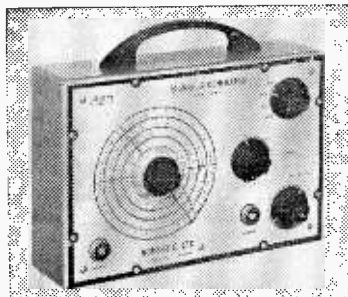
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# Club News

## REPORTS OF CURRENT ACTIVITIES

**BARNSELY AND DISTRICT AMATEUR RADIO CLUB**  
 Hon. Sec.: P. Carbutt, G2AFV, 19 Warner Road, Barnsley, Yorkshire.

An illustrated tape-recorded lecture provided entertainment for members at the meeting on November 9th, the subject of the lecture being an expedition to St. Pierre. On November 23rd members had a chance to compare notes on their transmitting/receiving apparatus at a display of equipment organised by the Club.

Future Event:  
 December 14th—"Receiver Construction", by Mr. W. W. Williams.

**CHILTERN AMATEUR RADIO CLUB**  
 Hon. Sec.: H. D. Colman, G3PVJ, 301 Micklefield Road, High Wycombe, Buckinghamshire.

The only meeting of this Club in November was held on Thursday, 29th, and was devoted to a lecture on "Amateur Closed-circuit TV".

**CLIFTON AMATEUR RADIO SOCIETY**  
 Hon. Sec.: C. Godsmark, G3IWL, 211 Manwood Road, London, S.E.4.

The subject under discussion at the meeting on November 2nd was the club contests held from time to time for members.

**DERBY AND DISTRICT AMATEUR RADIO SOCIETY**  
 Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

November proved to be a busy month for members of this Society, beginning with the annual trip to London for the R.S.G.B.'s exhibition, on Saturday, 3rd. On November 7th a surplus sale was held and on the 10th some members took part in the second R.S.G.B. 1-8Mc/s contest. R. Cullen gave a talk entitled "Radio Controlled Models" on November 14th and the last official meeting for that month was devoted to a film show.

The first meeting for December was taken up by another surplus sale.

Future Event:  
 December 12th—"The Club in Retrospect".

**LEICESTER RADIO SOCIETY**  
 Hon. Sec.: R. E. Hill, 28 Fayhurst Road, Leicester.

At the recent A.G.M. of this Society the following officers were elected: Mr. M. Harrison, chairman; Mr. R. E. Hill, secretary; and Mr. H. A. Gray, treasurer.

Activity during the winter months will be confined to erecting the Society's operating room to be equipped with a 120W transmitter for the h.f. bands.

**MELTON MOWBRAY AMATEUR RADIO SOCIETY**  
 Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicester.

The informative lecture on "Crystal Grinding" given by G3FDF at the November meeting, was enjoyed by all those members who attended.

Future Event:  
 December 20th—"Transistors", by J. L. Bowley.

**MITCHAM AND DISTRICT RADIO SOCIETY**  
 Hon. Sec.: B. Blandford, 1 Biggin Avenue, Mitcham, Surrey.

Planning and organisation for the Society's participation in N.F.D. were under discussion at the meeting on November 2nd. On November 16th, G8TB gave a talk entitled "Why be afraid of Transistors?"

**NORTHERN HEIGHTS AMATEUR RADIO SOCIETY**  
 Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

This society ended November informally with a ragchew meeting on the 21st.

On December 5th members enjoyed a film show.  
 Future Event:  
 December 12th—The Annual Dinner.

**PURLEY AND DISTRICT RADIO CLUB**  
 Hon. Sec.: E. R. Honeywood, G3GKF, 105 Whytecliffe Road, Purley, Surrey.

Mr. J. Vaughan, G3DQY, gave an interesting talk and demonstration on November 2nd, dealing with "Pocket Paging Systems". At the second meeting of the month, Mr. R. Sykes, G3NFV, talked about the "Ham Hop Club".

**READING AMATEUR RADIO CLUB**  
 Hon. Sec.: R. G. Nash, G3EJA, Peacehaven, 9 Holybrook Road, Reading, Berkshire.

G3NNG gave an interesting lecture to members on November 24th; his lecture was called "Transistors v.h.f. and u.h.f.".

Future Event:  
 December 29th—"Transistor Tx and Rx".

**SLADE RADIO SOCIETY**  
 Hon. Sec.: D. D. S. Williams, 117 The Boulevard, Wylde Green, Sutton Coldfield, Warwickshire.

The lecture given on November 16th, entitled "Construction of Printed Circuits", was by member D. Wilson, who was followed by G. C. Simmonds, also a member of the society, and whose talk was called "An Analytical Review of D/F 1962".

The most important meeting for November was the Annual General Meeting, held on the 30th.

**WIRRAL AMATEUR RADIO SOCIETY**  
 Hon. Sec.: A. Seed, G3FOO, 31 Wither Avenue, Bebington, Wirral, Cheshire.

At the recent A.G.M., N. Kendrick was elected chairman, A. J. G. Keiller, treasurer, and A. Seed, secretary.

On November 7th, the second lecture on s.s.b. was given by G3FOS, and on the 16th members attended the local R.S.G.B. lecture given by Dr. Jennison.



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# Short-wave Listeners' Log

**I**NTERFERENCE can often be troublesome on the short-wave bands, and any method of reducing it is generally well worth while, especially when receiving weak, distant stations. Interference can be of several kinds, and may reach the receiver in various ways, thus the appropriate cure must be chosen.

Interference is seldom troublesome when powerful transmissions are tuned in. The strong signals reduce receiver sensitivity due to the AVC circuit, and in any case help to over-ride interference. But with weak signals and maximum receiver sensitivity, trouble from static, electrical equipment, etc., may be severe.

A general background of clicks and similar noise, from electrical equipment, may be introduced through the mains, and in such a case, a mains suppressor will help considerably. Ready-made plug-in suppressors are available, but quite often a single by-pass capacitor, across the mains circuit at the receiver, will reduce such noise. Alternatively, one capacitor may be wired from each mains lead to earth, or receiver chassis. In A.C./D.C. circuits, a capacitor from rectifier anode to chassis may be needed. Capacitors of 0.05 $\mu$ F to 0.01 $\mu$ F, 500V rating are suitable suppressor components.

## Suppressor Chokes

In severe cases, suppressor chokes may be used in series with the mains leads. For the average receiver, solenoid windings of about 200 turns of 28s.w.g. wire, on  $\frac{1}{2}$ in. diameter or similar formers, will do.

The complete suppressor is best enclosed in an earthed metal case.

## Aerial Filters

If modulation hum and similar noises are evident, an aerial filter consisting of two 100pF capacitors and an H.F. choke will probably be needed to clear this trouble. The capacitors are wired in series with the choke joined from their junction to chassis. One capacitor is then taken to the aerial, and the other to the receiver aerial socket. This filter is particularly successful with A.C./D.C. receivers, which should in any case be so connected to the mains plug (that receiver chassis goes to mains neutral (black, or "N").

If interference ceases with the aerial disconnected, this indicates that it is not carried on the mains, and that the aerial, down-lead, earth and aerial coupling system may need modification.

The aerial is best kept clear of sources of local interference—that is, away from roads, mains wiring, telephone wires, etc. Fitting an aerial up unnecessarily near to

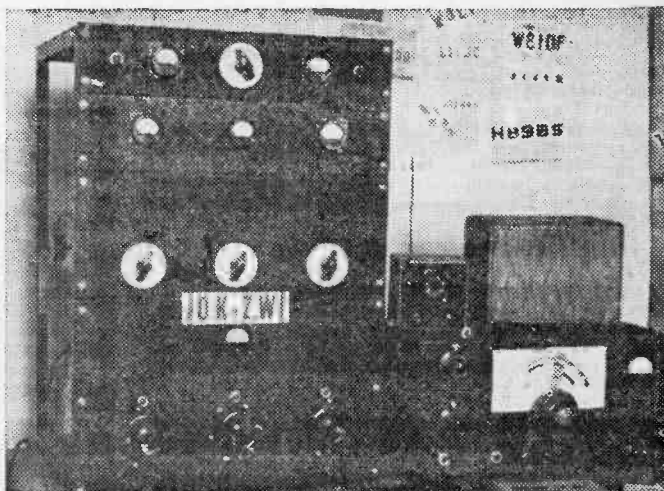
such interference sources is unwise. In some the aerial can be well clear, but any trouble taken to improve the aerial is always worth while.

With end-connected aerials, the down-lead may also pick up interference, so it must be clear of house wiring, etc. If this is impossible, a simple wire dipole, with coaxial or twin feeder, will greatly reduce interference.

## Faraday Shield

A coupling transformer incorporating a Faraday shield may be used between aerial and receiver. This provides normal electromagnetic coupling, but due to the presence of the shield reduces electrostatic coupling. For general short-wave use, a  $1\frac{1}{2}$ in. diameter former can be employed, with 28s.w.g. wire. The primary may be 14 turns spaced to occupy about  $1\frac{1}{2}$ in.

For a balanced twin aerial feeder, take one lead to each end of the primary, and solder on a centre-tap, which is earthed. With a single aerial lead, take this to one end of the primary, and earth the other end. A layer of insulating material is placed over the primary. The shield is aluminium foil a little wider than the coil, and long enough to form a single turn. Insulation is placed so that the end of the shield is not electrically in contact with the beginning, and the shield is earthed. A layer of insulation is placed on the shield and the secondary, 14 turns, is wound on this. For a receiver with a single aerial terminal, wire the secondary to the aerial terminal and chassis (earth). For a receiver with balanced or dipole input, connect each end of the secondary winding to one input socket.

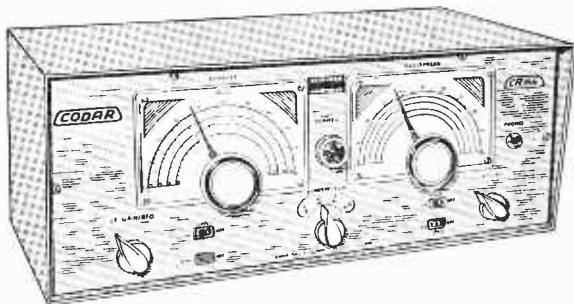


This photograph shows the 15W home-made station of a member of the Central Radio Club, Prague, Czechoslovakia.

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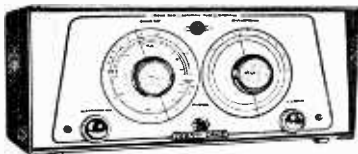
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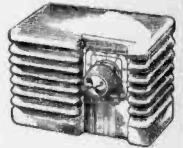
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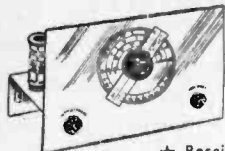
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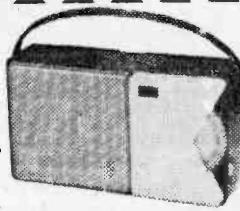
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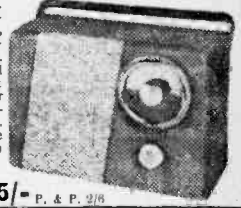
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# For Your Bookshelf

## REVIEWS OF RECENT PUBLICATIONS

### THE TECHNIQUE OF THE SOUND STUDIO

By Alec Nisbett; published by Focal Press Ltd.  
288 pages, 5½ x 8½ ins. Price 42s.

**W**RITING from his experience as a BBC studio manager and producer, the author has given us a comprehensive and informative account of the apparatus and techniques of recording sound based on methods employed at the BBC.

He covers a wide ground, taking in the basic design of a studio to the latest production techniques. Typical chapters are on microphone techniques for speech and music, checking quality, editing, fades and mixes, sound effects, echo techniques. One chapter deals specifically with *Radiophysics*, a study of the techniques used and the theoretical background to the building of tailor-made new sounds and the creative distortion of conventional sound. The relationship is shown between radiophysics and its parent fields of *musique concrete* and electronic music.

This authoritative book avoids unnecessary scientific and technological phraseology and is written in an easy style which keeps the reader interested—the facts are digested effortlessly. It will appeal to professionals and amateurs alike, for although the subject matter is initially based on the highest grade commercial equipment it also shows how the best results can be obtained with the simplest inexpensive microphone and tape recorder. For those interested in amateur recording, amateur dramatics, etc., this book contains a wealth of practical advice and will answer many of those hitherto difficult problems.—*W.N.S.*

### RADIO SERVICING POCKET BOOK

Edited by J. P. Hawker; published by George Newnes Ltd.  
198 pages, 4½ x 7 ins. Price 12s.6d.

**M**ANY readers will already be familiar with the original edition of this useful book, which now appears as a fully revised second edition.

A good deal of new material is now included and of particular interest is the section on the servicing of transistor receivers and the repair of printed wiring panels. The sections on servicing and alignment of v.h.f.-f.m. receivers has been expanded and the chapters dealing with car radio receivers, the suppression of car electrical interference, and record players (including stereo) are all enlarged.

Apart from basic details of modern radio circuitry, the book contains useful information on servicing instruments, fault finding and alignment, aerials, gram mechanisms and pick-ups. There is also a 35-page section of tabulated reference data including valve base connections, transistors and diodes, valve equivalents, BBC and European broadcasting stations, battery equivalents, wave-length-frequency conversion and so on.

To sum up, this useful pocket manual provides in a compact form much of the essential information needed in servicing both a.m. and f.m., valve and transistor, radios and should repay the initial outlay many times over. It forms a valuable companion volume to the Television Engineers' Pocket Book.—*D.C.*

### HIGH FIDELITY POCKET BOOK

By W. E. Pannett, A.M.I.E.E.; published by George Newnes Ltd.  
314 pages, 4½ x 7½ ins. Price 40s.

**T**HIS new addition to the Newnes Pocket Book Series has been compiled to bring together information on all aspects of high quality sound reproduction in the home.

Introductory chapters on the nature of sound and its reproduction are followed by sections giving basic information, with circuits, on pre-amplifiers, tone control systems, power amplifiers, etc. This is followed by chapters on a.m. and f.m. radio tuners (again with full circuits), loudspeakers and loudspeaker enclosures.

Three chapters deal with disc and tape recording and reproduction. The book concludes with a section on power supply units, a collection of useful data and a glossary of terms used in sound reproduction.

This book is intended to appeal to the practising engineer, technician or to the home constructor enthusiast. The aim is to bring about a better understanding of the design and functioning of sound equipment. There is certainly a considerable amount of useful information packed into the 314 pages of this instructive book.—*J.S.*

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# Letters to the Editor

The Editor does not necessarily agree with the opinions expressed by his correspondents

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. **WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE.** If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of the cover.

## LOCAL COMMERCIAL RADIO

**SIR.**—I feel I cannot agree with the sympathies expressed by R. Robinson in the November issue of PRACTICAL WIRELESS. He, especially, as an amateur, should be aware of the seriousness of shortage of bandpace. That this should be cluttered up with multitudinous stations advertising each town seems to me to be against the ideas expressed by those who drew up the frequency allocations at Geneva.—N. J. H. DENT (Godalming).

## TEST TRANSMISSIONS

**SIR.**—In answer to Mr. A. J. Richards in the August issue of PRACTICAL WIRELESS. The test transmissions he hears are, as he says, transmitted by many countries. They are transmitted by government stations solely for communications purposes. The reason for these, in my country anyway, is to provide a test signal for ships entering and leaving the country, to tune in on. These tapes are played for a considerable time until the transmitting station considers the ship is tuned in. It then calls the ship several times and waits for an answer—on another frequency. Meanwhile the test transmissions continue.—K. R. MOON (Te Awamutu, New Zealand).

## FREAK M.W. SIGNAL ON TV RECEIVER

**SIR.**—It may interest readers to note that I have a 13 channel Pye VT4 TV receiver, here in far-away Malaya (where, by the way, there are no TV transmissions, as yet) with which I am surprised to note that I am able to pick up the local radio broadcast from apparently the nearby M.W. radio broadcast relay station (operating around 800kc/s), or alternatively from the main transmission of the same programme on approximately 8Mc/s, S.W. I receive the signal on channel five only—at one end of the fine tuning adjustment.

The aerial used is an indoor telescopic "V" type and although the reception is distorted it is quite audible. I have checked that this is not a radiated signal from a neighbour's radio set.

After having read of other freak receptions on radio and tape recorders in these columns, I wonder whether any other reader has experienced similar receptions to mine and whether an explanation can be offered?—E. R. SUNDARAJ (Kaha, Bharu, Kelantan, Malaya).

## BROADCAST BREAKTHROUGH

**SIR.**—With reference to those letters which have been appearing concerning "Broadcast Breakthrough"—I should like to say I have experience of a case up here in Ayrshire of reception of Luxembourg with no apparatus other than a pair of 50Ω headphones which are plugged into aerial and earth. Usually one requires a tuning circuit to select the carrier and some sort of a demodulation system before the modulation becomes audible; but *not* in this case. One simply connects the earphones to aerial and earth and listens. Readability is R4 and there is no sign of the usual Luxembourg fading experienced in these parts. What intrigues me, however, are the facts that no capacitors, resistors, coils, or any apparatus of any kind, other than a 54ft "Z" type aerial and earth connected to 'phones, are employed. That the local station, located at a distance of 35 miles is not heard: only Luxembourg some 600 miles away. Changing to a 2,000Ω set of 'phones only alters the volume: (We thought it was the coils in the head-set which were resonant at that frequency, leaving the inertia of the diaphragm to iron out the modulation) and lastly the introduction of an aerial trimmer makes very little difference either in series or parallel.—J. M. J. HARRING (Altonhill, Kilmarnock).

## CAN YOU HELP?

**SIR.**—I would be much obliged if any reader would lend or sell me certain copies of PRACTICAL WIRELESS, which I require for completing the information on certain circuits.

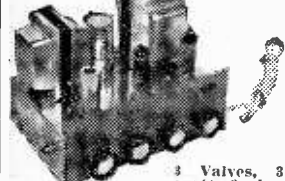
They are: November and December 1957, September 1958 and November 1960.—J. D. HILLS-HARROP (85 Hamlet Gardens, Hammersmith, London W6).

**SIR.**—I should like to know of any reader who would let me buy or borrow a copy of February 1961 PRACTICAL WIRELESS. I need this issue for the article on the Combined Radio and Table Lamp.—F. G. LAWRENCE (6 Essex Street, Forest Gate, E7).

**SIR.**—I wonder if any of your readers could supply me with an address from where I could obtain circuit diagrams and information for my 4660 receiver.—H. G. BROWN (4 Midcroft Avenue, Glasgow S4).

**SIR.**—I would be grateful if one of your readers would sell or loan me the circuit diagram of the R107 Communications Receiver, failing that, the valve line-up.—I. L. MCCALLUM (Elderslie Hotel, Largs, Ayrshire).

**MULLARD 3-3 HI-FI AMPLIFIER**



3 Valves, 3 watt, 3 ohm and 15 ohm. Output. A really first-class Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, EZ81. Extra HT and LT available for Tuner Unit addition. This is the ideal companion Amplifier for FM tuner units.

**TECHNICAL SPECIFICATION**—Freq. Response:  $\pm$  1db. 40 c/s.-25 Kc/s. Tone controls: Max. Treble Out 12 db at 10 Kc/s. Max. Bass Boost 14 db. at 80 c/s. Sensitivity: 100 Mv. for 3 w. output. Output Power (at 400 c/s): 3 w. at 1% total harmonic distortion. Hum and Noise Level: At least 70 db below 3 w.

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Contemporary style, exine covered cabinet in two tone maroon and cream. Size 18 x 13 1/2 x ht. 8 1/2 in., fitted with all accessories including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13 in. supplied.

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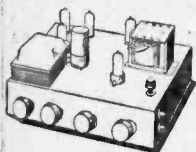
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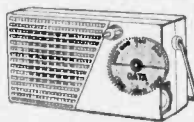
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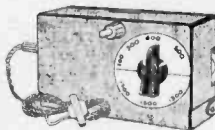


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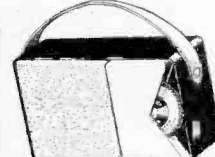
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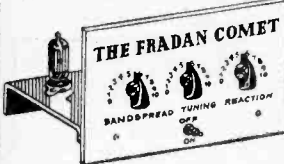


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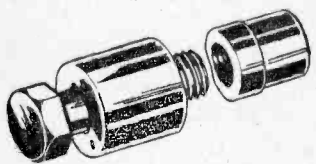
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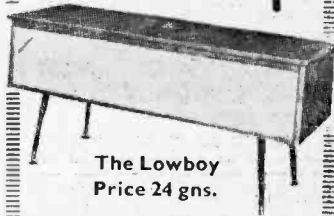
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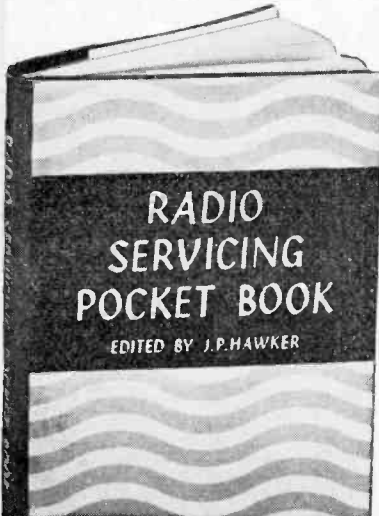
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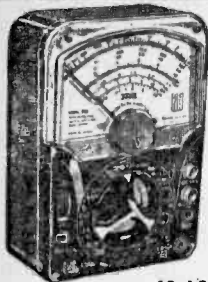
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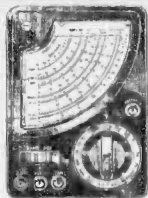
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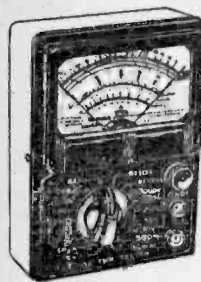
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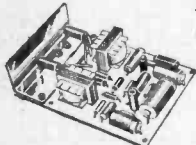
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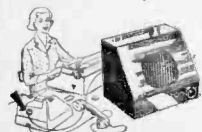
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3. De Luxe version of No. 1, also charges PP3 type batteries. 29/6. P.P. 1/-.
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★ 2-transistor transformer coupled, two speakers in moulded cabinets. Features 2-way Buzzer system and talking. Supplied complete with cable **89/6** P.P. 1/6 and batteries.

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Complete kits supplied with all necessary chemicals, brush, dishes, etc. Fully detailed instructions. 3-boards 5 1/2 x 3 1/2 in., 19/6, P.P. 1/-.

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Tubular unit, size 9 1/2 x 3 1/2 in. dia., which plugs into earphone socket of any transistor radio. Performance increase is fantastic. Ideal for home or car. 52/6. P.P. 1/6.

**PERSONAL EARPHONE**

- ★ 600 ohm. 10/6
  - ★ Crystal 6/-
  - ★ 1,000 ohm. 12/6
  - ★ 8/10 ohm. 9/6
- Fitted leads, Jack Plug and Socket.

**"CARVETER"**

**MOBILE TRANSISTOR SHORTWAVE CONVERTER**

As featured in May edition of "Radio Constructor." Just plugs into the aerial socket of any medium wave car radio. Crystal controlled, covers broadcast bands from 5 to 16 Mc/s. Total cost with sprayed metal cabinet, booklet and 39/40 metre band crystal, 69/6. P.P. 2/-.

**No modifications to your existing car radio at all! Full booklet 1/-.**

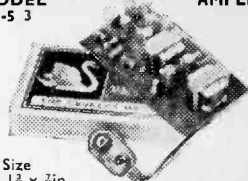
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★ Ideal for recording or amplifying telephone conversations. Supplied with screened cable. Fitted rubber sucker, 12/6. Have fun recording.

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Size 3 x 1 1/2 x 3/4 in.

A ready built miniature 250mW push-pull amplifier incorporating input and output transformers, 4 transistors, 9 volt battery snap cord, speaker and column connection leads. Ideal for use with record players, intercoms, hearing aids, tape recorders, etc. Complete with full instructions and circuit diagram.

**PRICE 52/6** P.P. 1/6

SUITABLE 2 1/2 in. SPEAKER 16/6

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● 6-7 1/2 volt Garrard turntable with crystal pick-up. Plays 45 r.p.m. Ideal for above amplifier. 55/- P.P. 1/6.

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New stethoscope type stereo earphones with adjustable tubes. Fitted miniature jack plugs and leads. 2 x 8 ohms impedance, 27/6.

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HIGH EFFICIENCY.



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**ACOS 40.** Desk Microphone with screened cable and built-in stand (list 50/-), 15/-, P.P. 1/6.

**ACOS 45.** Hand Microphone with screened lead, very sensitive, 25/-, P.P. 1/6.

**100 C.** Stick Microphone with muting switch and screened cable, detachable desk stand and neck cord, 39/6, P.P. 1/6.

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(Illustrations of all types in our New Catalogue. 1/- post free).

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PADdington 100B/9  
5 HARROW ROAD, LONDON W.2  
Open Monday to Sat. 9-6, Thurs. 1 o'clock

← TURN PAGE →

# Practical Wireless

## BLUEPRINT SERVICE

These blueprints are drawn full-size and although the issues containing descriptions of these are now out of print, constructional details are available free with each blueprint except those marked thus (\*).

Preferably a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, W.C.2.

### DOUBLE-SIDED BLUEPRINTS

Each blueprint in this series contains details of two separate instruments or items of equipment.

The Strand Amplifier ... ..	}	*	5/-
The PW Signal Generator ... ..			
The Savoy VHF Tuner ... ..	}	~	5/-
The Mayfair Pre-amplifier ... ..			
The Berkeley Loudspeaker Enclosure	}	+	5/-
The Luxembourg Tuner ... ..			
The PW Troubadour ... ..	}	+	7/6
The PW Everest Tuner ... ..			
The PW Britannic Two ... ..	}	+	6/-
The PW Mercury Six ... ..			
The PW Regency ... ..	}	+	5/-
The PW International Short Wave Two			

### RECEIVERS

The Tutor ? ... ..	3/-
The Mini-amp * ... ..	5/-
The Citizen * ... ..	5/-
Junior Crystal Set ... ..	PW94 2/-
Dual-wave Crystal Diode ... ..	PW95 2/6
Modern One-valver ... ..	PW96 2/6
All-dry Three ... ..	PW97 3/6
Modern Two-valver ... ..	PW98 3/6
A.C. Band-pass Three ... ..	PW99 4/-
A.C. Coronet-4 ... ..	PW100 4/-
A.C. D.C. Coronet ... ..	PW101 4/-
The PW Pocket Superhet ... ..	5/-

### MISCELLANEOUS

The PW 3-speed Autogram ... ..	8/-
The PW Monophonic Electronic Organ ... ..	8/-
The PW Roadfarer * ... ..	5/-
The PT Band III TV converter ... ..	1/6

### SOME EARLIER DESIGNS

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

Experimenter's Short Wave ... ..	PW30a 2/6
Midget Short Wave Two ... ..	PW38a 2/6
Simple S.W. One-valver ... ..	PW88 2/6
Pyramid One-valver ... ..	PW93 2/6
BBC Special One-valver ... ..	AW387 2/6
A One-valver for America ... ..	AW429 2/6
Short-Wave World Beater ... ..	AW436 3/6
Standard Four Valve S.W. ... ..	WM383 3/6
Enthusiast's Power Amplifier ... ..	WM387 3/6
Standard Four Valve ... ..	WM391 3/6
Listener's 5-Watt Amplifier ... ..	WM392 3/6

### QUERY COUPON

This coupon is available until 4th January, 1963, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, JANUARY, 1963



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Size only  
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**REALLY  
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Size  
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A 7-stage push-pull output printed circuit portable radio of attractive appearance. Features 5in. speaker, clearly marked printed circuit panel, ferrite aerial, carded components and fully detailed and illustrated building instructions.

★ Plans Free on Request ★  
Clearly marked dial with all station names. Full countrywide performance including Radio Luxembourg without station overlap.  
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**ALL PARTS IN STOCK**  
For "PW"-6 Mercury-6, Weyrad MW, LW and MW/SW, "PW" Regency, Alpha-3, Ranger 2 and 3, Mini-amp and Citizen. Let us quote for your circuit.  
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New 6-transistor and diode pocket radio. Latest miniature type complete with personal phone, battery and leather case.

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Red or Blue  
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**Three  
transistors  
Two  
diodes**

A new printed circuit 5-stage personal pocket radio fully tunable on medium waves and top band, including Radio Luxembourg. A tiny but powerful radio designed to fit into your jacket top pocket. No external aerial or earth. Full station separation with amazing sensitivity and volume. Fully illustrated instructions free on request with clearly marked pre-tinned printed circuit and 15c grade components make this radio Easy to Build and use. Fitted volume control and calibrated dial. All parts sold separately. After sales service and guarantee.

TOTAL  
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## "PW-6" SUPERHET RADIO

Medium and  
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Pocket  
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Size  
 $5\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$  in.



6-transistor and diode printed circuit superhet radio. Features attractive two tone cabinet, push-pull output, high "Q" ferrite aerial. Fully detailed step by step building instructions.

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