

PRACTICAL WIRELESS

JUNE 1964

2¹/₂

**FREE
INSIDE!**

**2 in 1
BLUEPRINT**
to build this
**COMPACT SW
TRANSCEIVER**



and this

MAINS POWER PACK
for BATTERY TRANSISTOR RADIOS



ADCOLA
ESTD. 1911 LIMITED
 (Large Trade Mark)

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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Praise for the **WHARFEDALE SUPER 10/RS/DD**

The following letter is typical of many received praising the performance of the new Wharfedale Super 10/RS/DD and the new Golden 10/RS/DD, both of which have a remarkably wide and smooth response as the response curve indicates.



16 Grant House,
Albion Avenue,
LONDON, S.W.8.

Dear Mr. Briggs,

I feel I must write to you to say how pleased I am with my converted W10 Speaker (now a Super 10/RS/DD) which I received safely on Saturday.

The treble response is a delight to hear and even my poor quality records sound better, no doubt due to the absence of peaks in the middle and upper register. My pressure unit tweeter has now been dispensed with as it certainly cannot compete with the treble in your unit.

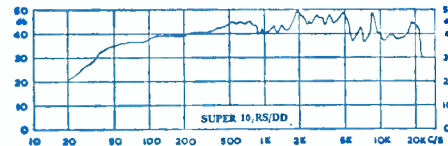
Being lucky enough to live within good range of Wrotham, I was able to put it through tests with various transmissions including the Proms, and we all have been most impressed—the bass improvement is also exceptionally good.

Yours sincerely,

Geo. H. Hunter.

Impedance 10/15 ohms only. lin. dia. centre pole. Flux density 16,000 oersteds. Max. input 10 watts rms or 20 watts peak. Frequency range 30-20,000 c/s. Aluminium voice coil. Roll surround and double diaphragm.

Axial response curve. Mic. distance 12in. Input 4 v. at 1,000 c/s.



PRICES: SUPER 10/RS/DD £10.18.8 including P.T.
GOLDEN 10/RS/DD £7.17.5 including P.T.

Descriptive Leaflet on request



**WHARFEDALE WIRELESS WORKS LTD.
IDLE BRADFORD YORKSHIRE**

Grams: 'Wharfedel' Bradford

Phone: Idle 1235/6

*- all these and
hundreds more*

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COMPLETE VALVE LIST FREE WITH ORDER

METAL RECTIFIERS

RM1 7/6	14A86 23/-	16RD 2-2-8-1 12/- (FC142)
RM2 8/-	14A97 26/-	16RE 2-1-8-1 10/- (FC150)
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RM4 17/6	14RA 1-2-3-2 21/- (FC301)	18RA 1-1-16-1 7/- (FC116)
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BRAND NEW TRANSISTORS

OC35 10/-	OC72 8/-	OC8D 5/-
OC42 6/-	OC74 8/-	OC81m/pt 12/6
OC44 5/-	OC75 8/-	OC82 6/-
OC45 5/-	OC77 8/-	OC82D 6/-
OC71 5/-	OC81 5/-	OC170 6/-

SILICON RECEIVERS

400 volts 350 mA 7/6 each

SETS OF VALVES

IR5, IS5, IT4, 3S4, 3V4	Set of 4, 17/-
DAF91, DF91, DK91, DL92, DL94	Set of 4, 17/-
DAF96, DF96, DK96, DL96	Set of 4, 25/-

R.S.T. VALVE MAIL ORDER CO. Tel: MITcham 6202
211a STREATHAM ROAD MITCHAM SURREY
Open Daily to Callers



CLEAR PLASTIC PANEL METERS

First grade quality meters, available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows: Type MR. 38P.

1 1/2 in. square fronts.

50µA	22/8	1A. DC	22/8
100µA	22/8	5A. DC	22/8
200µA	27/8	3V. DC	22/8
500µA	25/-	10V. DC	22/8
50-0-50µA	22/8	50V. DC	22/8
100-0-100µA	27/8	100V. DC	22/8
1mA	22/8	150V. DC	22/8
5mA	22/8	300V. DC	22/8
10mA	22/8	500V. DC	22/8
50mA	22/8	750V. DC	22/8
100mA	22/8	15V. AC	22/8
150mA	22/8	50V. AC	22/8
200mA	22/8	150V. AC	22/8
300mA	22/8	300V. AC	22/8
500mA	22/8	500V. AC	22/8
750mA	22/8		

2 1/4 sq. fronts.

Type MR. 52P	1mA	32/8	
50µA	47/8	10mA	32/8
100µA	47/8	100mA	32/8
500µA	37/8		
50-0-50µA	57/8	1A. DC	32/8
100-0-100µA	47/8	300V. DC	32/8

3 1/4 in. fronts.

Type MR. 65P	1mA	35/-	
50µA	59/8	10mA	35/-
100µA	49/8	100mA	35/-
500µA	39/8	100mA	35/-
50-0-50µA	59/8	1A. DC	35/-
100-0-100µA	49/8	300V. DC	35/-

POST EXTRA.



BAKELITE PANEL METERS

First grade quality meters, 2 1/4 in. square fronts.

25µA	65/-	1A. DC	22/8
50µA	42/8	5A. DC	22/8
100µA	32/8	1A. AC	22/8
500µA	22/8	30A. AC	22/8
50-0-50µA	42/8	300V. DC	22/8
100-0-100µA	32/8	300V. DC	22/8
1mA	22/8	300V. AC	22/8
10mA	22/8	300V. AC	22/8
100mA	22/8	VU Mtr.	45/8

* Moving iron. All others moving coil.

ILLUMINATED 'S' METER

1 1/2 in. sq. front. Cal. in S units. 6V lamp, 22/8. P.P. 1/-.

MORE METER BARGAINS

100µA 2 1/4 in.	Flush r.	42/8
300-0-30mA 2 1/4 in.	"	9/8
300V. AC 2 1/4 in.	"	25/-
500V. AC 2 1/4 in.	"	25/-

1mA Meter Rectifiers. 8/6

Post extra.

6IN. PANEL METERS

Flush panel mounting, hermetically sealed.

300A. DC m/c 65/-. Post 5/-.

R.C.A. HEADSETS

Low Imp. Fitted with std. Jack plug. 15/6. P.P. 1/6.

TELEPHONES TYPE H

Sound powered, generator bell ringing 2 line connection. Fully tested. £4.18.6 pair. Carr. 5/-.

MAINS RECORD PLAYERS & AUTOCHANGERS

ALL GUARANTEED WITH ARM AND CARTRIDGE

GARRARD SRP-10 PLAYER	£4.17.6
GARRARD AUTOSLIM CHANGER	£6. 9.6
GARRARD AUTOSLIM DE LUXE	£11. 15.0
GARRARD AT6 CHANGER MONO	£10. 8.6
GARRARD AT6 CHANGER STEREO	£10.18.6
GARRARD 4 H/F MONO	£15.18.6
GARRARD 4 H/F STEREO	£15.18.0
GARRARD TYPE 4 CHANGER	£11.15.0
GARRARD 301 STEREO NO ARM	£10.18.0
B.S.R. GU7 SINGLE PLAYER	£4. 7.6
B.S.R. UA14 CHANGER	£5.19.6
B.S.R. UA18 CHANGER	£6.12.6

POSTAGE EXTRA.

HE-40 DE LUXE 4-BAND COMMUNICATION RECEIVER



Frequency coverage 550Kcs to 30 Mcfs continuous. Operation 220/240 volt A.C./D.C. The perfect receiver for short wave listening. Special features include: Slide rule tuning dial—electrical band-spread—0-100 logging scale—improved selectivity—built in "S" meter—A.V.C.—Noise limiter—B.F.O.—Phone jack built in. Speaker—tone control—standby switch—supplied with three aerials, ferrite loop for broadcast band, adjustable 58in. whip for short wave and wire aerial. Smartly styled durable metal cabinet. Supplied brand new and guaranteed with manual. £24.15.0 carriage paid. S.A.E. for full details. Part exchanges welcome.

MODEL IT-2 MULTITESTER 20,000 O.P.V.

20,000 o.p.v. D.C.; 10,000 o.p.v. A.C. Specifications:
 D.C. V: 0-25-250-500-2500 V.
 A.C. V: 0-10-50-300-1000 V.
 Current: 0-50µA-25mA-250mA
 Resistance: 0-60K-∞M Ω
 Capacity: 0.01-0.3mFdB (at AC 10 V)
 Decibel: 20dB-∞dB
 Output range: 0-10-50-100-1000 V
 Battery: 1.5 V U12
 Size: 34 x 44 x 1 1/4 in.
 Supplied complete with batteries, leads instructions. 32/6. Post 2/6



MARCONI TF144G/4 STANDARD SIGNAL GENERATORS

First release of this late mark. 85Kcs to 2.2Mcfs ±1%. Output variable from 1µV to 1 volt. Internal sine wave modulation 400cs up to 75% depth. Operation 200/250 volt A.C. Offered in really excellent condition, like new fully tested and guaranteed. £25. Carr. 30/-.

TE-20 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120Kcs/∞-280Mcfs on 6 bands. Directly calibrated. Variable RF attenuator. Operation 200/240 V. A.C. similar in appearance to TE-46 CR Bridge. Brand new with instructions. £12. Carr. 8/-. S.A.E. for details.

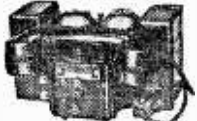
COSSOR DOUBLE-BEAM OSCILLOSCOPE 1035

4In. tube. Calibrated Y1 amplifier from 50 mV to 50V. Bandwidth 10Mcfs. Calibrated Y2 amplifier from 5V. to 500V. with band width up to 100Kcs. Directly calibrated X shift providing time measurements from 15 microseconds to 150 milliseconds. Supplied in guaranteed perfect condition. £37.10.0 each. Carr. 30/-. Spare tubes, TYPE 89D. Brand New. 59/6 each. P. & P. 4/6.

ERSKINE TYPE I3 DOUBLE BEAM OSCILLOSCOPE

Time base 2cs/∞-750Kcs/∞. Callibrators at 100Kcs and 1Mcfs. Separate Y1 and Y2 amplifiers up to 5.5Mcfs. Operation 110/230 volt A.C. Supplied in perfect working order. £27.10.0. Carr. 20/-.

FIELD TELEPHONES



Type "L". Two line connection, generator bell ringing. Complete telephone intercom. Supplied in excellent condition, fully tested and complete with batteries. Only 69/8 per pair. Carr. 5/-. Type "F". As above but moulded bakelite case (as illustrated). Supplied complete with wooden transit case for field use. £4.18.0 per pair. Carr. 5/-.

MICROAMMETERS

0-500 microamp. 2 1/4 in. circular flush panel mounting. Dial engraved 0-15. 0-300 volts. Brand new, boxed. 15/-. P. & P. 1/6.

MINE DETECTOR No. 4A

Will detect all types of metals. Fully portable. Complete with instructions. 39/8 each. Carr. 10/-. Battery 8/8 extra.

GEARED SLIDER RHEOSTAT

1.2 ohms 12 amp. 15/6. P.P. 3/6.

FIELD STRENGTH METERS



Frequency coverage c.250Mcfs. Fitted with 200 microamp meter. Supplied with telescopic aerial. earpiece and instructions 69/6 post paid.

9 TRANSISTOR TRANSCEVERS TWO-WAY RADIOS

Average range up to 1.5 miles. Supplied complete with Telescopic aerials Batteries. Personalities. Earpieces. Leather carrying cases and instructions. Brand new, un-waretted. £25 pair. S.A.E. for details.



SEMI AUTOMATIC BUG KEY



Super speed key, speed adjustments, 10 WPM to as high as desired weight scale for reproducible settings. Precision brooled anti rust nickel plated brass and stainless steel operating parts. Size 6 1/4 x 4 x 2 1/4 in. Brand new. £4.12.6. Post paid.

SILICON RECTIFIERS

400V. P.I.V. SCR.	4.7 amp	7/6
200V. P.I.V.	6 amp	5/6
1000V. P.I.V. 650mA		7/8
800V. P.I.V. 500mA		5/8
400V. P.I.V. 1 amp		5/8
400V. P.I.V. 3 amp		5/8
150V. P.I.V. 185mA		1/-
400V. P.I.V. 500mA		3/8
70V. P.I.V. 3 amp		3/8
95V. P.I.V. 3 amp		5/8

Post extra.

PLUGS AND SOCKETS

Painton 15-pin In-line printed circuit connectors. 7/6 pair. Large quantities available. Ditto 32-pin. 12/6 pair. L units. 4 pin. 2/6 pr; 8 pin 3/6 pr; 12 pin 4/6 pr; 18 pin 4/6 pr; Painton Miniature Jones. 4 pin 3/8 pr; 5 pin 4/6 pr; 8 pin 4/6 pr; 12 pin 5/8 pr; 18 pin 7/6 pr; 24 pin 10/6 pr; 33 pin 12/6 pr. Post extra.

AMERICAN BLOCK PAPER CONDENSERS

Very high quality. 10mFd, 600V. 5/8; 10 mFd 1kV 10/8; 12 mFd 1.5kV 15/-. Post extra.

L.T. METAL RECTIFIERS

FULL wave bridge connected. 12/18V 1A 3/8 24/36V 1A 7/8 12/18V 2A 6/3 24/36V 2A 13/6 12/18V 4A 8/6 24/36V 15A 45/8 12/18V 6A 12/3 36/48V 6A 32/6 12/18V 10A 22/8 Post extra.

L.T. TRANSFORMERS

For chargers, models etc. All primaries tapped 200/250V. (1) 3.5. 9 or 15V., 1 amp 9/8; (2) ditto 2A., 14/8; (3) ditto 4A., 18/6; (4) ditto 6A., 26/8; (5) 3. 4. 5. 6. 8. 10. 12. 15. 18. 20. 24 or 30V., 2 amp. 18/6; (6) ditto 4A., 30/8; (7) ditto 5A., 37/8; (8) 50V. 1 amp. 13/8; (9) 50V. 1 amp. 15/8. Post extra.

AUTO TRANSFORMERS

Step up or step down. Tapped 0/115/220/230/250V. 20W. 9/-; 60W. 12/6; 75W. 15/6; 150W. 18/6; 200W. 27/8; 300W. 42/8; 500W. 67/8; 1,000W. 90/-; 1,500W. £9.18.6; 3,000W. £7.10.0; 7,500W. £15/- (only tapped 0/110/230V.) Post extra.

30,000 O.P.V. TEST METER MODEL 500

Reads voltages up to 1,000 D.C. at 30,000 ohms per volt and A.C. at 15,000 o.v.v.; D.C. current to 12 amps. Resistance to 60 Megs; Decibels from -20 to +56. Incorporates internal buzzer for audible warning of direct shorts and blocking condenser for A.F. output measurements. Size 3 1/4 x 6 1/4 x 2 1/4 in. PRICE £8.17.6.



G. W. SMITH & CO. (RADIO) LTD.
 3 & 34 LISLE STREET, LONDON, W.C.2.
 SEE OPPOSITE PAGE

CONSTANT VOLTAGE TRANS.
85/130V. Input. 115V. output.
500 watts. Can be used in series
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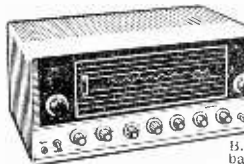
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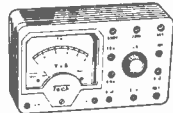
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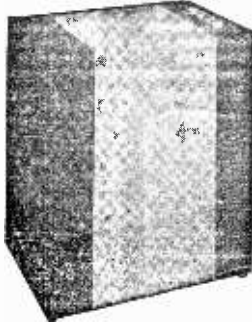
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R.S.C. JUNIOR GUITAR AMPLIFIER
5-watt high quality output. Incorporating high flux 12in 10 watt 12000 line loudspeaker Sensitivity 51 m.v. Two high impedance inputs. Handsome strongly made cabinet (size 14 x 14 x 7in. approx.) finished in complimentary shades of Rexine/Tygan. 200-250 A.C. mains.
£9.19.6 Or DEPOSIT 2/3 & 9 monthly payments of 2/3. Carr. 7/6.

LINEAR TREMOLO/PREAMP. UNIT
Designed for introducing the Tremolo effect to any amplifier which is fitted with a reserve power supply point for smoothed H.T. and 6.3 v. A.C. L.T. This applies to practically all amplifiers of our manufacture, and to those of several other manufacturers. The unit plugs into power supply point and any input socket or amplifier. Controls are Speed (frequency of interruptions), Depth (or heavy or light effect), Volume and Switch. Three sockets are for two inputs and Foot Switch.
ONLY 4 Gns.

R.S.C. SENIOR 15 WATT LEAD or RHYTHM GUITAR AMPLIFIER

High-fidelity push-pull output. Separate bass and treble "cut" and "boost" controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Loudspeaker is a heavy duty high flux 12in. 20 watt model with cast chassis. Chassis is well made and finished as Junior Model. Size approx. 18 x 18 x 8in.
Only 18 Gns. Carr. 10/-



Send S.A.E. for leaflet. Or DEPOSIT 37/9 and twelve monthly payments of 31/6.

R.S.C. B20 BASS GUITAR AMPLIFIER

A highly efficient unit incorporating a massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "boost" and "cut". Two high impedance Jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains.

Send S.A.E. for leaflet.
Or Deposit **£3.2.0** and 12 **29½ Gns.** monthly payments of 51/8. Carr. 17/6.

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326 ARGYLE STREET
Now open

238 EDGWARE ROAD
Opening shortly

133 LEITH STREET
Now open

TRANSISTOR SALE. Mullard OC71 3/9, OC45 4/11, OC44 4/11, OC72 4/9, OC81 4/11, OC71 8/9, Ediswan XA101 5/9, XB102 3/9, XA12 3/9, XB13 3/9, XB104 3/9, XC101 3/9. Postage 6d. for up to 3 Transistors.

D.C. SUPPLY KIT. 12 v. 1 a. consisting of a partially drilled metal case, mains trans., F.W. Bridge Rectifier, 2 fuseholders and fuses. Change Direction switch, variable speed regulator and circuit. For 200-250 v. A.C. mains. Suitable for Electric Trains. Limited number available at 29/11.

SELENIUM RECTIFIERS

F.W. BRIDGE	24 v. 2 amp.	14/9
6/12 v. 1 a.	3/11	24 v. 20 amp.
6/12 v. 2 a.	6/11	H.T. TYPES H.W.
6/12 v. 3 a.	9/9	150 v. 40 mA.
6/12 v. 4 a.	12/3	250 v. 50 mA.
6/12 v. 6 a.	15/3	250 v. 60 mA.
6/12 v. 10 a.	26/9	350 v. 80 mA.
6/12 v. 15 a.	35/9	250 v. 250 mA.

CONTACT COOLED. 250 v. 75 mA. F.W. (Bridge), 10/11. 250 v. 50 mA. F.W. (Bridge) 8/11. H.W. 250 v. 60 mA. 5/11.

HI-FI 10-WATT AMPLIFIERS.
Brand New Complete. Carr. 5/6.
Manufacturers' discontinued Model. Push-pull output. Latest high efficiency valves. Dual separately controlled inputs for "Mike". Separate Bass and Treble Controls. High sensitivity. Output for 3 or 15 ohm speaker. Guaranteed tested and in perfect working order.

DERBY

Now open at
26 Osmaston Road
The Spot

HEAVY DUTY LOUDSPEAKERS IN SUBSTANTIAL REXINE COVERED CABINETS. Type EGI. Suitable for Bass Guitar. Speaker Unit 15in. High Flux. 15 ohms 30 watts. Cabinet size approx. 24 x 21 x 13in. Only 19j gns. Or Deposit 43/- and 12 monthly payments of 34/- Type BG/2. Suitable Bass and Lead Guitar. Two 12in. high flux 15 ohm 25 watt speakers, one with aluminium speech coil and dual cone to provide smooth frequency response from 25 to 17,000 c.p.s. Cabinet size approx. 30 x 21 x 14in. Covered in two contrasting tones of grey Vynair and Rexine. Rating 50 watts. Only 29 gns. Or Deposit £3.7.6 and 12 monthly payments of 50/-.

LARGE REXINE COVERED SPEAKER CABINETS. Heavy blackboard construction. Very attractive two tone covering of Rexine and Vynair. Size 30 x 21 x 16in. cut for 15in. or 18in. speaker or for two 12in. 11 gns. or Deposit 25/9 and 9 monthly payments 25/9. Size 30 x 30 x 16in. cut for 15in. or 18in. speaker 13 gns. or Deposit 30/4 and 9 monthly payments 30/4. Suitable speakers available.

FANE EXTRA HEAVY DUTY LOUDSPEAKER 15in. TYPE 153. 40 watts. Total flux 375,000 lines. Extremely high sensitivity. 15 ohm voice coil. Only 18 gns. or Deposit 37/9 and 12 monthly payments of 31/6.

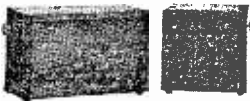
FANE EXTRA HEAVY LSPEAKER 18in. 15 ohms. 60 watts. 3in. diam. Speech Coil. Total Flux 375,000 lines. High sensitivity. ONLY 24 gns. or Deposit 51/- and 12 monthly payments of 42/9. Send S.A.E. for leaflet on 153 and 183.

EX. GOVT. SMOOTHING CHOKES.
200 mA. 3-5 H. 50 ohms, Parmeko 8/9
150 mA. 10 H. 50 ohms 9/6; 80 mA. 8 H. 900 ohms 5/9; 120 mA. 12 H. 100 ohms 8/9; 50 mA. 50 H. 1,000 ohms 6/9; 100 mA. 10 H. 100 ohms 6/9; 60 mA. 5-10 H. 250 ohms 2/11.

COMPLETE POWER PACK KIT, 19/11
Consisting of Mains Trans., Metal Rectifier, Double electrolytic, smoothing choke chassis and circuit. For 200-250 v. A.C. mains. Output 250 v., 60 mA. 6.3 v. 2 a.

R.S.C. POWER PACK, 39/9. Louvred metal case only 8 x 5 1/2 x 2 1/2. Stove enamelled. For 200-250 v. A.C. mains. Output at 4 pin plug and socket 250 v. 60 mA. fully smoothed and 6.3 v. 2 a. Suitable for power requirements of almost any Pre-amp. or Radio Tuner.

R.S.C. BABY ALARME or INTER-COMM. KIT. Complete set or parts with diagrams, etc. Housed in two polished walnut finished cabinets of pleasing design. High sensitivity. For 200-250 v. A.C. mains. Fully isolated. Controllable at both units. An intercomm. of this class would normally cost £20-£30. Only 8/9s. carr. 5/- or assembled ready for use 6/9s.



EX. GOVT. SELENIUM RECTIFIERS 12v 15 AMP 19/9 (BRIDGE) F.W. ONLY

R.S.C. (Manchester) Ltd.

LEICESTER 32 High St.
BIRMINGHAM 6 Gt. Western Arcade, Opp. Snow Hill Station
Half-day Thursday
No half-day

MAIL ORDERS to 54 Wellington St, 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.

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MANCHESTER 8-10 Brown St. (Market Street) Manchester 2
No half-day

LEEDS 5-7 County (Mecca) Arcade
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SHEFFIELD 13 Exchange St. (Castle Market Bldgs.) Sheffield
Half-day Thursday

HULL 51 Savile St., Hull
No half-day

LIVERPOOL 73 Dale St. Liverpool 2
Half-day Wednesday

BRADFORD 85 Morley St. (above Alhambra Theatre) Bradford
No half-day

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No half-day

DERBY 26 Osmaston Road THE SPOT

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies. 122/10 20watt, 7 gns. 122/10A 20watt, 6 gns. 122/12 20watt, 7 gns. 122/12A 20watt, 8 gns. 122/14 22watt, 9 gns. 122/14A 22watt, 10 gns. 122/17 25watt, £11.17.6 122/17A 25watt, £12.17.6 12in. 15 ohms. (Just classes). Exceptionally robust 2in. diam. Voice Coil Assemblies. 152/12 20watt, 12 gns. 152/12A 20watt, 13 gns. 152/14 24watt, 14 gns. 152/14A 24watt, 15 gns. 152/17 35watt, 16 gns. 152/17A 35watt, 17 gns. "A" indicates dual cone type. 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

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 30-20,000 c/s. A specially designed sectional 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 OUT-DOOR P.T. CLUBS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long-playing records. OUTPUT SOCKET PROVIDES L.T. and H.T. for RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" 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 Carr. 10/- perforated cover with carrying handles can be supplied factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet.

11 Gns. Terms: DEPOSIT 33/9 and 9 monthly payments of 33/9. Suitable microphones and speakers available at competitive prices.

ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMAN'S, W.B. and FANE SPEAKERS, GARRARD and GOLDRING T/ABLES CASH or H.P.

SUPERMET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V.C. Controls are Tuning, Wch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.5 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7 1/2 in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building cost £4.15.0. S.A.E. for leaflet.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 8 1/2 x 4 x 2 1/2 in. 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 hi-fi amp. worked on battery receivers requiring 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, 58/6.

P.M. SPEAKERS. 10in. W.B. "Stentorian" 3 or 15 ohms type HP 1012 10 watts, hi-fidelity type. Recommended for use with our A11 Amplifier. £4.12.6. 12in. R.A. 3 ohms 10 watts (12,000 lines), 59/9.

TWEETERS. R.A. 3 ohm. 25/9; 15 ohm. 25/9

R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

Jason FMFI V.H.F./P.M. Radio Tuner design. Total cost of parts including valves. Tuning dial. Esutechcon, etc., £6.19.6

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feedback 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5 1/2 in. high. Guaranteed 12 months. Only £5.19.6. Send S.A.E. for leaflet. Terms: Deposit 22/6 and 3 monthly payments of 22/6.

R.S.C. 4/5 WATT A5 HIGH-GAIN AMPLIFIER



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest hi-fi 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. L.T. of 300 v. 35 mA and L.F. of 4.3 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 ohms speaker. Classes is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue Hammer finish and 140-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.

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THE SKYFOUR T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-point wiring diagrams, instructions and parts list 1/9. maximum building costs £4.19.6. inc. attractive walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed Bass Reflex HE102 speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use. £5.19.6. Set of legs with brass ferrules, 19/6.

R.S.C. JUNIOR HI-FI REPRODUCER. The very latest Goodman Acute 8 High Fidelity loudspeaker (retailing at approx. 5 gns.) fitted in a specially designed Bass Reflex cabinet size 12 x 16 x 10in. Acoustically lined and ported. Finished in polished walnut veneer. Matching impedance 15 ohms. Frequency range 40-15,000 c.p.s. Power handling 6 watts nominal. Ideal for Stereo.

8 Gns. Carr. 4/6.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £41.9.6 Carr. 5/- Terms: Deposit 11/3 and 9 monthly payments of 11/3.

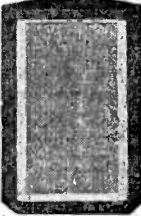
12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS. Size 18 x 18 x 10in. Finish as above. Terms: Deposit 17/6 and 9 monthly payments of 17/9. Only £79.19.6. Carr. 8/6. For larger types see preceding page.

LINEAR L634 GRAM AMPLIFIER. High quality. Separate Bass and Treble controls. Handsome appearance. Completely enclosed. Black/Gold Frontplate 5 gns.

MULTI-METER CARY M1. Sensitivity 2,000 ohms per volt. A.C. and D.C. 54/-
A.10. Basic Meter sensitivity 155 microamps A.C. and D.C. ranges £4.11.6. B.40. Sensitivity up to 10,000 ohms per volt A.C. and D.C. £6.2.6. 30,000 ohms per volt with overload buzzer. £8.18.6.

R.S.C. CORNER CONSOLE CABINETS

Polished walnut veneer finish. Pleasing design. **JUNIOR MODEL.** Size 20 x 11 x 8 1/2 in. for 8 or 10 in. 6in. speakers, £29.9. **STANDARD MODEL.** Size 27 x 18 x 12in. for 8 or 10 in. speakers, £41.9. **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 superbly realistic reproduction. Standard 10 watt rating £4.19.9. Carr. 5/- Or Senior 15 watt, £6.19.9. Carr. 7/6.

AUDIOTRINE EQUIPMENT CABINETS.

Size 33 x 15 x 13in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut, removable baseboard. Depth above baseboard 5 1/2 in. Only 12 1/2 gns. Carr. 15/- Terms: Dep. 29/9, and 9 mthly. pymts. 29/9



AUDIOTRINE HI-FI TAPE RECORDER KIT 25¹/₂ GNS. Carr. 17/8.

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR
 Incorporating the late-st. Collaro Studio Tape Transcriber, The Audiotrine 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 tastefully covered in contrasting shades of Rexine and Vynal, 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 £2.13.9 and 12 monthly payments of 44/- Cash price if settled in 3 months



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, E231. 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** "Lit" and "Cut" Frequency response + 3 dB 30-20,000 c/s. Six negative feedback loops. Hum level 60 dB 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, LEAD OR RHYTHM GUITARS**, etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT**, Size approx. 12 x 9 x 7 in. For A.C. mains 200-250 v. 50 c/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. 10/-** (Or factory built 51/- extra.) If required louvered metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 2/9** and 9 monthly payments of 24/9. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

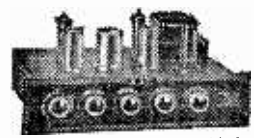


ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

LINEAR TAPE PRE-AMPLIFIER, Type LP/1, Switched Negative feedback equalisation. Positions for Record 11in., 3in., 7in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriber and a high fidelity amplifier, but suitable for almost any Tape Deck. **Only 9 gns. S.A.E. for leaflet.**

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

A complete set of parts for the construction of a stereo-phantom 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 "HF" and "LF" Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, E231. Outputs for 2-3 ohm speakers. Point-to-point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.** Full constructional details and price list 2/6. Carr. 10/- ready to use for 59/8 extra.



Kit can be supplied assembled and

R.S.C. GRAM. AMPLIFIER KIT. 3 watts output. Negative feedback. Control Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis. Circuit, etc., supplied. **Only 39/9. Carr. 3/9.**

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, 16/8. Acos Stereo-Monaural, 29/9. Romance Stereo-Monaural 39/9. B.S.R. Stereo 39/9. **BRADMATIC RECORDING HEADS.** High Impedance Record/Playback 22/- Low Impedance Erase, 12/6.

MARIBOT RECORDING HEADS. High Impedance. Record/Playback 15/- Low Impedance. Erase, 10/- **PICK-UP ARMS.** Complete and with latest Acos/hi-f Turnover Cartridge 29/11. **CRYSTAL MICROPHONES.** Hand 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 29/9.

COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-f Turnover head. **Only £3-19-6.**

B.S.R. UAH 4-SPD AUTO-CHANGERS hi-f hi-f turnover head, £6.19.6. Carr. 4/6 **GARRARD AUTO-SLIM 4-SPD AUTO-CHANGER** with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. £7.17.6. Carr. 4/6.

GARRARD ATTS AUTO-SLIM DE-LINK 4-SPD AUTOCHANGERS. Turnover C8E head, for 200-250 v. A.C. mains. £11.9.0.

GLA 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 11 1/2 x 2 1/2 in. Controls. Vol. and Tone with Switch. **Only 59/6.**

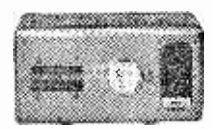
SENSATIONAL STEREO OFFER

A complete set of parts **4 Gns.** to construct a good quality Stereo Amplifier with an undistorted output of 10 watts. For A.C. mains input of 200-250 v. Sensitivity 130 mV. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head 19/9 extra with above only.

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.**

R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months.



charging. Louvered steel case with stoved grey hammer finish. Fused and ready for use with mains and output **59/9** leads and battery clips. Carr. 4/6. **Terms:** Deposit 12/- and 5 monthly payments of 12/-.

All on A.C. Mains 200-250v. 50 c/s. **ASSEMBLED 6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Fused, ready for use with mains and output leads. 39/9. Carr. 3/9.** 6/12v. 1amp. 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 Clip, circuit. Carr. 3/6 extra. 6 v. or 12 v. 1 amp. 22/9 As above, with Ammeter. 28/9 6 v. 2 amps. 19/9 6 v. or 12 v. 2 amps. 25/9 6 v. or 12 v. 2 amps. inclusive of Ammeter. 35/9 6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector. 52/9

CHARGER AMMETERS 0-1.5 a., 0-4 a., 0-7 a. 8/9 ea.

CHARGER KIT, 12 v. 14 AMP or 24 v. 7 AMP Consisting of mains trans. 200-230-250 v. F.W. (Bridge) selenium Rectifier, Ammeter, Fuses, Variable Resistor, Steel Stove enamelled case and Circuit. **Only £9.19.6. Carr. 15/-.** Please state if 12 v. or 24 v. kit required.

CHARGER KIT, 12v. 10 Amp. with variable charge rate adjustment and ammeter. **£4.18.6. Carr. 10/-.**

R.S.C. MAINS TRANSFORMERS

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened **TOP SHROUDED DROP THROUGH**
 250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a. 17/9
 350-0-350v. 80mA. 6.3v. 2a. 0-5-6.3v. 2a. 19/8
 250-0-250v. 100mA. 6.3v. 2a. 0-5v. 1a. 21/9
 250-0-250v. 100mA. 6.3v. 3.5a. C.T. 19/9
 250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 25/9
 300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier 29/9
 300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 28/8
 350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 26/9
 350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a. 29/9

FULLY SHROUDED UPRIGHT
 250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a. 17/11
 Midget type 21 x 3 x 3in. 17/11
 250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 28/9
 300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 27/11
 300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier 33/9
 350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 27/11
 350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a. 35/9

(FULLY GUARANTEED)
FULLY SHROUDED (continued)
 425-0-425v. 200mA. 6.3v. 4a. C.T. 5v. 3a. 55/9
 425-0-425v. 200mA. 6.3v. 4a. C.T. 6.3v. 4a. C.T. 5v. 3a. 59/9
 450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a. 68/9

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 Midget Battery Pentode 631 for 3S4. 4/6
 Small Pentode 5,000Ω to 3Ω .. 4/6
 Small Pentode 778,000Ω to 3Ω .. 4/6
 Standard Pentode 5,000Ω to 3Ω .. 5/8
 Standard Pentode 7,000Ω to 3Ω .. 5/8
 10,000Ω to 3Ω .. 5/8
 Push-Pull 8 watts, EL84, 6r 6V6 to 3Ω or matched to 15Ω .. 9/9
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 Push-Pull 10-12 watts 6V6 or EL84 .. 18/9
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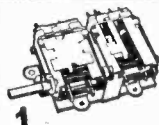
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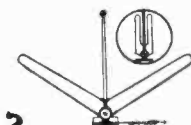
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1



3



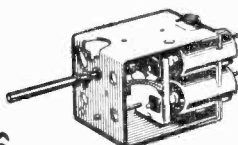
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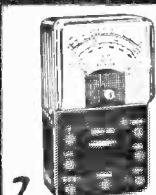
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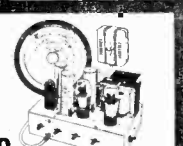
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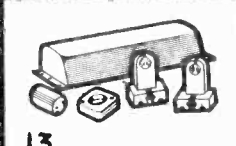
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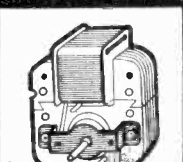
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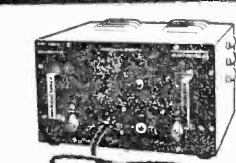
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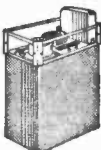
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Output impedance 600Ω, 10Ω, 50kΩ, ±30%. Effective output level: 98 dB (50kΩ) ±3 dB at 1,000 c/s. (0 dB 1v/p.a.). Response: 100-2,000 c/s ±0 dB non directional. Attractive plastic and chrome finish. All necessary accessories for adaptation as hand, table or suspended mike 6 feet of P.V.C. cable. 45/-, P. & P. 3/6.



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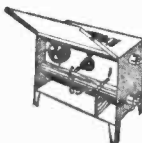
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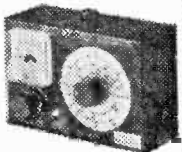
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Increase the output of your 19 set 6 to 10 times by using the R.F. AMPLIFIER NO. 2. This unit can also be used with most other low powered transmitters. Built in 12 volt power unit. Overall size same as 19 set. Range 2-8 Mc/s.

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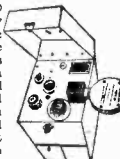


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Frequency range 20 to 100 Mc/s in two bands selected by plugging in the appropriate loop aerial, two of which are supplied with the set. Operates from a 6 v. D.C. supply which is converted by an internal vibrator pack to 250 v. and 6 v. L.T. vibrator unit worth pounds. The unit is in good condition, and a clear circuit drawing is mounted on the interior of the rear panel. The equipment contains many useful components, e.g. twin gang tuning, condensers, valves, transformer, chokes, resistors, etc. A neat compact unit in grey enamelled case 16 1/2 x 7 x 6 1/2 in. with carrying handle. **39/6** P. & P. 5/-.



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● Charge Rate Adjuster
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● Easily fitted to charging circuit.
3/6 each; 2 for 6/6. P. & P. 1/- each.

SONA MORE BARGAINS OPPOSITE



ALTIMETER TRANSMITTER/RECEIVER AN/PN

Frequency approximately 400 to 470 mc/s.
TRANSMITTER
 Containing two 9004 acorn valves and moving coil transducer wobulator unit.
A.F. AMPLIFIER
 Containing two 12SH7 and one 12SJ7 valves. The above chassis are housed in a black crackle case which contains three relays Resistors, Potentiometers, and the following valves: 3-12SH7, 1-12SJ7, 1-1V150/30 and 2-12H6's making a total of 14 valves in all. A Dynamotor Unit is also incorporated.
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Plug into all sockets with the NEW UNIVERSAL PLUG. Saves money. Saves time. Fits all 13, 15 and 5 amp. 2 pin, 3 pin and adaptors. Easily adjustable. Robust construction. Only 12/8 P. & P. 11d.



RESISTORS

Special offers. High quality 1/2 watt resistors. All preferred values (state values required), 10 Ω, 100 meg. ohm. 3jd. each, 6 for 1/6. 12 for 1/8. 100 for 2/4/-.

RESISTOR COLOUR CODE INDICATORS

Enables you to determine value of resistor at a glance. A must for the constructor. Price 1/6. P. & P. 3d.

MIDGET MAINS SELENIUM RECTIFIERS

Only 2/6 each. P. & P. 9d. each.

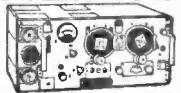
BUMPER CONSTRUCTION PARCEL

Britain's Biggest Radio Bumper Bundle.
 One brand new 30 watt soldering iron complete with plug. Heavy duty 100 ma. 10 to 20 H smoothing Choke. Two TCC Metal Encased Block Condensers size 4 1/2 x 2 1/2 x 1 1/2in. value 8mfd 350v. working. Three paxolin Tag Strips—14 tags per strip. Six .05 mfd Electrolytic Condensers 350v. working. Six 50mfd 12v. working Bias Condensers. Six 750 pf Ceramic Trimmers. One operator's unit, containing host of valuable components including Block Condenser, Jack Plug Socket etc. One heavy duty RP choke on stand, suitable for transmitting circuits. Three Brand New BTG Valves. Three Brand New International Octal Valves. Three black bakelite moulded control knobs. Six assorted pots. Three small selenium rectifiers. One pair low resistance 'phones.
35/- P. & P. 4/6.

FOUR IMPORTANT RADIO BOOKS

Mullard circuits for Audio Amps. 8/6.
 Transistor Audio Amplifier Manual. 6/-.
 At a Glance Radio Valve and TV Tube Equipments. 3/6.
 Transistor Superhet Receivers. 7/6.
 Special offer to P.W. readers, all four books for 22/6.

NO. 19 TRANSMITTER RECEIVER



New stocks just arrived. Equipment comprises 3 separate units built into one chassis and separate power pack.
 Specification: "A" Set Transmitter/Receiver. Frequency coverage 2-4.5 mc/s and 4.5-8 mc/s (150-37 meters).
 For R.T., C.W.V. or M.C.W. Range on R.T. 165 miles. C.W. 50 miles. Superhet R.X., I.F. 465 kc/s, B.F.O. etc.
 R.X. valve line-up: 6K7, R.F.: 6KS mixer, 2 6K7 I.F.: 6B8 det. A.F. phone output. T.X.: 6K8, mixer, B.F.O., EF50 buffer, EB34 ADC, and output stage, decommisioned to conform with government regulations.
 Transmitter/Receiver 239/241 mc/s. Local use up to 1 mile. Valve line-up CV5, 6K7 and 6V6. Intercom set 2 valves A.F. amplifier for vehicle crew inter-communication. Valve line-up 6K7 and 6V6.
 A 2 1/2in. meter is built in reading L.T. and H.T. voltages, drive etc.
POWER UNIT, 12 volt DC input. Output 275 volts 110 mA, and 50p volts 60 mA. Equipment is of American or Canadian manufacture and is supplied in good condition.
PRICE Complete with Power Pack £4.10.0

- Carriage 17/6.
- 19 set only **£3.10.0**
- Carriage 10/-
- Power Unit only **£1**
- Carriage 10/-
- Two 19 sets complete with **£8.10.0**
- Power Packs
- Carriage 30/-

Accessories

- Handbook 3/6 P. & P. 6d.
- Connectors 12 pin 12/6 P. & P. 2/6
- 7/8 P. & P. 2/6
- 6 pin 6/8 P. & P. 2/6
- Control Boxes Single, new 7/8 P. & P. 3/6
- Double 7/8 P. & P. 2/6
- Whip Aerials 8ft. 6in. 4/6 P. & P. 2/6
- 5ft. 5/11 P. & P. 2/6
- Aerial Bases (Fits all types) 15/- P. & P. 2/6
- Varimeters for 19 set 12/6 P. & P. 2/6
- Headphones and Mike 5/- P. & P. 2/6
- Headphones less mike insert 5/- P. & P. 2/6

CLEARANCE LINE

While stocks last. Mains metal rectifiers. Full wave at 150 ma. Price 3/11 each. P. & P. 1/6 each.

GOVERNMENT SURPLUS MULTI RATIO OUTPUT TRANSFORMERS

Robust and Compact
 Price 4/11. P. & P. 1/6.

12 Volts CONVERTOR to 240 Volts

Run all your mains A.C. D.C. equipment from your car battery, shavers, radio players, etc. New type vibrator, low battery drain, not to be confused with heavy battery drain rotary transformers. Square fuses, vibrator, battery clips, etc.



12 volts to 240 at 100 ma. BRAND NEW tested in waterproof cartons. ONLY 35/- P. & P. 6/6.

TSL GORLER SUPER VHF FM TRANSCRIBER TUNING HEART

Type 312-0015 or 0029 uses one AF 106 and one AF 125 Super Gain Transistor plus 2 diodes in ultra high HF plus additive mixer circuit. Tuning range 87-108.5 Mc/s. Amplification greater than 35 dB. Built in A.F.C. and A.G.C. Size 4 x 1 1/2 x 1 1/2in. £6.5.0 including Purchase Tax. Post Free.

WE APOLOGISE FOR ANY INCONVENIENCE CAUSED TO OUR CUSTOMERS THROUGH DELAY. THIS WAS DUE TO OVERWHELMING ORDERS, BUT WE ARE NOW IN A POSITION TO OFFER A 48 HOUR DESPATCH SERVICE.



TERMS:
 CASH WITH ORDER.
 5/- EXTRA ON C.O.D.
 ORDERS
 No C.O.D. under 30/-.

**TRADE SUPPLIED
 ORDERS FROM
 ABROAD WELCOMED**
 Telephone 34703

SOMA ELECTRONIC CO. (Dept. PW5), BRIGGATE HSE., 13 ALBION PL., LEEDS

Brand new individually checked and guaranteed VALVES

Table listing various vacuum tube types and their specifications, including AC/HL, AC/CL, AC/CP, etc., with associated numbers and prices.

MARCONI COMMUNICATION RECEIVERS. CR.150.

Frequency coverage 2-60 Mc/s in 5 bands. Two I.f.s. 1st 1,600 kc/s, 2nd 463 kc/s. Image signal protecting over 40 dB up to 30 Mc/s and 20-40 dB from 30-60 Mc/s. Self checking calibration (built in calibrator). Stabilisation of supply and temperature compensation. Electrical and mechanical handspreads. Metering and visual tuning indicator. Bandpass from 100c/s to 10 kc/s in 5 stages. Acoustic filter associated with 100 c/s. Bandpass position for CVW reception. Facilities for diversity reception. Excellent checked condition, £49. Mains P.S.U. by P.C. Radio, £4.10.0. Carriage 30/-.

CR.150/2. Frequency coverage 1.5-22 Mc/s in 4 bands, all other features as in CR.150. Price £35. Carriage 30/-.

P.C. RADIO'S mains P.S.U. for above 90/-

R.209 RECEPTION SET. A 10-valve high-grade superhet Receiver with facilities for receiving R/T (A.M. or F.M.) and CW Frequency 1 Mc/s-20 Mc/s. Hermetically sealed. Built on miniature valves and incorporating its own vibrator power-supply unit driven by a 6 v. battery (2) point connector included). The set provides for reception from rod, open-wire or dipole aerial with built-in loudspeaker or phone output. Dimensions: Length 12in., width 8in., depth 9in. Weight 23 lb. As new, tested and guaranteed condition, £23.10.0, including special head-phone and supply leads. Carr. £1.

ROTARY TRANSFORMER. 11.5-12.5 v. D.C. Input 300 v. 200mA D.C. Output, 30/- P. & P. 15/-.

RECEIVER TYPE R.206. Frequency 0.55 Mc/s to 30 Mc/s in 6 bands. 100-250 v. AC. or 12 v. D.C. Loudspeaker in power supply unit. High performance superheterodyne, eleven valves including a separate local oscillator valve, beat oscillator valve and two valves (Amplifier and Detector) in the A.B.C. system. In very good condition £20.10.0, including power pack. Carriage and Packing 15/-.

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.

Original mains power pack for H.R.O. 110/220 v. A.C. Brand new in original packing, 45/- P. & P. 4/-.

CONNECTORS FOR TCS RECEIVER, TRANSMITTER AND REMOTE CONTROL, with original plugs on both ends. New £1.17.6 each. P. & P. 2/6.

TRANSMITTER RECEIVER. TYPE 68T. 3-5 Mc/s netting facilities. Low power consumption. Requires 150 v. h.t. and 3 v. l.t. dry batteries. In good condition. 35/-. Carriage 8/-.

P.C. RADIO LTD 170 GOLDHAWK ROAD, W.12 Shepherd's Bush 4946 Open 9.5.30 pm. Thursday 9-1 pm.

TRANSFORMER HEAD SUPPLY. Primary 230 v. Sec. 0.27-29.31 v. at 0.5 amp., 15/- P. & P. 5/-.

ARRBD RECEIVERS. Fully reconditioned, £55, or rebuilt model, £85. Carriage paid U.K.

CHR HIGH RESISTANCE HEAD- PHONES. New, 16/- P. & P. 1/6. R.107 COMMUNICATION RECEIVER. 1.2/17 mcs. 9 valves. "Wide" and "narrow" band switch. AVC and BFO, with internal speaker. 100/250 v. A.C. and 12 v. D.C. Meas: 24 x 13 x 17in. Price £13.10.0. Carriage 20/-.

CARBON INSET MICROPHONE. G.P.O. type, 2/6. P. & P. 1/6.

Table listing various electronic components and their prices, including microamps, resistors, capacitors, and transformers.

STERN-GLYNE

Electronics Centres throughout Great Britain

NEW LOW PRICES — NOW YOU CAN AFFORD A CAR RADIO



THE 'HIGHWAYMAN'
OUR QUALITY CAR RADIO
TO BUILD YOURSELF AT
A NEW LOW PRICE

Look at these features:
★ Attractive styling. ★ Push-button output. ★ Three latest

Mullard transistors plus valves types 6BF8 and 6CH8. ★ No Buzz, high output and sensitivity. ★ Printed circuit (latest type). 7 x 4in. high flux p.m. speaker and baffle. ★ Medium and Long Waves. ★ Push button for fingertip control. ★ Extremely low battery consumption (less than 1 amp). ★ Easy to fit any make car (Positive earth only.) ★ 12-volt operation. ★ Compact size, measures only 7 x 7 x 2in. deep. ★ Easy assembly, supplied with dial and drive already mounted.

Special inclusive price of ONLY **£7.19.6** Plus 5/- P. & P.

All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later.)

THE "TRAVLER" MkII
Introducing our new ready-built transistorised car radio for ONLY

9½ Gns. P. & P. 5/-, including 7 x 4" speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts with fitting instructions

H.P. Terms: Dep. £2.19.6

and 7 monthly payments of £12.6. (Plus 5/- P. & P.)

Star Features ★ Handsomely Styled. ★ Mullard Valves and Transistors. ★ Push Buttons. ★ 11 watts Output. ★ Long and Medium Wavebands. ★ Quality Speaker (E.M.I.). ★ Easily Fitted. ★ Radio Luxembourg (and many other foreign stations) 12 volt Positive Earth Only (applies to 99.8% of the cars on the road). ★ Dimensions 7 x 2 x 7" depth.

Optional extras, 3 section chromium plated weatherproof telescopic aerials type 1 17/44", 19/6; type 2, 27/43", 20/6, both plus P. & P. 2/6 if purchased separately.



THE WORLD AT YOUR FINGERTIPS!!

THE HE-30 4-BAND COMMUNICATION RECEIVER

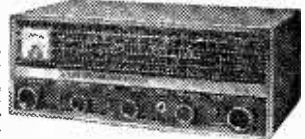


One of the finest general coverage bandspread Receivers available at this price. Covering 50Kc/s—1800Kc/s, 4.8Mc/s—14.5Mc/s, 1.6Mc/s—4.8Mc/s, 10.5Mc/s—30Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter, 0-100 logging scale, coverage from 0.55—30 Mc/s. 8 valve plus Rectifier superhet circuits. RF Stage with B.F.O. control Q-multiplier. Frequency (BFO). Band Selector. IF Gain. Trimmer. AVC-MVC Switch. Ant Switch. Main Tuning. Bandsread Tuning and Headphone Jack. Selectivity—60dB at 10Kc/s, 0.8Kc/s at 6dB (with Q-Multiplier) IF-45Kc/s. External PM Speaker read, 4 or 8 ohms impedance. Output 1.5 watts, 8 modern Miniature B7G Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7in. Grey crackle finish. 220/240 volt A.C. mains. 50-60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. for leaflet.

PRICE **40 Gns.** Carriage Paid.

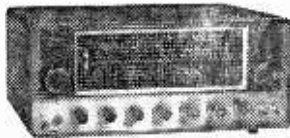
THE HE-40 4-BAND COMMUNICATION RECEIVER

Completely built and ready to go. High sensitivity Superhet receiver covering 55Kc/s—1,500 Kc/s, 1.6 Mc/s—4.4 Mc/s, 4.4 Mc/s—11 Mc/s, 11 Mc/s—30 Mc/s. Electrical Bandsread tuning. Slide rule type tuning dial. Internal ferrite rod aerial for medium waveband reception and 1 59in. 10 section chromium plated telescopic whip aerial for the short wave bands. Sockets for optional outdoor aerial. Internal high flux monitor loudspeaker. Latest modern miniature B7G base valves. Headphone socket (may also be used for external loudspeaker). ANL. BFO. built-in "S" meter. 220/240 volt A.C. mains, 50-60 cycle operation. Handsomely styled cabinet with grey crackle finish and handsome front panel, with chrome and satin chrome fittings. Measures 13 3/4in. x 8 1/2in. x 5 1/2in. (high) and weighs only 11 1/2 lbs. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Send S.A.E. for leaflet.



PRICE **£24.15.0** Carriage Paid.

THE NEW HE-80 COMMUNICATION RECEIVER

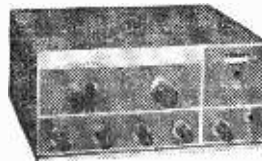


The HE-80 has outstanding sensitivity 0-100 logging scale for instant read-out built-in "S" meter special recording Jack, remote Control Socket allowing simultaneous control with transmitter, 100Kc crystal oscillator circuit providing accurate harmonic signals of either 4 or 8, ohms impedance. Two headphones sockets, one high, one low.

TECHNICAL SPECIFICATIONS. Frequency Coverage: Band 1 540—1805Kc; Band 2 1.6—4.8Kc; Band 3 4.8—14.5Mc; Band 4 10.5—30Mc; Band 5 144—146 Mc/s. Band Spread (Ham Band directly read): 80 Metre Band, 10 Metre Band, 15 Metre Band, 15 Metre Band, 10 Metre Band. Sensitivity: 1 microvolt for 10dB signal to noise ratio. Selectivity: Normal 10Kc at —75dB, 1.25Kc at —6dB. With Q-Multi: variable to 707 c.p.s. at 6dB. Operation: AM, SSB, CW and FM. AM diode detector. SSB/CW product detector (BFO). FM gated beam detector. Power Source: 240 volts 50/60 Cycles A.C. Power Consumption: 80 watts. Audio Output: 1.5 watts, 8 or 500 ohms impedance. Auxiliary Circuits: Electrical Bandsread, Q-Multiplier, ANL, AVC-MVC, BFO, 100Kc crystal calibrator. Valve Line-up: 4—6AQ5, 6BL6, 3—6BA6, 2—6BE6, 6AL5, 6AQ5, OA2, 6CA4. Dimensions: 17in. wide, 6 1/2in. high, 10in. deep.

PRICE **59 Gns.** Carriage Paid.

"STARFLITE TRANSMITTER"



Designed to meet the needs of most amateurs the Starflite has single-knob band-switching, a front panel switch to select any of five crystal positions with provision for an external VFO. Controlled carrier modulator permits almost 100% of the CW input to be used on AM peaks. Grid-block keying provides chirp-free operation. A full wave silicon diode power supply effects extremely low output ripple for cleaner CW transmission, electron-coupled Pierce Oscillator, capacitance bridge neutralization of the final and a three-stage lowpass filter. An illuminated edgewise D'Arsonval panel meter. Pi-network output provides the correct impedance match between the plate circuit and any 50-72 ohm co-axial feeder. Easy to follow point-to-point instructions supplied with each set of components. When constructed the Unit is housed in a heavy gauge steel Cabinet finished in grey crackle.

SPECIFICATIONS: Power Input—90 watts peak; Operation: C.W., AM Phone—crystal or VFO Control; Band coverage: 80-10 metres; Coupling: Pi-network; Valve Line-up: 6146, 2 6CL6, 12AX7, 6DE7, Low Pass Filter. Size 13 1/2in. wide x 12in. deep (inc. knobs) x 6 1/2in. high (inc. rubber feet). Weight 28 lbs. Power Requirements, 200/240 v. 50-60 CPS, 225 watts.

MAY BE BUILT FOR **35 Gns.** Carriage & Insurance 15/-

SEE FOLLOWING PAGES FOR ADDRESSES AND OTHER ITEMS

STERN-CLYNE

Electronics Centres throughout Great Britain

MULLARD 2-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 mV.



★ Equalisation for the latest R.I.A.A. characteristics. ★ Inputs for Crystal Pickups 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.

From a Tape Amplifier or Pre-Amplifier. ★ Sensitive Microphone Channel. ★ Wide range BASS and TREBLE Controls.

ASSEMBLED **£9.10.0** (Carr. & Ins. 5/-).
KIT OF PARTS **£6.6.0** AND TESTED

Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

MULLARD 3-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. Incorporates 5 Input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s, low pass filter 5-9 Kc/s. Totally enclosed in case Size 11" x 4" x 4".



ASSEMBLED **£13.13.0** (Carr. & Ins. 5/-).
KIT OF PARTS **£10.0.0** AND TESTED

Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD "5-10" MAIN AMPLIFIER



For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained. SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMEKO or PARTRIDGE Output Transformer.

COMPLETE KIT (Parmeko Output Trans.) **£10.0.0**
ASSEMBLED AND TESTED **£13.10.0**

(Carr. & Ins. 6/6). ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra. Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

COMBINED PRICE REDUCTION

MULLARD 5-10 Main Amplifier and 2 valve Pre-Amp. Kit **£15.15.0**. C. & I. 8/6. Built and tested, **£21.10.0**. C. & I. 10/-.
MULLARD 5-10 Main Amplifier and 3 valve Pre-Amp. Kit **£19.10.0**. C. & I. 8/6. Built and tested, **£25.10.0**. C. & I. 10/- With Partridge Transformer **£1.6.0** extra.

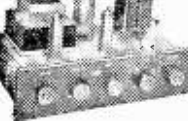
THE MULLARD 5-10RC AMPLIFIER

The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600 mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus power available for Tuner.



COMPLETE KIT **£12.0.0**
ASSEMBLED AND TESTED **£16.0.0** (Carr. & Ins. 7/6). With PARTRIDGE OUTPUT TRANS. **£1.0.0** extra. Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE MULLARD 3-3RC



A HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.

KIT OF PARTS **£8.8.0**
ASSEMBLED AND TESTED **£11.10.0** (Carr. & Ins. 6/6).

Complete to the MULLARD specification including PARMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and 100 Mc/s. Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE "MONO-GRAM"



A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve, separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 3 watts undistorted output. (Carr. & Ins. 3/6).

Kit of Parts **£4.10.0** and Tested **£6.0.0**

Instruction book and detailed price list (free with kit) available separately at 2/6 Post Free.

CHASSIS BARGAIN



A 6 valve Superhet Radiogram Chassis of outstanding quality covering MW 200-550 Metres, LW 1200-2000 Metres, VHF 87-100Mc/s.

Incorporating internal Ferrite Rod Aerial and the famous Gortler Tuning Heart for VHF. Pickup input suitable for most modern Record Players. Power output 4 watts, valve line up E280, EABC80, EF86, ECH81, EL84, ECC85. Volume On/Off and Tone Control, attractive black Tuning Dial Size 15" x 6" with gold lettering and contrasting cream and gold knobs. A.C. 200/250 v. Size 15 x 7 1/4 x 6 1/4". P. & B. 8/-.

PRICE 16 Gns. Or £3.9.0 deposit (plus P. & P.) and 9 monthly payments of 32/8.

MODEL CR3/S TAPE RECORDER



MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin Track 3-speed Deck operating at 1in., 3in., and 7in. speeds. Complete with microphone and 1,200ft. tape.

KIT OF PARTS **£33.8.0**
ASSEMBLED AND TESTED **£43.0.0** (Carr. & Ins. 15/- extra).

STEREO TAPE PRE-AMPLIFIER

MODEL STP-1. For use with current TRUVOX, BRENNEL or COLLARO "STUDIO" 1 and 4 track Stereo Decks. Incorporates Ferro-cube Oscillator, 4-speed Equalisation Signal Level Meter and separate Gain Control. Includes separate Power Unit. KIT OF PARTS **£22.0.0** (Carr. & Ins. 8/6) ASSEMBLED **£28.0.0**



Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.

TAPE PRE-AMPLIFIER MULLARD Type "C"

Suitable for most 1 track, Mono Tape Decks. Incorporates Ferro-cube Push-Pull Oscillator, Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit. KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**



Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD TAPE AMPLIFIER

MODEL III/TR3/MK.II Based on Mullard's Type "A" design and suitable for most 1 track Mono Tape Decks. Incorporates Ferro-cube Treble Inductor, Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer. KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.0.0**



Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

COMBINATION TAPE UNITS

All our Tape Units can be supplied specially matched to any Tape Deck such as Collaro, Brennel Mk.5 Series II, also the Wearite. Specimen prices as below.

	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck.....	£36.0.0	£42.0.0
Assembled with track switch fitted, 244.2.0		
STP-1 with Brennel Mk.5 Series II with Track Switch fitted.....		
STP-1 with Brennel Mk.5 Series II, 4 Track Deck.....	£68.4.0	£74.15.0
Type "C" Pre-amp with Collaro Studio Tape Deck.....	£24.10.0	£30.0.0
Assembled with deck wired and matched, £32.2.0.		
Type "C" Pre-amp with Brennel Mk.5 Series II Deck.....	£46.11.0	£53.1.0
Assembled with deck wired and matched, £55.3.0.		
HF TR3 with Collaro Studio Tape Deck.....	£24.3.0	£29.10.0
Assembled with deck wired and matched, £31.12.0.		
HF TR3 with Brennel Mk.5 Series II Deck.....	£46.4.0	£51.11.0
Assembled with deck wired and matched, £53.13.0.		

(Carr. & Ins. 15/- on above units. Send S.A.E. for comprehensive price list.)
SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

STEREOLYNE

Electronics Centres throughout Great Britain

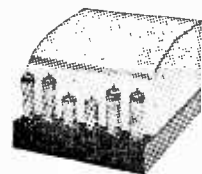
DUE TO PRODUCTION STREAMLINING WE ARE PLEASED TO ANNOUNCE REDUCTIONS IN PRICE

THE TUDOR STEREO HI-FI SYSTEM



FOR ONLY **48gns.**
Plus 15/- Pkg. & Carr.

Comprising a Self Powered AM/FM Tuner, Stereo Pre-amplifier, 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: Tuner—Outstanding quality providing full VHF/FM long and medium waveband coverage, frequency range FM 87.5-108.5 Mc/s, AM/MW 522-1630 Kc/s, LW 145-270 Kc/s 100mV output mains supply 105/240 A.C. Valve line-up: ECC85, ECH81, EB99, EB91, EM84, ECC83. Multiplex outlet provided. Pre-amplifier—Designed for use with the Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape-Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1% tape outputs 100mV from 90K ohm source inputs—Microphone 5 mV, Tape 5.3 mV, R.I.A.A. 4.3 mV flat 250 mV Tuner



100 mV. Valve line-up: 2—EF86, 4—ECC83. Power Amplifier—14 watts per channel, sensitivity 1 volt rms, for 14 watts output, frequency response ± 0.5 dB 20 c/s.—20 Kc/s. Speaker impedance 4, 8 or 16 ohms, surplus power available for Tape Pre-Amp, mains supply 105/240 v. A.C. Valve line-up, 2—ECC83, 4—EL84, 1—GZ34.

DOUBLE FEATURE PRE-AMPLIFIER AND JLI10 POWER AMPLIFIER

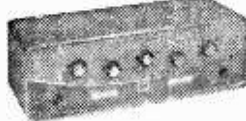
★ J.L.10 POWER AMPLIFIER



Incorporates the latest triode-pentode ECL86 valves in push-pull. PARTRIDGE ultra linear output transformer. PARTRIDGE mains transformer and smoothing choke. 10 watts power output, surplus power available for tuner. Output impedance 3—7.5—15 ohms. C. & I. 7/8.

KIT OF PARTS **£10.0.0**
READY BUILT **£13.13.0**

★ DOUBLE FEATURE PRE-AMPLIFIER



Inputs for microphone, crystal or magnetic pick-ups, tuner unit, and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck. Push-button switching for 3 tape speeds equalised. Lane erase Bias Oscillator circuit incorporating ferrite-core transformer. Function switch, separate base, treble and volume controls, level control and latest EM87 magic eye level indicator. The pre-amplifier is totally enclosed in a silver hammer finish steel case, and an attractive perspex front panel completes the presentation.

KIT OF PARTS **£13.13.0** READY BUILT **£19.19.0** C. & I. 5/-
PRICES: If both above units purchased together:
KIT OF PARTS **£23.13.0** READY BUILT **£32.0.0** C. & I. 10/-

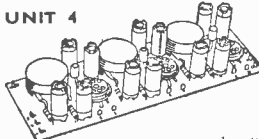
AGOS MONAURAL STETHOSCOPE HEADSETS

Suitable for Tape Recorders, or monitoring tape recorders, 100 ohm impedance magnetic. Complete with lead. P. & P.
(Originally 21/-). OUR PRICE **12/6** 1/6

SEND STAMP FOR COPY OF OUR INTERESTING LITTLE BOOKLET "What is High Fidelity"

MARTIN Fully Transistorised AUDIOKITS

These ingeniously designed sub-assembled kits enable you to build a transistorised Hi-Fi system by simply linking together your choice of units. No technical knowledge or special tools are needed to build with complete success. All units are supplied on printed circuit boards ready to mount and connect. Latest type transistors used in conjunction with the specially developed circuits give you superb reproduction or battery operation or can be used on A.C. mains with Martin power supply unit



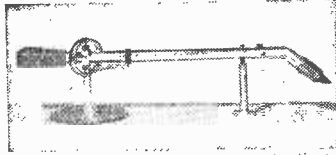
Following Audiokits available:—
Unit 1.—5-Stage Matching Input Selector Unit. 47/6.
Unit 2.—Pre-Amplifier with Master Volume Control. 37/6.
Unit 3.—3-Channel Mixer. 79/6. (Plug-in matching adaptors for above. 8/6 each.)
Unit 4.—Combined Pre-Amplifier and Tone Control Unit. 62/6.
Unit 5.—10 watt Main Amp. (3 ohm o/p imp. only at present). 25.12/6.
Unit 6.—Power Supply Unit. 22.12/6.
P. & P. extra on above items. Full range of attractive perspex escutcheons available. Send S.A.E. for fully descriptive literature.

HI-FI STEREO HEADPHONES

For the connoisseur who requires perfection. Each Earphone consists of a 2" Dynamic Loudspeaker with a full frequency range, fitted with foam rubber Ear Pads for added comfort to keep out noise and to maintain an excellent bass response. The resistance junction box with change-over switch provides simple transfer from Phones to Speaker. Specifications: Frequency Range 25-15,000 c.p.s. Input Impedance—16 ohms. Power rating—1 watt. Weight—13 ozs. PRICE **5 Gns.** P. & P. 2/6. (Junction box 15/- ex.)



OUTSTANDING PRICE REDUCTION



THE B & O. STYL PICKUP COMPLETE WITH SP 11 STEREOYNE MAGNETIC CARTRIDGE

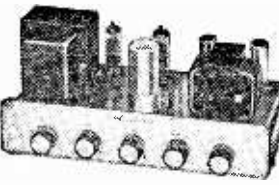
A Transcription Pickup of outstanding quality employing a specially designed counter-balanced and unique weight adjustment. Specifications: Length 1 1/2 in. from tip of Cartridge. Height 2 1/2 in. Stereo/Mono Cartridge Frequency Response: +2.5dB from 30cps. to 15 K.C. Output Voltage: 7mV per channel at 5cm/sec. at 1000 cps. Separation: 20dB minimum. DC Resistance: 1250 ohms. Inductance: 200mH Recommended Tracking Force: 2 to 4 grams. Compliance: 5 x 10⁻⁶ cm/dyne in all directions. Stylus: Diamond, radius of curvature: 17 μ . Recommended Load: 47000 ohms. PRICE **9 1/2 gns.** Plus 3/6 P. & P.

WEST END:	18 Tottenham Court Road, W.1.	MUSEum 5929/0095	Half-day Sat
(Premier Radio)	23 Tottenham Court Road, W.1.	MUSEum 3451/2	Half-day Thurs
(Premier Radio)	309 Edgware Road, W.2.	PADddington 6963	Half-day Thurs
CITY:	109 Fleet Street, E.C.4.	FLEEt St. 5812/3	Half-day Sat.
NORTH LONDON:	162 Holloway Road, N.7.	NORth 8161/5	Half-day Thurs
SOUTH LONDON:	9 Camberwell Church Street, S.E.5.	RODney 2875	Half-day Thurs
CROYDON:	12 Suffolk House, George Street.	MUNicipal 3250	Half-day Wed
BRISTOL:	26 Merchant Street, Bristol 1.	Bristol 20261	Half-day Wed
MANCHESTER:	10 Withy Grove, Manchester 4.	BLAck Friars 5379	Open 6 days a week
Mail Orders and enquiries to Dept. P.W. 162 Holloway Rd, London, N.7. NORth 8161/5			

THE TRIPLETONE HI-FI MAJOR

PRICE ONLY **£15.18.9** COMPLETE

Guaranteed 12 Months.



A 12 watt quality amplifier incorporating negative feedback, with a pre-amp for mic, and provision for mic./gram mixing. Frequency response ± 1 dB 15-20,000 c/s. Distortion only 0.15% with noise and hum - 80 (B). Separate Bass, Middle and Treble lift controls. Valve line up, 12AX7, 12AX7, EL84, EL84 and E231. Push-pull output with matching to 3 or 16 Ω . Fully isolated power supply from 200/250 v. a.c. input, with take-off for tuner etc. Size 12 x 3 1/2 x 6 in. high.

De Luxe Case: 14in. x 9in. x 7 1/2in. 30/- extra.

New Boxed VALVES 90-day Guarantee

074	5/-	6K74	5/-	6B91	4/-	6CP62	8/-
1R5	8/-	6R80	5/-	6BC41	8/-	6CL84	10/-
1R5	8/-	6R66	8/-	6BR81	8/-	6CL84	10/-
1T4	8/-	6X3M	5/-	6B180	9/-	6PL3	10/-
2X2	3/-	6G47	6/-	6CH42	9/-	6PL3	8/-
2R4	7/-	6N7	5/-	6CH81	8/-	6V33	10/-
3V4	7/-	6V6G	5/-	6C180	8/-	6V80	7/-
3Q4	7/-	6X3	5/-	6C192	10/-	6V81	8/-
3E4	6/-	6X3	5/-	6C265	6/-	6V82	7/-
3Y3	6/-	12AT7	6/-	6F86	10/-	6P41	8/-
5Z4	9/-	12AU7	6/-	6F89	8/-	6P61	8/-
6A7	4/-	12AX7	7/-	6L32	5/-	6U2	7/-
6AM6	4/-	12BH7	7/-	6L84	7/-	6U84	8/-
6A76	6/-	6X3	5/-	6L80	8/-	6U81	8/-
6R46	7/-	12K8	14/-	6Y86	9/-	6UB89	9/-
6R5	6/-	12Q7	7/-	6Z40	7/-	6U81	8/-
6R6	7/-	12Y3G	9/-	6Z50	7/-	6U82	12/-
6E4	6/-	6Z56	8/-	6Z61	7/-	6U193	12/-
6D6	6/-	6Z24	5/-	6Z60	10/-	6U80	8/-
6G6	4/-	9A4	2/-	6VE24	5/-	6U41	8/-
6H6	3/-	6A76	6/-	6T33C	5/-	6V41	7/-
6J5	5/-	6D96	8/-	6T76	8/-	6V85	7/-
6J6	5/-	6K95	8/-	6U14	7/-	6U9	7/-
6J7G	6/-	6I136	8/-	6U284	8/-	6V150	6/-
6K6	5/-	6EAC80	8/-	6PC80	8/-	6W81	9/-

I.F. TRANSFORMERS 7/6 pair
665 K/s Flux Tuning Miniature Can, 2 x 1 x 1 1/4 in.
 High Q and good bandwidth. Data sheets.

NEW ELECTROLYTICS

TUBULAR	TUBULAR	CAN TYPES
1/850V 2/-	500/350V	5/6 8/800V 8/-
2/350V 2/3	100/25V	1/- 16/300V 5/-
4/350V 2/3	850/25V	3/- 16/600V 12/-
8/450V 3/0	350/12V	3/- 16/1500V 7/6
16/450V 3/9	1,000/12V	3/- 50/450V 6/6
32/450V 3/9	3,000/6V	3/- 32+32/350V 6/6
55/25V 1/9	8+8/450V	3/6 32+32+32/350V 7/6
25/50V 2/1	8+16/450V	3/9 30+30/350V 7/6
50/25V 2/1	16+16/450V	4/3 64+120/350V 11/6
50/50V 2/1	32+32/350V	4/6 100+200/275V 12/6

TELESCOPIC CHROME AERIALS. 13 to 43in., 8/6.
TRIPLEXERS Bands I, II, III, 12/6. **COAX PLUG.** 1/-.
LEAD SOCKET. 2/- (Surface or Panel Sockets, 1/-).
OUTLET BOXES (Surface or Flush) 4/-
BALANCED TWIN FEEDER 1/6. 6d. 80 or 300 ohms.
TWIN SCREENED per yd. 1/- 50 ohms only.
Wirewound EMI Shielding Conduit. 100 Yds 2/5 6/6.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Types. All values to 10 ohms to 25 K. 3/- ea.
 30K, 4/- (Carbon 30 K to 2 meg. 3/-).
WIRE-WOUND 4 WATTS. Pots. Long spindle. Value 50 ohms to 50 K. 8/6; 100 K. 7/6.
PHILIPS TRIMMERS. 0-10 pF. 3-30 pF. 1/-.
TRIMMERS. Ceramic. 30, 50, 70 pF. 9d.; 100 pF., 150 pF. 1/3; 250 pF. 1/6; 500 pF. 75p. 3/9. 1/9. TV etc. TRIMMER, 1,000 pF., with knob. 2/-.
RESISTORS. Preferred values. 10 ohms to 10 meg. 1 w. 4d.; 1 w. 4d.; 1 w. 6d.; 1 1/2 w. 8d.; 2 w. 1/-.
High Stability. 1 w. 15c. 2/- Preferred values 10 Ω to 10 meg. Ditto 5c. 10c to 22 meg. 5d.
BRIMISTORS. 0.2, 1, 3/6; 4.2, 2/6; 4.25, 1/6. 1/3
 15 watt } **WIRE-WOUND RESISTORS** {
 10 ohms to 10,000 ohms { 2/-
 15 watt } 100 ohms to 10,000 ohms { 2/-
 15 watt } 100 ohms to 10,000 ohms { 2/-
 12.5 K to 25 K 10 w. 3/-

Volume Controls	80 ohm COAX
Linear of Log Traps	Semi-air spaced 3in.
Long spindles, Midget	40 pins 12/6
5 K ohms to 2 M	60 vds. 2/6
1.8, 3/-; D.P. 4/6;	6d. vds. 1/6
Stereo L1810; D.P. 14/6	Ideal 625 lines.
1m. log + 1m. A/10x. 7/8	Low noise 5d/18
	1000, 500 Mc. 1/6 yd.

MAINS TRANSFORMERS 200/250 v. A.C.

STANDARD. 250-0-250, 80mA, 6.3 v. 3.5 a. Tapped 4 v., 4.1a. Rectifier, 6.3 v. 1.1a. 5 v. 2a. or 4 v. 2a. 22/6, ditto, 350-0-350 .. 29/6
MINIATURE 290 v. 20 mA, 6.3 v. 1 a. 10/6
MIDGET. 250 v. 45 mA, 6.3 v. 2 a. .. 15/6
SMALL. 250-0-250, 45 mA, 6.3 v. 2 a. .. 17/6
STD. 250-0-250, 65 mA, 6.3 v. 3.5 a. .. 17/6
HEATER TRANS. 6.3 v. 1.4 a. .. 7/6
 Ditto, tapped 1.4, 2, 3, 4, 5, 6.3 v. .. 8/6
 Ditto, sec. 6.3 v. 4 amp. .. 10/6
GENERAL PURPOSE LOW VOLTAGE. 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 24, 30 v. .. 22/6
AUTO TRANSFORMERS. 150 w. .. 22/6
 0, 110, 200, 230, 250 v. 500 w. v. .. 22/6
MULLARD "510" Mains Transformer. .. 33/6
MAINS POWER PACKS Ready built with Transformer, Rectifiers, Condensers, providing H.P. and L.T. outputs.
 200 v. 20 ma. D.C. 6.3 v. 1a. D.C. .. 25/6
 220 v. 50 ma. 110 v. 6.3 v. 2a. A.C. .. 35/6
 250 v. 80 ma. 110 v. 6.3 v. 3.5a. A.C. .. 45/6
TRANSISTOR TYPES TO REPLACE P.P.3 21/- also 9 v. 200 ma. replaces batteries P.P.1-4-7-9 same size as P.P.9 45/-.

INTERVAL TRANSFORMERS. 3:1 or 5:1, 9/1.

O.P. TRANSFORMERS. Heavy Duty, 5/6. Multi-ratio. 200-0-250, heavy duty push-pull, 10 w. 15/6 Battery 4/6. Sub. min. 5/9.
 10 w. O.P. matching trans. 3, 7, 15, 12/6.
L.F. CHOKES 15/10H. 60/65 ma. 5/1; 10H. 85 ma. 10/6, 10H. 150 ma. 14/-.
TUNING COIL WIRE 16 to 22 awg., 22/6
ENAMEL COPPER WIRE 16-22 2/8; 24-30, 3/6; 32-40, 4/6; 10 C.C. 28, 34, 36 swg. 2oz. 3/6.
FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 14 amp. 8/8; 2 a. 11/3; 4 a. 17/6.
CHARGE TRANSFORMER. Tapped input 200-250 v. for charging at 2, 6 or 12 v. 14 amps. 15/6; 2 amps, 17/6; 4 amps, 22/6. Circuit included.
4 AMP CAR BATTERY CHARGER with ammeter, Leads, Fuse Case, etc., for 6 v. or 12 v., 69/6

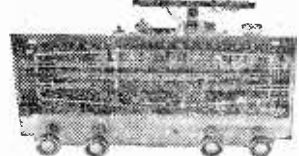
BOOKS list S.A.E.

Boys' Book of Crystal Sets.	2/6
"W.W." Radio Valve Data.	7/6
High Fidelity Speaker Enclosure 5/- Valve and TV Tube Equivalents	9/6
TV Part II Finding.	5/-
Multirad Amplifier Manual	8/6
Radio Valve Guide, Books 1, 2, 3.	5/- each
Practical Superhet Receivers	7/6
Practical Radio Inside Out	3/6
Master Colour Cine Chart	1/6
Transistor Controlled Models	7/6
Principles of Colour TV	16/-
International Radio Stations	2/6

4 TRANSISTOR PUSH-PULL AUDIO

Size 3 x 1 1/2 x 3 in. **AMPLIFIER**
 A really built miniature push-pull amplifier with Driver and output transformers, 4 transistors. Ideal for use with record players, intercoms. BABY A.I.R.M.S., etc. Complete with full **Price 47/6** instructions and circuit. 1/6
 9v. Batt. 2/3. 2 tin. Speaker 15/-
 Foggle Switches, s.p., 2/-; d.p., 3/6. d.p.d.t., 4/-. Min. Slide d.p.d.t., 3/6.

1964 RADIOGRAM CHASSIS



THREE WAVEBANDS **FIVE VALVES**
 S.W. 16 m.-50 m. LATEST MULLARD M.W. 200 m.-550 m. EC81B, 6F80, 6BR81, L.W. 800 m.-2,000 m. EL84, EZ80
 12-month Guarantee.

A.C. 200/250 v. short-circuiting. Long/Grand Ferrite Aerial A.A. 3 ohm output, 5 watts. Tape Sockets. Glass clad, horizontal winding, size 1 1/2in. x 4in. Aligned and calibrated. Isolated Chassis, size 1 1/2in. x 9in. high x 5 1/2in. deep. **£9.15.6** Carr. & Ins. 4/6-

BAKERS SELHURST LOUDSPEAKERS



12in. Baker, £15 w. Stalwart 3 or 15 ohms. 45-15,000 c.p.s. .. 5/6 Ears.
 12in. Stereo, Foam Suspension, 125-16,000 c.p.s. .. 7/6 Ears.
 12in. Standard H.D. 20w. 40-14,500 c.p.s. .. 7/6 Ears.
 12in. De Luxe 15w. 25-17,000 c.p.s. .. 8/6 Ears.
 12in. Bass 25w. 20-18,000 c.p.s. .. 12/6 Ears.
 15in. Auditorium 35 w., 20 c.p.s. to 12 kc/s. Heat proofed paxolin coil former. 18/6.

LOUDSPEAKERS P.M. 3 OHM. 2 1/2, 3, 4. 5in.: 7 x 4in., 15/6; 6 1/2in. Rols., 16/8; 8in. Plessey, 17/6; 9 x 6in., 8 x 5in., 2 1/2-10 x 6in., 22/6; 10 in. Rols., 30/-; 12in. R.A., 30/-; EMI double cone, 13 x 8in., 45/-; STENTORIAN HF101, 10in. 3 to 15 ohms. 10w. 57/6; 8in. HF112, 72/6; tweeter T339. 30/-; Cross-over CX3000, 30/-; EXTENSION SPEAKER CABINETS. 5in., 15/6; 6 1/2in., 18/6; 8in., 17/6; 10in., 20/6; 12in., 60/-.

CRT. 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., 3v. or 4v., or 6.3v., or 10.8v., or 12.6v. State voltage required. **PRICE 10/6.**

TWIN GANG TUNING CONDENSERS. 365 pF. miniature 1in. x 1 1/2in., 101-300 pF Standard with trimmers. 9/-; midget, 7/6; with trimmers, 9/-, 500 pF slow motion Tuning; standard 9/4. Transistor gang 208-175 pF with trimmers. 10/8. **SMALL** 3 gang 500 pF, 17/-, SINGLE 300 pF, 7/6. SINGLE 10 pF, 25 pF, 50 pF, 75 pF, 100 pF, 150 pF, 5/6. Solid dielectric 100, 300, 500 pF. 3/6.

CERAMIC CONDENSERS. 500 v. 0.5 pF to 0.01 mfd., 9d. 0.1, 0.01, 0.005, 0.01, 1/3, 1/3, 1/3, 1/3, 2, 900, 2, 900, 2, 900, 2, 900. T.C.C. 6/6; Duto, 20 kv, 8/6; 0.1 mfd, 7 kv, 9/6; Tubular 500 v. 0.001 to 0.05 mfd. 8d.; 0.1, 1/-, 0.25, 1/6; 0.5/350 v., 1/8; 0.1/350 v., 8d.; 0.01/2,000 v., 0.1/1,000 v., 1/8; 0.1 mfd. 2,900 volts, 3/6.

SILVER MICA CONDENSERS. 10% 5 pF to 500 pF, 9d.; 600 pF to 3,000 pF, 1/-; Close tolerance (1+1 pF) 2.3 pF to 47 pF, 1/-; Ditto 1% to 50 pF to 615 pF, 1/-; 1,000 pF to 5,000 pF, 1/8.

485 kc/s SIGNAL GENERATOR

Price 10/6, ready made with valve IS5. **POCKET SIZE**, 2 1/2 x 4 x 1 in. One resistor to change. Full instructions supplied. Battery 8/6 extra. Details Free.

WAVECHANGE SWITCHES

3 p. 4-way 2 water slide .. 8/6
 2 p. 2-way or 2 p. 6-way long spindle .. 3/6
 4 p. 2-way or 4 p. 3-way long spindle .. 2/6
 3 p. 4-way or 1 p. 12-way long spindle .. 3/6
Wavechange "MAKERS" Walters available: 1 p. 12 way, 2 p. 6 way, 3 p. 4 way, 4 p. 3 way, 6 p. 2 way, 1 water switch, 8/6. 2 water switch, 12/6; 3 water switch, 16/-; additional waters up to 12, 3/6 each extra.

CRystal MIKE INSERTS, 6/6

High output. Size 1 1/2 in. dia. x 1 in.	8/6
ACORN MIC. 14 insert. 1 in. dia. x 1 in.	8/6
ACORN 39-1 DE LUXE STICK MIKE 35/-	
TSI 1000 AUDIO STICK MIKE	25/-
TELEPHONE TAPE MIKE	10/6
GUITAR CONTACT MIKE	15/6
MOVING COIL MIKE	59/6
FLOOR STANDS	57/6

Valveholders. EA50. 6d. B12A CRT, 1/8. Engr. and Amer. 4, 5 and 7 pin, 1/4.
Moulded Mazda and int. oct., 6d.; B7C, B9A, B9B, B9A, 5/6; B7C with can, 1/6. B9A with can, 1/3. Ceramic EF50, B7C, B9A. Int. oct., 1/-, B7C, B9A cans. 1/- each. Valve pins B7C, B9A, int. octal, 2/3.

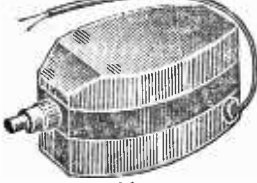
HIGH GAIN TV PRE-AMPLIFIERS

B.C.C. Channel 1 to 5, Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (P.CC84 valves if preferred). Coils only 5/6. **BAND III P.I.A.** Same prices. B9A. Tunable channels 3 to 13. Gain 17dB. Circuit and coils only, 9/6. Chassis 4/6.

Our written guarantee with every purchase. **NEW COMPONENT LIST 1/-.**

THE ORIGINAL RADIO COMPONENT

THE "INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETIZER



200/250 v. A.C. **35/-** Leaflet S.A.E.

PLASTIC RECORDING TAPE

Double Play 7in. reel, 2,400ft. 42/- 5in. reel, 1,200ft. 26/-	Spare Plastic Reels
Long Play 7in. reel, 1,800ft. 22/6 5in. reel, 1,200ft. 17/6 5in. reel, 900ft. 15/6	3in. 1/6 4in. 2/- 5in. 2/-
Standard 7in. reel, 1,200ft. 17/6 5in. reel, 600ft. 11/6	5in. 2/6 7in. 2/6

"EASIFLICE" Tape Splicer 5/-.
Leader tape 4/6; Splicing tape 3/-.

CRYSTAL SET BOOKLET 1/-.
CRYSTAL DIODE + E.C. 2/-, GEX 34, 3/-, OA01. 3/-.
HIGH RES. PHONES. 4,000 ohms. 15/-, 2,000 ohms 12/6.
MOVING COIL PHONES. 100 ohms. 10/-.
SWITCH CLEANER. Fluid squirt sprout. 4/6 tin.

"6+1" TRANSISTOR RADIO MEDIUM AND LONG WAVE KIT

First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, with car aerial coil, printed circuit. 8 1/2 in. x 2 1/2 in., but EXCLUDING Speaker and cabinet.
Speakers, 35 ohms, 7 x 4 in. 21/- £4.50
5in., 17/6, 3 1/2 in., 15/6.

BULGIN PLUGS AND SOCKETS. Non-reversible PT. 2-pin, 4/3; 173, 3-pin, 4/6; P104, 6-pin, 6/0. JACKS. Enfield open circuits 2/6. Closed circuit, 4/3. Grundig type 3-pin, 1/3. Grundig lead jack 3/6. JACK PLUGS, English, 3/-, Screwed, 4/6; Grundig, 3-pin, 3/6; Photo Plug, 1/-; Sockets 6d.
ALADDIN FORMERS and cores, 1in., 8d.; 1 1/2 in., 10d. 0.3in. FORMERS, 6937 or 8 cans TV1 or 2, 1 1/2 in. sq. x 2 1/2 in., or 1in. sq. x 1 1/2 in., 2/- with cores.
SLOW MOTION DRIVES, 61 4/3, 301, 10/6.
BLOWN IRON, 25W, 200V or 230V, 24/-.
ANTEX SUB-MIN. IRON, 15w, 200 or 240v., 20/6.
BENCH STAND for above 12/6. Spares in Stock.
Paxolin Panels, 10 x 8 x 1/4 in., 2/-; Selenium 250 V, 60mA, 7/6; 250V 35mA, 9/6; Selenium Rect., 300V 35mA, 5/-; TV etc., Silicon Sub. Min. Rectifiers, 250V 45mA, 10/-, K3/25, 600V, 5mA, 5/-, RM4, RMs, 14A100, 14A116, 10/- each, FC31 20/.

Coils Wearite "P" type, 4/- each.
Osmon Midget "Q" type, ad. dust core, from 4/- each. All ranges. List S.A.E.
Repenco DRK2, L. and Med. T.R.F. with reaction, 4/6, Med. wave D.R., 3/6.
Ferrite Aerials, M., 3/6; M. and L., 12/6.
Osmon Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x 1in., 6 x 1in., 6 x 1/2 in., 3/-.
H.F. Chokes, 2/6, Osmon QT1, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/6.
Screwdriver, 5in., 6d. Test Prods., 2/9.
Neoside Trimming Tool, 1/9.
Neon Mains Tester Screwdriver, 5/-.
Multicore Solder, 4d. yd. Dispenser, 3/6.

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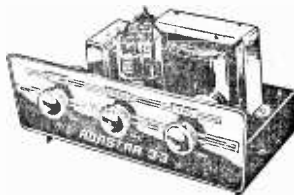
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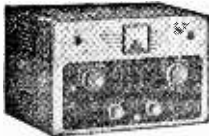
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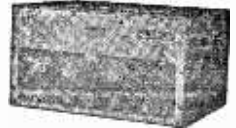
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Practical Wireless

Vol. XL No. 688 JUNE, 1964

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Sense of Proportion

ALL manner of interests and aims motivate the amateur radio enthusiast. These stimuli are not so varied as the results of the motivation, but nevertheless the initial interest can be triggered off by a variety of reasons.

For many constructors it is the end product which makes it all worth while—the actual listening on a newly-built receiver or amplifier. Others derive their greatest joy from the actual physical construction, so that when the equipment is finished interest tends to flag until a new building project is under way.

To others, the challenge lies in designing their own new equipment, or in adapting published designs to suit their personal requirements. There are some who just like reading about things!

Thus the stimulus may be materialistic, utilitarian, manipulative, theoretical, and so forth. What drives one constructor on, leaves his companion cold; and vice versa. Basically, this is splendid. It provides contrast, adds spice to the hobby and makes talking points between fellow enthusiasts.

Most constructors have *some* technical knowledge, albeit only slight, and because of this understanding of *why* a piece of equipment functions in the way that it does and the realisation of what it *could* do when working at optimum efficiency, it is inevitable that after completing a new piece of equipment, the enthusiast with an enquiring mind may well find himself dissatisfied.

He may seek to further improve the results obtained—by critical adjustments, by experimenting. This again is commendable for it shows a willingness to learn and to search for better and better results. It is this attitude which leads enthusiasts to squeeze the last microvolt of sensitivity from a communications receiver, to reduce to the smallest degree the distortion in an amplifier, even to tidy up wiring and smarten the physical appearance of a finished unit.

These efforts are quite understandable and the hallmark of the true enthusiast. For inside most radio constructors there is a perfectionist trying to get out. But danger can lurk if we become too hyper-critical! It is one thing to be content with nothing short of the optimum efficiency one can *reasonably* expect from a given piece of equipment, but quite another to strive for the impossible.

And apart from the frustrations inevitable when failing to realise the limitations in a design, one is always in danger of losing sight of the original objective. We all know of the audiophile so intent on trying to assess the degree of phase distortion that he never hears the music being played. Or the TV enthusiast who sits miserably glowering at a slight frame non-linearity while the family relax with Panorama. Or the dyed-in-the-wool hi-fi fanatic who would rather listen to a frequency test record than a concerto.

Although this is, naturally, only a matter of maintaining a sense of proportion, there must surely be more than a few enthusiasts who, in their preoccupation with the search for perfection have completely lost sight of what they set out to achieve in the first place—the building of a piece of equipment to be enjoyed!

Our next issue dated July will be published on June 5th



ROUND THE WORLD of WIRELESS

**NEWS AT HOME
AND ABROAD**

RSGB V.H.F./U.H.F. CONVENTION DATE

THE Radio Society of Great Britain has announced the date of its tenth International v.h.f./u.h.f. Convention as Saturday, May 16th. The Convention will be divided into three sections; the morning will be devoted to an exhibition of trade and amateur products, the afternoon will consist of a programme of lectures and in the evening there will be a dinner at which a number of prizes will be presented.

The venue for this event will be the Kingsley Hotel in London



The window of aluminium foil used in U.K.2's meteorite detector equipment.

and tickets are available for the Convention and dinner or for the Convention only.

Electronic Navigation Equipment in Trident Airliner

MUCH of the electronic equipment carried by the Hawker Siddeley Trident airliner, which recently made news by making a successful "hands-off" landing, was supplied by the Marconi Company Limited. In fact the aircraft's "Autoland" system which was to a large degree responsible for this accomplishment, was fed with primary information provided by Marconi-made navigation and approach guidance equipment, type AD260. This equipment forms part of the well-known Marconi Sixty Series of airline radio equipment.

The very exacting degree of accuracy and stability required of these equipments, has been achieved by employing the latest techniques in electronic circuit design and sealed modular construction.

Also included in the Trident's radio equipment are Marconi v.h.f. communication and automatic direction finding equipments and an aircraft selective calling system.

U.K.2 Transmits Meteorite Data

ON board the second United Kingdom satellite—U.K.2—now circling the earth after its successful launch from Wallops Island, Virginia, is electrical equipment manufactured by Ferranti Limited, and which is being used to transmit data on the concentration and size of micro-meteorites (cosmic dust) in space. After it was decided to include this experiment in the scientific programme of U.K.2, Dr. Jennison of Manchester University evolved a technique for counting and sizing the micro-meteorites, to be developed and built subsequently by Ferranti Limited.

In operation an aluminium foil moving across a window in the satellite housing, is punctured by micro-meteorites meeting it, thus allowing sunlight to penetrate the foil for a brief period of time when the rotation of the satellite presents the window towards the sun. Behind the foil is a bank of Ferranti solar cells on which one ray of light for every hole in the foil falls, producing a pulse of electrical energy in the cells in proportion to the size of the hole. A second instrument in the satellite detects finer dust particles and although its mechanics are different, the principle of operation is similar.

The outputs from the solar cells are amplified by equipment designed and developed once again by Dr. Jennison and Ferranti Limited respectively, and these amplified signals are next transmitted back to earth to be picked up by the ground tracking stations.

BBC REVIEW STEREO BROADCASTS

THE BBC's recognition of the substantial public demand which exists for regular stereophonic broadcasts, was illustrated recently by the Corporation's contribution of special stereo

transmissions during London's Audio Fair (see "Audio Fair Comment" page 161). However it has also been recognised that commitments to regular broadcasting cannot be made until a

decision on the system to be used has been taken, and this in turn must be influenced by any decision on a common system for use throughout Europe. Although this latter question has already been considered by the CCIR and will probably be considered again early in 1965, final agreement is not expected before the next Plenary Assembly of the CCIR in 1966.

New Water Pipes Present Electrical Hazard

RECENT discussions between representatives of the Institution of Electrical Engineers and the Institution of Water Engineers has led to the Councils of the two Institutions issuing a joint statement concerning earthing of electrical installations to water pipes. The statement was authorised in consideration of the increasing use of non-metallic water mains and water pipes which presents an electrical hazard by not being able to provide the earthing properties which have become associated with metallic pipes and for which they have been used considerably by consumers for earthing electrical equipment.

The statement explains that most danger exists when part of an existing water pipe installation is altered to incorporate pipes made from non-metallic materials, without allowing for the fact that this may break the continuity of the metallic path to earth and thus leave some electrical equipment, which had previously been adequately earthed by connection to one point in the system, without proper earthing. As efficient earthing is one of the best means of ensuring freedom from fire and shock in a consumer's electrical installation, such a situation would present a very real electrical hazard.

When a new water pipe installation is completed however, the position is somewhat different as, on the advice of the local Electricity Board, a form of electrical earth will be provided which will be independent of the water system and to which electrical equipment will be earthed. If, initially, metallic pipes are installed, equipment may be bonded to them as an extra precaution as any alteration in the water pipe system at a later date which would remove its earthing properties, would still leave the equipment properly earthed.

A consumer who wishes to alter his water supply system can obtain the advice of his Electricity Board concerning its earthing properties.

Telephone Contract with Portugal

AS part of their expansion and modernisation programme, the Portuguese Department of Posts, Telegraphs and Telephones has placed an order for automatic exchange equipment with Automática Eléctrica Portuguesa, S.A.R.L., company operated by Plessey Overseas Limited, for the manufacture of telecommunications equipment.

The equipment will be assembled at the Company's Lisbon factory and will be installed in the centres of the national telephone network.

Museum Marks Pioneer's Centenary

LONDON'S Science Museum currently has on show a special exhibition commemorating the centenary year of the birth of S. Z. de Ferranti, pioneer of the use of electric power, and well remembered for his Deptford scheme of 1890, which included a power station destined to become the forerunner of the modern power station. The name of Ferranti has become automatically associated with many other inventions of electrical equipment and the Science Museum exhibition—which was opened during April by his grandson Sebastian Z. de Ferranti—and a specially prepared booklet, provides an interesting account of his life's work. The exhibition will continue until the end of August.

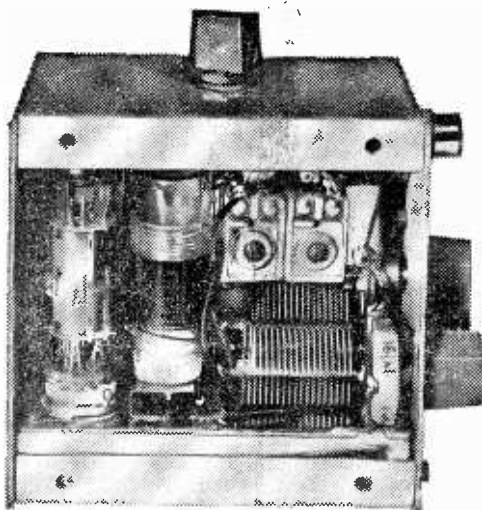
The approval of the Postmaster General is necessary for the introduction of stereophonic broadcasting in this country and, as with the question of adopting an agreed system of colour television transmission, it now seems that a final decision on stereo broadcasts must be deferred pending recommendations from Europe and various official bodies including the Television Advisory Committee.

This whole problem has been the subject of a review made recently by the BBC taking into account, amongst other factors, the results of the experimental work already done and with which it is now proposed to continue until the time of the CCIR meeting in 1966.

GPO INSTALL NEW EQUIPMENT

TRAFFIC on International Radio-Telegraph circuits is often subject to interference or fading on the radio path which introduces errors into the information being sent. To combat this, the G.P.O. has brought into service a fully electronic automatic error detection and correction installation at Fleet Building, London. Believed to be the first installation of its kind in the world to carry traffic, this equipment—known as ARQ—"protects" the circuits by automatically detecting and correcting any errors that have been introduced. These two operations are carried out by ARQ terminal equipments, 50 of which will eventually handle 200 channels terminating at the London Centre.

Other equipment at this ARQ Centre permits traffic to be stored on magnetic drums when radio conditions over the protected links are poor.



Designed and
Described by
David Gibson

7Mc/s TRANSCEIVER

IN the world of wireless, as in any other spheres of technical interest, there will always appear from time to time apparatus which has a "novelty" appeal. There are, no doubt, readers who are essentially very practically minded and who have no time for novelties, whereas some other readers will delight in such circuitry.

Any magazine or editor, is faced with the constant, and very difficult, problem of trying to accommodate all tastes, and in presenting this month's blueprint, it is felt that both these two groups will gain a measure of satisfaction. The novelty enthusiasts, because it is shown how to build an amateur transmitting station—transmitter, receiver, and frequency meter on a chassis which measures only $3\frac{3}{8}$ in. x $2\frac{3}{4}$ in. x $\frac{7}{8}$ in. complete with valves. This unit is thus small enough for the overcoat pocket and requires only a very modest power source to get on the air. Indeed, the power supply from the average domestic valve receiver will suffice.

The practically minded or the more serious reader will find this project of interest since it presents a transmitter and receiver which is efficient and will take up hardly any room at all. It can be used as a standby rig and/or a crystal frequency meter to provide accurate calibration from 1—30Mc/s. Miscellaneous crystals may be tested with it and if the appropriate crystal and coils are inserted, it could prove most useful for 160 metres, where there is a maximum of 10W anyway.

Most QRO rigs for 3.5—28Mc/s present a problem when trying to use them on top band because a great deal of power has to be lost. If the big rig runs 150W then some means of "losing" 140W is required and the usual practice is to construct a separate TX for top band. This article describes the construction of just such a rig with the minimum number of components consistent with reliability together with simple uncomplicated circuitry.

For others, this unit might prove very useful to take on holiday. In such an application as this, a companion midget power unit might be constructed using a TV preamplifier type double wound mains transformer together with a couple of silicon diodes.

THE TRANSMITTER SECTION

The transmitter consists of a Pierce crystal oscillator operating on 7Mc/s, followed by a pentode power amplifier also tuned to 7Mc/s. This circuit configuration (see Fig. 1 on Blueprint) is chosen so as to use the minimum number of components consistent with reliable performance.

Now to consider the circuit in some detail. C1 is used mainly to isolate the crystal X1 from the h.t. line. Some constructors may point out that circuits do exist which do not use a capacitor at all in this position, but this would have meant that the crystal socket pins on the front panel were live with respect to the case, and C1 was included to

avoid this. R1 provides the necessary bias for the triode portion of V1 and L1 is an r.f. choke anode load.

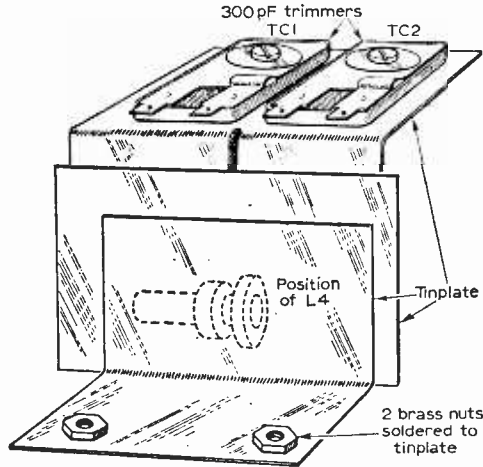
C2 performs the usual role of coupling capacitor, passing the generated signal to the grid of the p.a. stage, and also serves as a blocking capacitor.

R2 provides the necessary bias for the pentode section and the actual bias voltage is obtained from the signal itself. Using this method of biasing means that the p.a. must be keyed, otherwise when there is no signal there will be no bias and the p.a. will immediately start to draw excessive current. It would, of course, be possible to place a resistor-capacitor combination in the cathode of the p.a. in order to limit the current under no-drive periods, but this would have meant two extra components plus a slight loss of power.

It was also necessary to key the c.o. otherwise it would block the receiver if left running. Since, however, the h.t. is switched from transmitter to receiver, it would be in order to take the cathode of V1 triode directly to earth and key only the pentode section if so desired. Should this be done, it might also be an idea to plug a modulator into the key socket thus using cathode modulation of the p.a. As this form of modulation is in the "efficiency" class, only a very small amount of audio power would be required.

The inductor L2 functions as an r.f. choke and C4 as a blocking capacitor to prevent a short between h.t. positive and earth via L3. VC1 and L3 form a tuned circuit resonant at the transmitting frequency.

It would have been in order to place the tuned circuit in the anode lead to the p.a. thus eliminating C4, but the spindle of VC1 would then be at h.t. potential and this was considered undesirable.



high gain valves today's O-V-1 circuit can prove lively and efficient. The receiver, therefore, consists of a triode detector followed by a pentode audio amplifier.

The triode section is a regenerative detector complete with the normal tuned grid circuit and grid leak R3, with VC4 acting as the regeneration control. R4 and R5 are anode load and decoupling resistors, the capacitor C8 passing on the signal to the pentode grid.

C7 is used to provide an "easy" path to earth for any residual r.f. which may have ventured thus far. R7 and C9 are the usual bias components common to many audio stages and R8 forms the anode load of the pentode. The earphones are

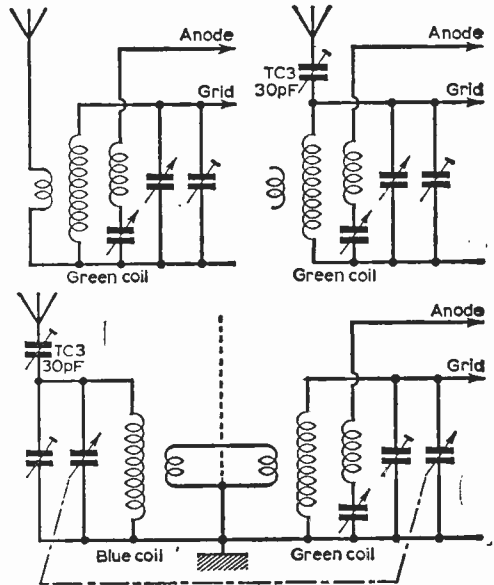


Fig. 7 (above): Alternative aerial coupling circuits.

Fig. 6 (left): The tin plate bracket used to mount the trimmers, TC1 and TC2.

plugged into the jack socket J2 and the capacitor C10 provides the necessary isolation from the h.t.

plugged into the jack socket J2 and the capacitor C10 provides the necessary isolation from the h.t.

AERIAL INPUT ARRANGEMENT

The aerial input and tuned circuits may appear a little unusual, especially on the receiving side. One of the shortcomings of a regenerative detector is poor selectivity. The present circuit helps to improve matters by providing an additional tuned circuit ahead of the usual one VC3, L5. These two tuned circuits are top coupled by the small capacitance of C5 and it is very important that this is the only coupling between the two.

If the twin gang capacitor VC2, VC3, is not to hand or proves difficult to obtain, then the circuit will continue to function well by omitting this first tuned circuit, i.e., L4, TC1, VC2 and C5. The antenna input then goes to the spare winding on

THE RECEIVER SECTION

There is nothing startling or new about the receiver, indeed one old timer on seeing it remarked that apart from the size it was pretty much the same as his main station receiver back in the 1920's. However, with the use of modern

L5 which in the present circuit is ignored. (See Fig. 7.)

Some readers may prefer to ignore the coupling windings anyway and tap the aerial on to the grid end of the coil via a trimmer, this being a practical aid to help eliminate "dead spots" and also to offer a much better match to certain types of aerial. Constructors who prefer this may do so with confidence and modify the circuit shown accordingly.

Also, with a regenerative circuit there is always a possibility of radiating interference. With an

This material is used instead of the more usual aluminium because it can be cut to any shape or size with a pair of household scissors and is very easy to bend, while being already tinned, components requiring to be earthed can be soldered directly to it. If aluminium was used nuts, bolts, and tags would be required for this purpose. Note, do not make the chassis any deeper than $\frac{1}{8}$ in. If you do, the result will be a midget station with the only minor drawback that it will be impossible to plug in the valves. You have been warned!

The holes for the two B9A valve holders are cut first and a couple of holes drilled to allow leads to come up from below chassis. Next, complete all under chassis wiring prior to its insertion in the case as once this and the variable capacitors above chassis are wired there is no way of getting at under-chassis components again without unsoldering all the variables and removing both them and the valves in order to lift out the chassis.

One interesting and very practical suggestion is that the bottom on the case should be removed and a small base-plate fitted. This would make inspection and servicing very much simpler—not to mention ease of construction. See Fig. 8. This is not done in the prototype and there may be some, who, for various reasons

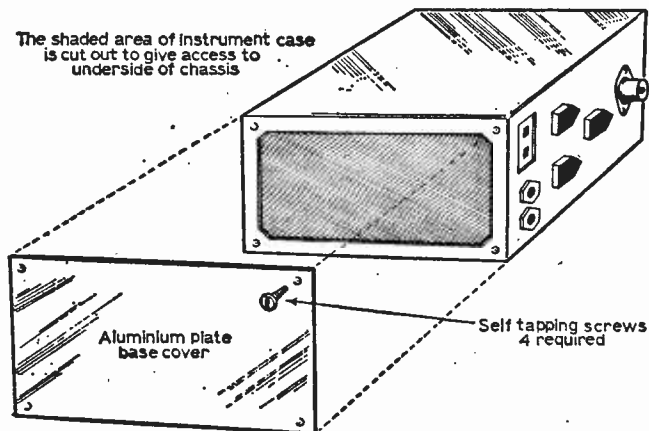


Fig. 8: Showing how the base of the unit is modified to incorporate a cut-out inspection opening.

extra tuned circuit between the regenerative detector and aerial this would obviously assist in preventing unwanted radiation. Another way of wiring the extra tuned circuit is shown in Fig. 7 and wired in this manner would be similar to having an aerial tuning unit—but with the added advantage of only having one knob to tune.

The main tuning, i.e. bandset, is centred on the band by the trimmers TC1 and TC2, and the variable then acts as a bandspread. This was found very helpful on today's crowded bands. When adjusting the trimmers to centre the tuning, remember to set the bandspread to half mesh first.

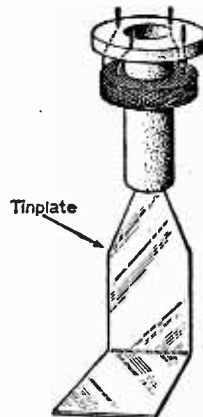
CONSTRUCTION

It is very strongly advised that intending constructors should be in possession of ALL components including chassis and case prior to commencing actual construction. This is very important especially when working to close tolerances as in the present case.

All parts should be measured carefully and holes drilled accordingly. There may well be slight differences between similar components and the drawings and layouts given should be used only as a guide. As an example of the exactness of layout the two capacitors VC1 and VC4 just fit flush in the case specified. There is no room for any error at all since they are already flush up against the sides of the case and thus these components cannot be manipulated either way to correct for inaccuracies in holes already drilled.

The actual chassis was made from a piece of thin tinplate.

Fig. 9: Mounting details of the green coil.



will not wish to cut a panel from the case. For the benefit of those the following tips are offered based on experience gained in wiring the original unit seen in the photograph.

First wire the whole chassis. all leads from below chassis, to anything above, i.e. p.a. tuning capacitor lead, etc., should be wired and a long floating lead pushed through the appropriate hole. The green coil with reaction winding (Denco Range 4) may either be mounted by drilling a hole and using the plastic locking nut supplied, or the method used in the original may appeal. A small scrap of tinplate is cut roughly to shape shown in Fig. 9. The core of the coil is removed and the thread for the plastic locking nut is cut off. The pointed end of the tinplate is then heated and pressed into the plastic end of the coil and allowed to cool and set. The coil can then be soldered via the piece of tin-

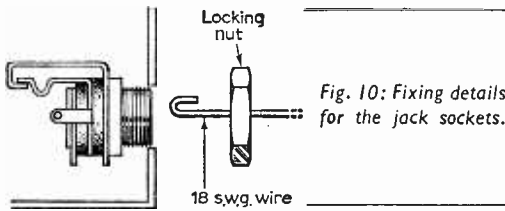


Fig. 10: Fixing details for the jack sockets.

plate to the chassis. Note, the dust cores are removed from both coils.

The crystal holder and the two jack plugs present a problem as once the chassis is in place these three components are inside and have to be fixed from the outside. The jack sockets are "rescued" with a small piece of 18s.w.g. wire bent as shown in Fig. 10. This was inserted into the hole in the "front panel", hooked on to the jack socket, and pulled. This exposed the threaded collar of the jack socket and the locking nut was then screwed on with the other hand.

The crystal holder was a bigger problem, as there was no fixed threaded part which was itself connected to the component as in the case of the threaded collar on the jack sockets. In order to overcome this difficulty two bolts were inserted in the fixing holes in the crystal socket and were glued in place. When the glue was quite dry (24 hours to be certain) the socket was then wired into circuit and the chassis placed in the case. The jack sockets were then brought out as per the instructions given above. A pair of long-nosed pliers were then inserted into the actual crystal sockets and the whole assembly was pulled gently into position. The two nuts were then screwed on with the free hand. (Fig. 12.)

No definite dimensions are given for the shield and mounting for the variable bandspread capacitor since these will vary depending on the component used. If a single capacitor is used instead of the bandpass arrangement shown, then the screen will not be necessary. In the prototype, the two bandset 300pF trimmers are mounted on one tinplate shield and the aerial coil on the other. This latter coil is held in position by a piece of 18s.w.g. wire from pins 1 and 9 and are earthed anyway. This coil and the trimmer or trimmers are wired up complete with tinplate screen, and the bandspread capacitors as one unit, prior to inserting the whole in the case.

POWER SUPPLY

On the roof of the case is a switch marked transmit/receive. It is either a single-pole two-way or a two-pole two-way.

One pole switches the aerial to either the transmitter p.a. coil or to the receiver input, the use of the other pole is optional. If a midget power unit is constructed using a TV pre-amplifier type transformer it must be noted that the maximum rating of these transformers is somewhere around 30mA. With both transmitter and receiver running, the drain on such a p.u. p.s.u. might well prove too great for the particular transformer, and in such a case the other pole S1b can be used to switch the h.t. to either valve, thus saving power. The power supply used on the original was capable

of supplying 150mA and the necessity did not arise.

Incidentally, the average domestic valve radio will supply a convenient form of power, if a suitable plug or adaptor is made. It would be even feasible to remove the output valve, plug in the rig in its place, and go on the air.

IMPORTANT. If you do use the power supply of a domestic receiver, first ascertain that the heater voltage is suitable—some radio sets have series connected heaters etc. It is imperative to check that the set is *NOT* an a.c./d.c. type, i.e. with mains directly connecting to one side of the chassis. It is equally important that if a midget p.s.u. is made that this is not an a.c./d.c. type either. One glance at the blueprint will show that the headphones would then be connected to one side of the mains as would the entire case, and this danger alone makes such a p.s.u. undesirable if not impracticable.

This point is mentioned at some length because in these days of miniaturisation it might prove a temptation to use just one

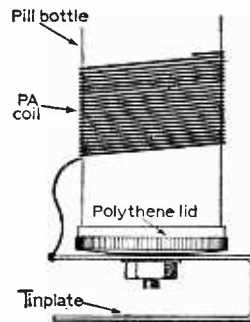


Fig. 11: The p.a. coil mounting details.

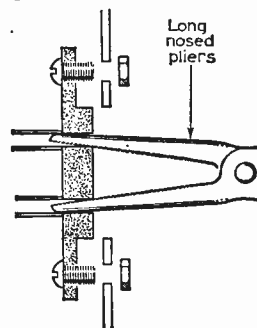


Fig. 12: The method of mounting the crystal socket.

tiny silicon diode in a half wave configuration for the h.t. line and do away with a comparatively bulky h.t. transformer.

R.F. CHOKES

The two r.f. chokes in the transmitter circuit can be small standard components of any type that will fit in. In the prototype these were, in fact, derived from i.f. coils of the type originally intended for transistor sets, the associated capacitor and dust core being removed in each case. The first r.f. choke in the anode of the triode has one pie removed to avoid the possibility of parasitics. These converted i.f.'s have proved very efficient in this unusual role and stand up to the higher voltages applied to them.

The two midget jack plugs and sockets again originally favourites for transistor work appear to stand up satisfactorily to the tasks allotted them in the present design.

TRANSMITTER AERIAL CIRCUITS

The p.a. coil will present no problems, being merely a length of wire wound on a ¼in. diameter

former. The actual former used in the prototype was a pill bottle with a plastic top bolted to a piece of tinplate which was soldered directly to the chassis. However $\frac{3}{4}$ in. diameter formers (preferably ceramic) are available, which will save would-be constructors touring chemists shops with a ruler! The method of feeding the aerial from this coil is a matter of choice and will rather depend upon the aerial to be used.

If a dipole is available, then a link winding of some three turns should prove satisfactory, it being only necessary to adjust their position on the tank coil for correct loading and maximum output.

Aerial tuning units and lowpass filters are usually wired to accommodate a low impedance input, and again link coupling will serve.

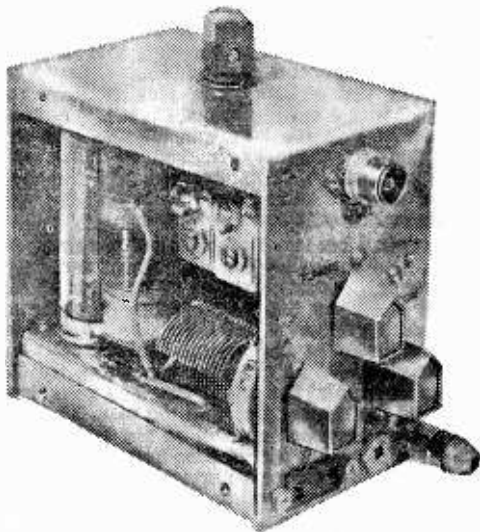
If, on the other hand a random length of wire, say, end-fed, is to be loaded up then it is possible to achieve this by tapping directly on the p.a. coil, the tap being varied up or down until a good match is secured. Once the correct tap has been located for a particular crystal and length of aerial

A view of the finished transceiver with the side panel removed to show the compact method of construction employed.

FINAL REMARKS

The case is a steel case, and perhaps aluminium would be a more suitable choice. The steel case was a standard line, easily obtainable and was, therefore, chosen. Those who prefer aluminium could, perhaps, get a case made specially to their desired dimensions from any of the firms advertising such a service.

In the prototype, there is no form of ventilation and in view of the bulb temperature attained by



it will not need to be varied. Thus, if, say, 40ft. of throw-out wire is loaded up then this could be carried in a small coil as a portable antenna.

A change of frequency, i.e. plugging in another crystal, will mean a change of tapping point on the p.a. coil. However, if two or three crystals are to be used and their frequencies are close together, then the same tap might be used with only slight loss of efficiency. The 40 metre band is only 100kc/s wide and of this 100kc/s only the lower 50kc/s are usually used for c.w. Suitable crystals for 7Mc/s are available very cheaply on the ex-government market and these units are recommended for the transmitter described here.

TRANSMITTER TUNING

The transmitter may be tuned in a number of ways. By far the best method is to use a standing wave ratio (s.w.r.) meter to ensure that the last watt goes up the spout! For those not so equipped, the usual method of tuning for a dip on a meter in the p.a. anode may be used. Here, the mA meter may conveniently be plugged into the jack socket in place of the key for initial tuning up. The power input cannot be exactly calculated from this, because the meter will read not only the p.a. anode current, but p.a. screen and triode current as well. However, with the valve and h.t. used it is doubtful if one could violate the terms of the transmitting licence and exceed the permitted 150W for 7Mc/s!!

RECEIVER TUNING

The usual tuning procedure for regenerative circuits is used. For phone signals, the regeneration control is advanced to the point just before the detector starts to oscillate. For c.w. reception the control is adjusted just to the point of oscillation, turning it any further may result in lowered sensitivity.

miniature glass valves it is advised that a number of small holes, grouped in a neat pattern, be drilled in strategic places in the case; at the rear of the valves, low down near their bases, and immediately above them should suffice.

To use the station for other bands the appropriate coils in the Denco range should be used in place of those shown. The p.a. coil in the transmitter would require the number of turns to be varied accordingly. Suggested lines for experiment would be 45 turns for 3.5Mc/s and 95 turns for 1.8Mc/s (fine wire). It is not suggested that the station be used on the higher bands due to the efficiency of the receiver decreasing with increased frequency. ■

35W Guitar Amplifier

FURTHER INFORMATION

An indirectly heated rectifier such as a GZ34 should be used instead of the 5U4, for although the 5U4 will prove satisfactory, it is probable that the reliability of the equipment will be enhanced by substituting a GZ34.

Suitable types of 32+32 μ F electrolytics for C6 and C7 are: Radiospares 450V, or Hunt's KB716 500V. It is important that the outer section of these dual units be used as a reservoir capacitor (C7).

Also the width of the cabinet should be 9 $\frac{1}{2}$ in. and not 8in. as given

TEST GEAR accessories

Part 5

BY C. MACKAY

CONTINUED FROM PAGE 43 OF THE MAY ISSUE

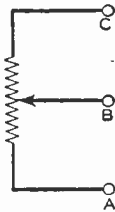
MANY experimenters when they see the words "calibrated attenuator" expect to be confronted with a highly expensive "T" or "H" type instrument using precision components to give matched input and output impedances.

While these are very desirable additions to any den, they are usually well beyond the pocket of the average experimenter.

However, a continuously variable potentiometer (volume control) type of attenuator can be made up and calibrated with quite a high degree of accuracy.

These kind of attenuators also have the added advantage that they can be used as a variable "resistance box" for easily changing the value of a resistor in an experimental set-up. In conjunction with a voltage a.c. source, then can also be used as calibrators for an oscilloscope, valve voltmeter or even a multimeter.

Fig. 16: The attenuator circuit described in the text.



BUILDING THE ATTENUATOR

The circuit of this attenuator is very simple and is given in Fig. 16. The volume control used should be of the wirewound type, and it should be of as large a diameter as possible for increased accuracy (3 inches diameter at least).

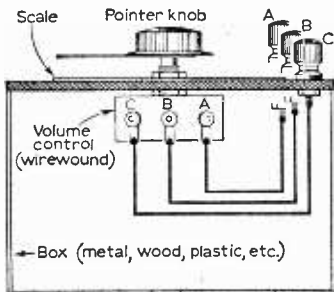


Fig. 17: The method of construction used and recommended by the author, for the two units discussed in this article.

The author originally built two attenuators, one with a low maximum resistance (100Ω) and one with a large maximum resistance (100,000Ω). Each control was mounted in a separate metal box (in fact, an old square biscuit tin painted black).

The contacts could be brought out on a tagstrip, spade terminals, or wander plug sockets, or as desired (see Fig. 17).

CALIBRATING THE ATTENUATORS

Firstly, the wirewound potentiometer must be carefully examined to ascertain the number of degrees through which the control must be turned to go from maximum resistance to zero. This angle is usually 270° or 300°.

A number of concentric arcs are now drawn on a piece of white paper or card (the number depending on the number of scales required).

First, one scale should be calibrated in ohms, and then the others calibrated from the ohms scale. Obviously, the wire must be evenly wound on the control to give accuracy, and, if possible, the actual track should be examined to make sure that the windings of the control have not slipped and bunched. This particularly applies to ex-Government components.

Scales which give the attenuation ratios for these attenuators are given in Fig. 18.

FINAL SETTING UP

Perhaps the main difficulty in making these attenuators is finally putting the pointer knob on to the spindle at the right place.

The author finally used a simple bridge method. In this method, two 2% resistors, R2 and R3, in Fig. 19 of equal values are attached to points A and C in Fig. 16, and the two free ends are joined. The resistors used for R2 and R3 in Fig. 19 should be of the same order as the value of one-half of R1.

A reasonably sensitive meter is connected across A and C as in Fig. 19 with some form of overload protection (R4 in Fig. 19). A d.c. voltage is applied across B and D, and B is adjusted until the meter reads zero. R4 is gradually increased towards its maximum, and each time R4 is

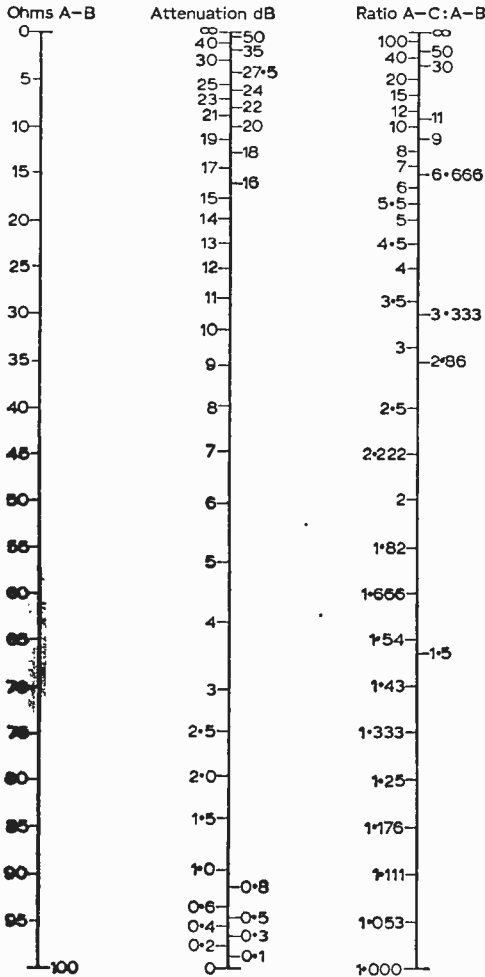


Fig. 18: Attenuator calibration scales.

adjusted, R1 should be readjusted for zero current. When the point of zero current is finally ascertained, the pointer knob is put on the spindle so that it is opposite the mark for one-half of the full resistance of R1.

Other methods may work just as well, and the experimenter is encouraged to try them.

ACCURACY

The accuracy of the finished attenuator depends on the components used, and the accuracy of the calibration. This may be checked if an accurate bridge is available. In general, however, the calibration may be taken to be accurate within

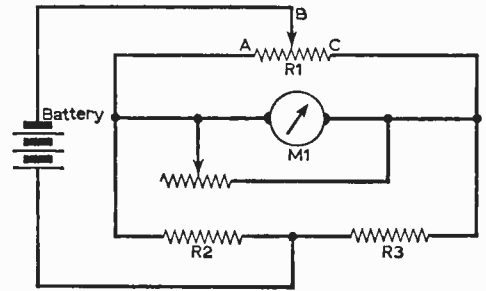


Fig. 19: The simple bridge arrangement used for setting up the attenuators.

2—10% of maximum resistance. However, the bottom tenth of the scale will not give very good accuracy, but it is useful for comparative indicators.

USING THE ATTENUATORS

Firstly, it should be clearly said that these attenuators are intended for use only where a negligible current is being taken out of the attenuator. If current is being taken out, it will be necessary to re-calculate the setting of the attenuator under the required conditions.

An example is shown in Fig. 20 (a) where Rab equals 10Ω and Rbc equals 90Ω. Vab therefore

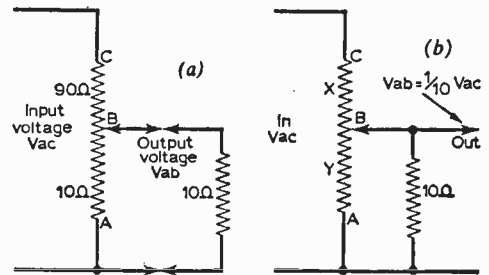
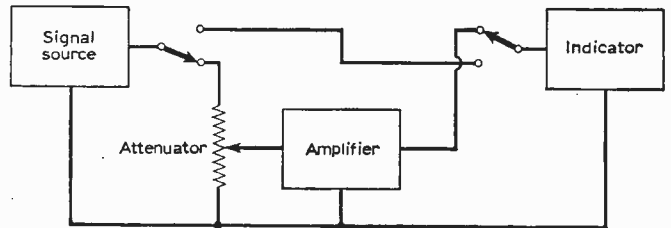


Fig. 20 (above): (a) allowing for load current; (b) representing the general principle of (a).

Fig. 21 (below): The set-up used when measuring the gain of an amplifier.



equals one-tenth of Vac.

If a 10Ω resistance is connected externally across AB, then Rab, the effective resistance across AB, becomes 5Ω.

Therefore Vab equals 5/95 Vac, i.e. 1/19 Vac.

—continued on page 136

Compact One-valve Amplifier

This has been designed as a companion unit to the "Short Wave One" (published in a recent issue) and, like that receiver, is suitable for the beginner to build.

BY C. J. MITCHELL

THIS is a small one-valve audio amplifier designed for use with the "Short Wave One" described in the March issue. The same method of construction is employed and this simple amplifier will bring the radio output up to loudspeaker strength.

Modifications to Original Receiver

This amplifier, or for that matter any amplifier, cannot be connected directly to the "Short Wave One" as the headphones are in series with the h.t. supply. The simplest and cheapest method of modification (see Fig. 1) is as follows.

Disconnect both sides of the headphone socket and earth one side. Now remove the r.f. choke L.2. Solder a 100kΩ resistor to the lead coming from

the anode of the valve. Also from this junction solder a lead to the other side of the headphone socket. Connect the h.t. + lead to the free end of the 100kΩ resistor.

This completes the receiver modification. Now for details of the amplifier.

Amplifier Construction

The audio amplifier (see circuit, Fig. 2) is constructed in a similar manner to the "Short Wave One", that is, a rectangular 2oz tobacco tin forms the chassis and the lid is bolted to one edge, thus forming the front panel (see Fig. 3). It will be seen that only half the tin chassis is occupied and a small preamplifier could be built on the other half if so desired.

The Components

A DL33 valve was chosen due to its cheapness, small size and modest current consumption. It provides an output of about 270mW which is adequate for many listening requirements.

Other components needed are three resistors, one potentiometer, two capacitors (one a small transistor type electrolytic) and a small pentode output transformer. The construction of this amplifier is even simpler than the radio, and needs really no explanation. Reference to the diagrams should make this work perfectly clear. The layout of the individual components is not unduly critical.

It is rather important that the output transformer be securely bolted down on the chassis. Shake-

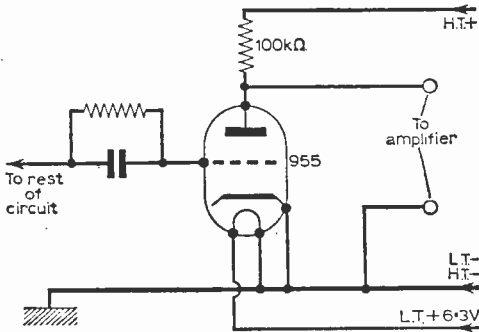


Fig. 1: The modified circuit of the "Short Wave One" for use with the amplifier.

Fig. 2 (right): The circuit of the amplifier.

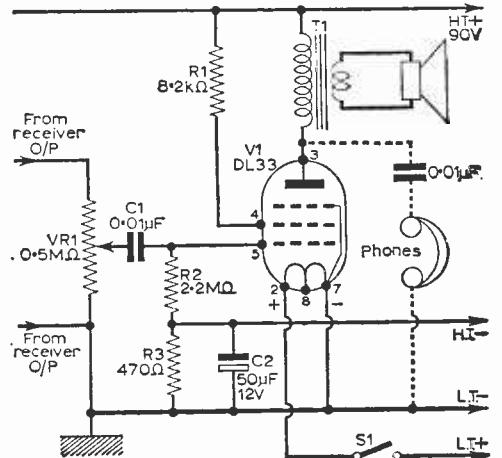
COMPONENTS LIST

Resistors:

- R1 8.2kΩ
- R2 2.2MΩ
- R3 470Ω
- All ½W carbon
- VR1 0.5MΩ potentiometer

Capacitors:

- C1 0.01μF paper or disc ceramic
- C2 50μF electrolytic 12V
- T1 Small pentode output transformer (Elstone MP/T)
- S1 Single pole on/off switch
- V1 DL33 or N16 pentode



proof washers should be fitted beneath the nuts.

Due to the small metal "chassis" used, it is possible that "buzz" from the transformer will be somewhat excessive. In such a case the transformer could be installed either on the loudspeaker chassis or inside the cabinet housing this unit.

Power Supplies

The h.t. current for the DL33 can be derived from the same 90V battery as used to supply the "Short Wave One". The current consumption of the DL33 valve is only a little above 10mA.

to loading effects on the regeneration of the receiver, but this should not complicate operation.

Headphones

If phone reception is required, a pair of high impedance headphones may be connected between anode and earth via a 0.01µF paper capacitor as shown in dotted lines in the circuit diagram. The output transformer *must* at all times remain in circuit.

It is possible to mute the loudspeaker by arranging for a "dummy load" resistor to be connected

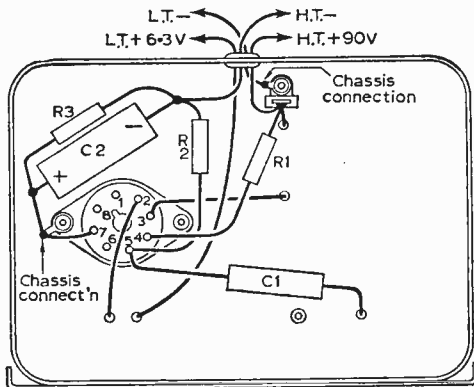
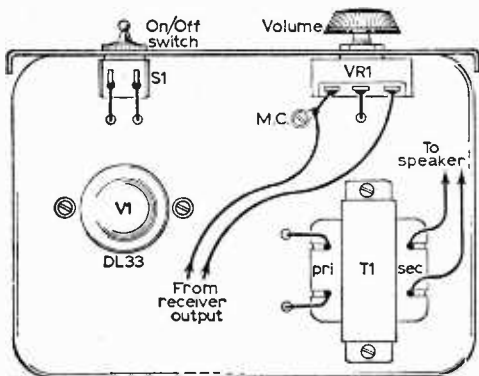


Fig. 3a (left) and b (right): Above and underchassis views respectively, showing component layout and wiring.

The filament of this valve requires a 1.4V supply, and a separate U2 or similar type of dry cell will suit for this purpose. The l.t. consumption is 0.1A. Note especially that the filament requirements of the DL33 are quite different to the heater requirements of the 955 acorn valve employed in the Short Wave One, thus a common source of l.t. current cannot consequently be used.

Operation

The volume control may have an optimum position about three-quarters along its travel due

across the secondary winding of T1 in place of the loudspeaker speech coil. This would require the use of a single-pole changeover switch. The rotor of this switch should be connected to one end of the output transformer secondary, one pole connected to the dummy load resistor, the other pole to one end of the loudspeaker coil; the other ends of the resistor, speech coil and T1 secondary are connected together.

The headphones may, of course, be freely connected or disconnected from the circuit without any detrimental effects occurring.

TEST GEAR ACCESSORIES

—continued from page 134

Thus, the potentiometer must be adjusted to give the correct output.

This can be computed algebraically as follows: Let the ratio of BC to AB be X to Y (see Fig. 20(b)).

Therefore $X+Y=100\Omega$.
A 10Ω resistor is in parallel with AB.

$$\text{Therefore } Rab = \frac{1}{\frac{1}{Y} + \frac{1}{10}}$$

$$= \frac{10Y}{10+Y}$$

The required ratio of Rbc to Rab is 9:1

Therefore $X : \frac{10Y}{10+Y} = 9:1$

and $X+Y = 100$

By working out these simultaneous equations in the usual way, we get the answer that Y must equal 31.6Ω .

If this calculation method is thought too complex, Abacs may be used.

MEASURING THE GAIN OF AN AMPLIFIER

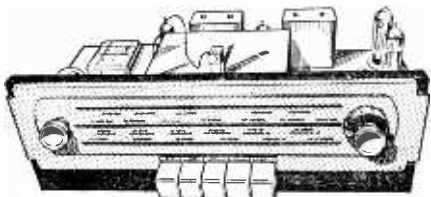
As shown in Fig. 21, some form of indicator is used to measure the level of output of an oscillator. The attenuated output of this oscillator is fed into the amplifier, and the amplifier output level compared with that of the unattenuated oscillator.

The attenuator is adjusted until these two output amplitudes are equal. When this is so, the amount of attenuation produced by the attenuator equals exactly the amount of amplification produced by the amplifier.

The attenuation level is thus read on the scale, and the gain of the amplifier is known.

Next Month part 6

BRAND NEW AM/FM (V.H.F.) RADIO GRAM CHASSIS AT £13.13.0 (Carriage Paid)



Chassis size 15 x 6½ x 5½in. high. New manufacture. Dia. 14½ x 4in. in 2 colours, predominantly gold. 200-250 v. A.C. only. Pick-up, Ext. speaker, Ac., E., and Dipole Sockets. Five push buttons—OFF, L.W., M.W., F.M. and Gram. Aligned and tested. O.P. Transformer. Tone Control. 1000-1500 Mc.: 200-550 Mc.: 88-98 Mc/s. Valves E250 rect.; ECH81, EF89, EABC90, EL84, ECC85. Speaker 8 x 5in. and Cabinet to fit chassis (table model), 47/6 (post 5/-). 10 x 6in. ELLIPTICAL SPEAKER 25/- to purchasers of this chassis. TERMS: (chassis) £3.10.0 down and 3 monthly payments of £2.4.0. (Cheap Room Dipole for V.H.F.). 12/6. Feeder 6d. per yard. (Circuit diagram 2/6. ALTERNATIVE DESIGN: L.W. 1000-1500 Mc.: S.W. (9 - 15 Mc.): M.W. 190-475Mc.: V.H.F. 87-100 Mc/s: Gram. position. Otherwise similar to above chassis. Price £15.15.0 (carr. paid). TERMS: £3.10.0 down and 6 monthly payments of £2.4.0.



PUSH-PULL AMPLIFIER £5.50
(6/- Carr.)

Brand new 200/240 A.C. mains. Bass, treble and vol. controls, with valves E250, ECC85 and 2-EL84 giving full 8 w. Chassis 12 x 3½ x 3½in. With o.p. trans. for 2-3 ohm speaker. Front panel (normally screwed to chassis) may be removed and used as "rinyng panel".

(normally screwed to chassis) may be removed and used as "rinyng panel".

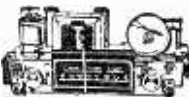
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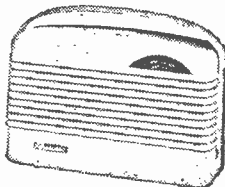
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7 Transistor Superhet. 350 Milliwatt output, 4-inch speaker. All components mounted on a single printed circuit board size 5½ x 5½in. in one complete assembly. Plastic cabinet, with carrying handle, size 7 x 10 x 4½in. External Socket for car aerial. Ferrite rod aerial. Price for the complete parcel including Transistors, Cabinet, Speaker, etc., and full Construction Data: £5.19.6 P. & P. 4/6.



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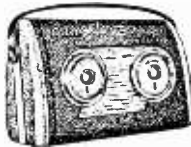


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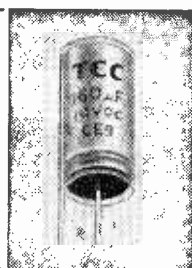
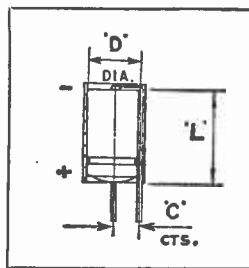
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CE.2 'V' or 'H'	1/8	1/2	0.07	8	6	4	3	2	—
CE.3 ..	7/16	7/8	0.1	25	20	15	10	6	4
CE.4 ..	7/16	1/2	0.1	40	30	20	15	8	6
CE.5 ..	1/2	7/8	0.14	50	40	25	20	10	8
CE.6 ..	1/2	1/2	0.14	80	60	40	30	15	12
CE.7 ..	7/16	1/2	0.18	100	75	50	40	20	15
	D	L	C	3V.	6V.	10V.	15V.	25V.	50V.
CE.8 ..	1/2	3/4	0.14	100	80	60	40	25	8
CE.9 ..	3/8	3/4	0.2	250	200	160	100	60	20

Operating Temperature Range. -20°C. to +60°C.

Connection wires are welded for low resistance contact, and solder-coated for ease of assembly, the standard length being 1 1/2" for the horizontal range, cropped to 3/8" long for the vertical range.

The capacitors are in insulated seamless aluminium cases, sealed with a synthetic rubber bung.
Cap. Tolerance. The standard tolerance of all capacitors is -20% + 100% of the rated capacitance.

Leakage Current. CE.2-7 may be determined from the following: 1 (µA) = .01 C.V. + 10 at applied working voltage and at 20°C. CE.8-9 may be determined from: .02 C.V. + 20 at applied working voltage and at 20°C.

V = Vertical Mounting H = Horizontal Mounting

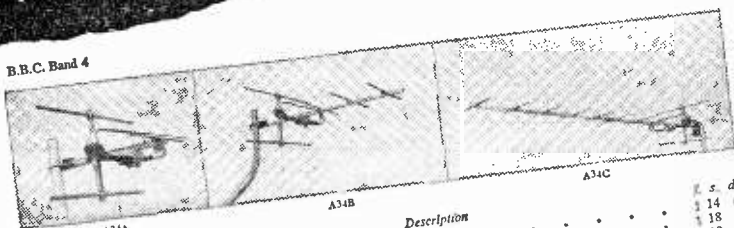
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A MINIATURE STABILIZED POWER SUPPLY TO
RUN TRANSISTOR PORTABLES FROM THE MAINS

A Transistor Radio MAINS UNIT

BY R. LEYLAND

A SMALL radio that has no visible external connections and can be freely moved around is more attractive than the captive set tethered to a mains socket. Nevertheless batteries become run down, and where a set is in constant use, there is something to be said for a mains unit which can be substituted for the battery, so enabling it to be run at negligible cost.

Removal of the mains unit and replacement of the battery power pack, makes the set completely portable again, and the mains unit, not being integral with the receiver, does not add to the weight; but in point of fact the battery may itself be slightly heavier than the mains unit.

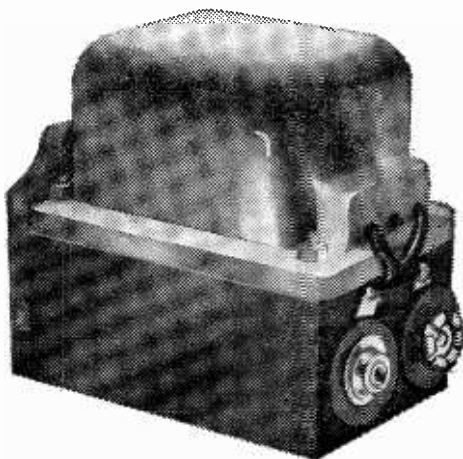
Switch

There is a minor disadvantage of such mains units in the hands of non-technical users. Accustomed to switching off at the volume control of their transistor radio, they may be unaware that this leaves the mains unit still drawing a small current from the mains. It is therefore preferable to switch off at the wall socket. Incorporating a neon indicator as a reminder if possible. On the other hand, the idea of a mains switch on the volume control with a two-pin connector should be rejected because of the proximity of the low-voltage wiring of the transistor receiver.

Leaving the transformer connected to the mains does not necessarily involve much risk. Bell transformers, for example, are intended for continuous working, the bell-push being on the low-voltage side.

Centre-tap

Some transistor sets require a centre-tap on the battery. This is the connecting point for the high-impedance loudspeaker, where the output stages are of the single-ended push-pull type. To avoid the need for a centre tap on the mains power unit, the best plan is to connect a 1,000 μ F capacitor (25V working) between the loudspeaker and the positive



supply line of the receiver. It must be connected the right way round, negative to the loudspeaker. This capacitor has a reactance of only 1.6 Ω at 100c/s, which is negligible compared with the 25 Ω or more of the loudspeaker.

Transformer

Power requirements of a transistor radio are small and can be adequately met by a power unit built around a miniature bell transformer as shown in Fig. 1 on the blueprint. The bell transformer in this design, delivers up to 8V; 3, 5, or 8V being available at 0.5A for an electric bell, according to the loudness required. This 8V is the r.m.s. value, and it will be recalled that the peak value is 1.414 x 8 or 11.3V. It is therefore feasible to derive the 9V direct current supply for a transistor radio without resort to complications such as voltage-multiplying rectifier arrangements.

It is, however necessary (for this particular application) to work the transformer from a mains

voltage of 240V. Those who have lower mains voltages would find it necessary to modify the transformer. The turns per volt figure is 27, so 27 turns would have to be removed from the primary for every volt downwards from 240. As the wire of the primary is rather fine, it might be preferred to increase the secondary turns instead. This would involve rewinding the secondary with finer wire. The present winding consists of 216 turns of 28s.w.g. enamelled wire tapped at 135 turns.

If it is found necessary to attempt modification, the greatest care should be taken over insulation, and careful checks should be made on the output voltage before putting the mains unit into service.

Rectifier

The choice of a rectifier is important. If we use the older types of rectifier, i.e. selenium or copper-oxide; or if we employ a point-contact crystal rectifier, the output voltage will be far too low. It is essential here to use a high-efficiency rectifier of the junction diode type—either germanium or silicon. The latter has the advantage that it can work at much higher temperatures. A silicon junction diode is used in this mains unit, although the temperature remains quite low.

Because of the rapid response of a junction rectifier, it is now standard practice to protect the larger junction rectifiers by means of special auxiliary selenium rectifiers wired across them. At very low voltages this is not however usually considered necessary, and a circuit for reducing possible voltage spikes has not been included.

Ripple

The current requirements of a transistor radio may be smaller than that of a valve radio, but as the voltage is very much lower, the consequence is a very low value of load resistance on the power supply. Accordingly a much larger reservoir capacitor is needed to obtain an adequate value of time-constant in order to suppress ripple sufficiently. Fortunately a 1,000 μ F capacitor with a working voltage of 15V can be quite small in physical size, enabling the dimensions of the power unit to be kept to slightly less than those of the equivalent battery.

Peak-to-peak ripple in the output appears to be a substantial fraction of a volt, but it is not audible in the average transistor radio with push-pull output stage. There is however an audible buzz in the receiver if the connections A—B in the circuit diagram are made the wrong way round. This is because of the stray capacitance between the primary and secondary windings of the mains transformer, which does not of course have an electrostatic screen between the windings. This buzz does not occur if the positive line of the receiver connects to the inner side of the transformer secondary as in the circuit diagram.

Zener Diode

By comparison with a battery which has a source resistance of about 8 Ω , a miniature mains

unit, if no Zener diode were added, would have a source resistance of between 30 and 50 Ω . This would correspond to rather poor regulation; the voltage to the receiver would vary too much, and to avoid too large a fall in voltage at full volume, the voltage at low volume would have to be higher than that of a battery. Better regulation can be secured by incorporating a Zener diode.

These voltage-stabilizers are types of silicon junction diodes connected so as to pass a reverse current—if connected the wrong way, a large and damaging forward current would flow. Note that the two diodes are in series opposition.

The usual way of employing a Zener diode is to supply it through a series resistance from a well-smoothed d.c. supply. It is, however, also possible to use them as peak limiters even on a.c., again with a series resistance. There must always be a series resistance, but in this mains unit the resistance inherent in the transformer windings will suffice.

Peak Limiters

When used as a peak limiter, the Zener diode passes a heavy pulse of current on the peak, lasting possibly one millisecond. Simple calculation shows that in this circuit the series resistance present will restrict the pulse to considerably less than 1A (not to take into account core saturation), and most Zener diodes have pulse ratings equal to or in excess of this. The series resistance also protects the electrolytic capacitor against the switching-on surge.

A 9V Zener diode of adequate wattage rating should be used. Individual Zener diodes differ in voltage, but a tolerance of $\pm 5\%$ on a nominal voltage can be obtained.

As shown in the graph, Fig. X, the unloaded voltage will be anything from 8.55 to 9.45V. The average Zener current will vary even more widely—between 30 and 60mA over this range. The large current taken by the lower voltage diodes when put into this circuit can be reduced by including a series resistance of a few ohms, and this would certainly be necessary if Zener diodes of lower nominal voltages were used.

The transformer secondary has a d.c. resistance of 2.8 Ω , the primary 1.350 Ω , the latter having the effect of an extra 1.5 Ω in the secondary, making a total of 4.3 Ω , which is further increased by core losses, etc. A resistor of 2 or 3 Ω could be added with a diode at the lower fringe of the voltage tolerance, but is not really necessary, and none can be added with diodes at the upper fringe.

Regulation

As the regulation curves with a Zener diode show, there is a considerable improvement over the unregulated supply, and at moderate currents the regulation is nearly equivalent to that of a battery normally used for currents up to 50mA.

The battery has of course excellent regulation, but at excessive currents polarisation occurs and the voltage begins to sag. The service life may be taken as the period from 9 down to 6V, reached in about 150 hours intermittent use at 25mA.

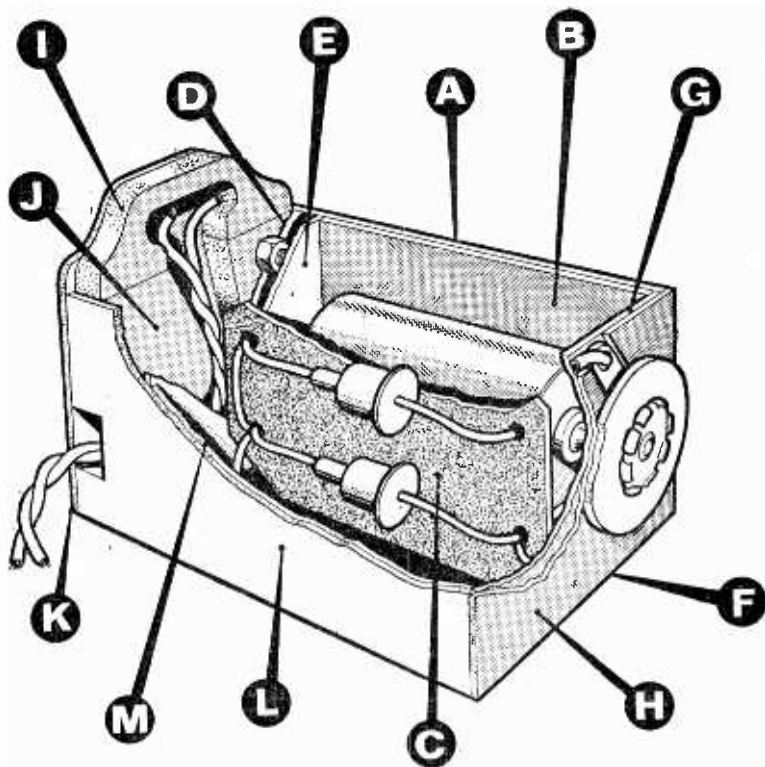


Fig. 5: The assembled Box.

Initially, the voltage of a new battery is somewhat above 9V.

Construction

Besides the transformer, the circuit of the mains unit contains only three other components. These are mounted on a small panel fitting vertically in a box under the transformer (Fig. 4).

The box is made from small pieces of $\frac{1}{8}$ in. insulating material glued together with impact adhesive, and is double-sided for robustness. The inner box fits into the transformer base, and the whole power unit is secured together by a pair of 6B.A. bolts $1\frac{1}{2}$ in. long. The various pieces of laminated plastic sheet which go together to make up this box are drawn in detail in Fig. 3. These pieces are marked A to M and the method of assembly is clearly indicated in Fig. 5.

To ensure electrical safety, a cord grip consisting of a curved channel between two shaped pieces of $\frac{1}{4}$ in. hardboard is provided at the end of the transformer where the mains flex is connected, with a removable cover fastened by two small bolts (items I, J and K). This is necessary because the bell transformer is normally intended for permanent installation, whereas in the radio mains unit the flex may be subjected to movement and strain.

At the other end is a connector panel (G and H) cut to seat a pair of battery connectors which are firmly glued on with impact adhesive. (Use a tube of the adhesive for convenience. Spread thinly. Leave for 15 minutes and then carefully first position and then press the parts together.)

The narrowness of the end of the box does not allow the connectors to be spaced more than $\frac{7}{8}$ in. apart, while on a battery the spacing is $1\frac{1}{8}$ in., and this means that short-circuits must be guarded against by wrapping with insulation tape the tags on the battery connectors of the radio set used with the power unit. To position the connectors on one of the longer sides of the mains unit instead, though possible, would not give as neat an appearance.

Markings on the transformer case show the proper end to which the mains flex is to be connected. At the other end it is unnecessary to cover the low voltage leads, and by transferring one or the other of the leads to the centre terminal, lower output voltages could be obtained if desired, but these would be unstabilized, as the 9V Zener diode will then be out of action.

In running tests lasting several hours the mains unit has shown no tendency to overheat, and even with a Zener diode at the lower limit of the voltage tolerance, remains quite cool. Its performance has been entirely satisfactory in a transistor radio in daily use. ■

on the Short Waves

A MONTHLY COMMENTARY BY J. GUTTRIDGE

FIRST of all this month let's have a look at conditions on the amateur bands. The 160m band (the lowest frequency amateur band) can really be considered as a medium wave band. This means that during daylight hours only fairly local stations can be heard. At night the range increases considerably.

Daytime range on the 80m band is also somewhat limited but at night things improve tremendously. At present really long-distance work is possible, especially on c.w.

Forty metres is by far the most congested band in the United Kingdom. During the day it is crowded with stations from all parts of Great Britain, with the odd North European breaking through. During the night it is the lowest amateur meter band on which really long-distance working is possible regularly at present.

But if you want to hear really long-distance ham stations during daylight hours 20m is the best band to try. Conditions are still, however, falling off fairly quickly with the advent of darkness.

Fifteen metres should give quite good daylight listening over long distances, although it will not be as consistent as 20m. After dark the band is useless at present, although things should pick up again very soon.

No long-distance reception is likely at present on 10m, although very local stations are likely to come in. This band is also a popular one for the mobile hams—that is, those who operate from cars.

Obviously as the ionosphere is continuously changing these can only be average conditions, so don't be surprised if you find stations coming in which are theoretically impossible to hear! Fortunately we are now well over the hump as far as this winter is concerned. Conditions on the higher frequency band are getting better almost weekly.

Newcomers are often at a loss to find sources of news and general information on short-wave happenings. Here are some suggestions:

For amateur band listeners there is probably nothing better than the Radio Society of Great Britain's Bulletin, issued only to members. The society's address is New Ruskin House, Little Russell Street, London, W.C.1. On general bookstall sale is "Short Wave Magazine", intended mainly for transmitting amateurs but containing much data on ham band activities of use to the listener.

Broadcast band listeners have several sources of information. Most comprehensive of these is the "World Radio and Television Handbook". In its 266 pages it gives frequencies and transmission times of just about every short, medium, v.h.f. and TV broadcasting station in the world. A supplement is published in June giving the

summer schedules of the major stations. Both publications can be obtained through bookshops or from Wm. Dawson and Sons Ltd., Cannon House, Macklin Street, London, W.C.2. Prices, excluding postage, are £1 2s. for the handbook and 11s. for the supplement.

Things change so quickly, however, that these two publications can only be used as a base on which to build. A fortnightly bulletin is available direct from the publishers of these handbooks but is probably a bit costly for the ordinary enthusiast.

His best source for follow-up information is the bulletin of one of the numerous short-wave clubs. The two main clubs in this country are the International Short Wave Club, 100 Adams Gardens Estate, London, S.E.16, and the International Short Wave League, 12 Gladwell Road, London, N.8.

Other sources of information are the special bulletins broadcast by the stations themselves. More about these next month. And now for some news of our own.

Radio New York Worldwide (mentioned last month) has made some changes. Full details are not yet available but at 1500 GMT it is using 11875/11950/15440/17760kc/s and at 1940 GMT is on 15440 and 11900kc/s.

The Swiss Short Wave Service, Berne, now operates its summer service. The main change is that the emergency winter English transmission to the British Isles in the morning has been dropped. The evening British Isles transmission is now for 1845-2015 GMT on 7110/9665kc/s. Full details of all the changes are contained in a booklet available free of charge from the station.

Kol Zion's summer schedule is now effective. Its English broadcast to Europe is from 2015-2045 GMT on an out-of-band frequency—9009kc/s. This station's address is Broadcasting House, Jerusalem, Israel.

Radio Denmark (Radiohuset, Copenhagen V, Denmark) in its summer schedule changes from 9520kc/s to 15165kc/s for the 0900-1000 GMT transmission beamed to the Far East (heard in this country) and for the 2145-2245 GMT transmission to South America.

Test transmissions have been going out from Radio Nederland, Wereldomroep (P.O. Box 222, Hilversum, Holland) to the Netherland Antilles. Good reception in London at 2130 GMT on 15425kc/s.

Finally from Argentina, Radio Nacional (Ayacucho 1556, Buenos Aires), transmits to Europe daily from 1900-2300 on 11710/11780/6090kc/s. There are one-hour transmissions in Spanish, German, Italian and French. The English transmission from 2300-0000 is on 11710kc/s only.

A New Build-and-Learn Series—4

The "JUNIOR" Crystal + 2

This series of receivers was designed primarily to give practical aid to students at an Evening Class. The circuits are unusual, but not novel. The final stage receiver described this month is much more sensitive than most two transistor receivers, but is not more difficult to build.

The text is written for the young beginner and naturally more advanced readers will find some of the information superfluous. The author is sure that any beginner will be able to make this radio as a result of this article.

CONTINUED FROM PAGE 86 OF THE MAY ISSUE

BY E. V. KING

It is now proposed to convert the present receiver to two-band operation by adding a medium wave coil. Full details for winding this coil are given in Fig. 14. The long wave coil already fitted to the ferrite rod is left in place (or the rod slid out temporarily) and the medium wave coils are wound at the other extreme end.

A layer of card is fixed with Sellotape and then, starting with a knotted piece of wire, 66 to 70 turns of 26s.w.g. enamelled wire is put on, each turn being close up against the previous one. About 1/4 in. further towards the end of the rod another similar coil is wound with only 14 turns —this is the feed coupling winding. Over the top of this latter winding is wound about five turns of thin plastic-covered wire for feedback purposes. All coil directions are important and Fig. 14 should make them clear.

Testing on Medium Waves

Testing the performance on medium waves is best done now by unsoldering the long wave coil from the chassis and connecting the medium wave one in its place. The coils exactly correspond and ends A, B, C, D, E and F correspond to M, L, K, J, G and H.

The ferrite rod is inserted and the receiver tested to make sure reaction is effective at any position of VC1 by the use of VC2. If reaction is over-effective, as it will be with a good r.f. transistor, then the feedback coil (GH) may be shortened one turn at a time. If feedback is ineffective the coil may be increased, but if the coil directions are correct this will usually be due to a low battery or poor OC44.

The whole of the medium wave band is covered and Luxembourg can be received but tuning for maximum sensitivity on medium waves takes some practise, since the reaction setting is quite critical. Thirty or forty stations should be easily obtainable in the evening on the medium wave band but daytime reception may be limited to the reception of only two or three stations.

When tested the long wave coil is replaced and the receiver tested again on long waves to ensure that its original performance has not been impaired.

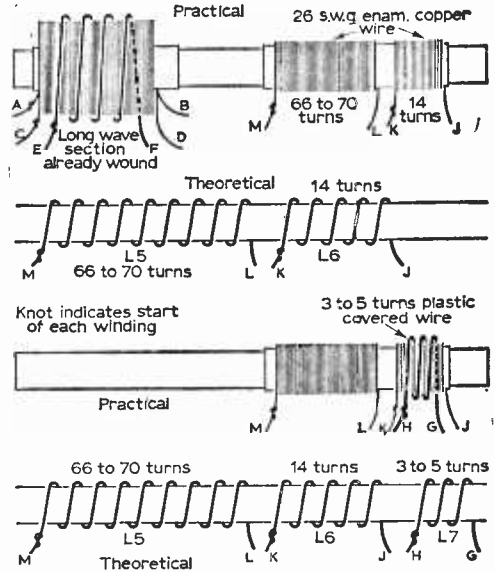


Fig. 14: Medium wave coil winding details.

Fitting the Wave Change Switch

The fitting and wiring up of the wave change switch S2 is perhaps the most tricky part of the wiring for the beginner to handle. However, everything has so far been tested and careful step-by-step testing will ensure success in the fitting of the switch.

Long Wave Switching

Leave the medium wave coil aside for the moment. The long wave coil is now working on the receiver. The long wave coil is now working on the receiver. Examine the rotary switch carefully and fit it in the vacant hole orientated in the manner shown in Fig. 16. Note carefully that each of the four sections of the switch exactly faces one of the four sides of the receiver. This is very important for the beginner to observe.

1. Remove wire from A to the tuning capacitor VC1 and fix it to tag A of the switch (Fig. 16). Now wire the tuning to centre tag 1 on the switch. Put the switch in the correct position for 1 to contact A and test the receiver.
2. Remove the wire from F to reaction capacitor VC2 and solder it to F on the switch. Join VC2 to the centre tag 2 on the switch. Test again.
3. Repeat similar procedure with tag C and centre tag 3. Test again.
4. Repeat with tag D and centre tag 4. Test again.

The receiver should now work exactly as before the switch was fitted provided the switch is fitted in the back of the box and turned to "long waves".

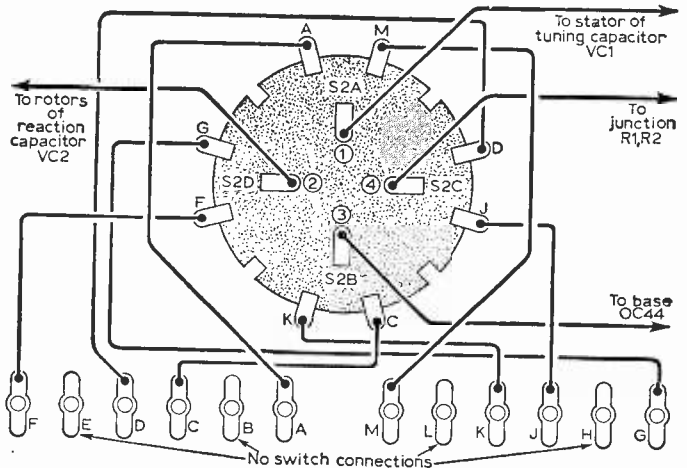


Fig. 16: The wavechange switch connections.

Fitting Medium Wave Coil

The medium wave coil is now slid on the ferrite rod and the assembly attached to the plastic board with loops of thread. The wires are shortened as necessary and are then soldered to their correct tags.

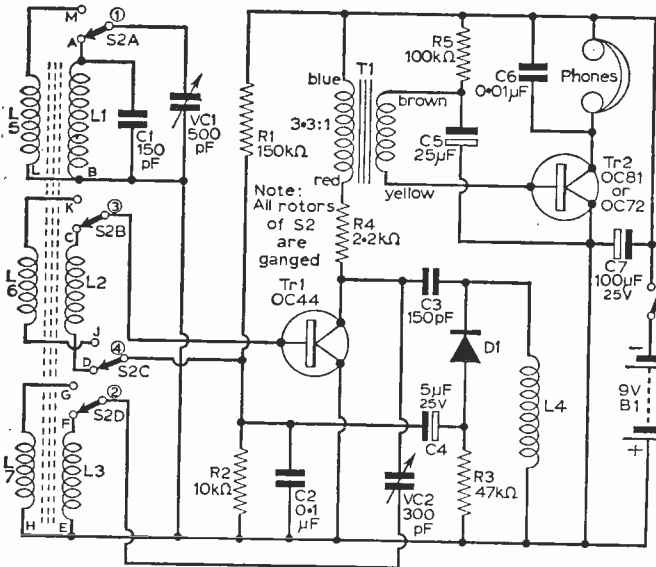


Fig. 15: The final stage circuit with both medium and long wave coverage

Tags L and H are joined to tag B. The other tags, M, K, J and G (Fig. 16), are now joined to the corresponding tags on the switch. The wiring is now complete and since the coil has been tested the receiver should now work on either waveband.

Fitting the Receiver into a Case

The size of the receiver chassis is such that a

standard plastic sandwich box (such as sold by many chain stores) will make an ideal case. The spindles of the controls are cut to about 1/4 in. in length and the chassis applied to the box. Marks are then made for 1/4 in. diameter holes for the control spindles.

Extra nuts are then obtained for the controls so that they may be placed on the outside and will in fact hold the chassis to the box. Fig. 2(d) in the first article of this series shows the general idea.

In the prototypes the author fitted a small jack plug into the side of the box and wired it to the phone tags.

The battery may be fitted secured with rubber bands or it may simply have plastic adhesive tape fitted over the live connections and be left loose within the box. Such an arrangement will do no harm as space within the case is fairly limited.

The appearance of the set will be improved if the inside is coated with gloss enamel and transfers used on the outside.

There is just room for an 80Ω or similar reed-type earpiece to be fitted in the back of the box and in some locations the volume given is well worth this addition. A somewhat easier and neater way to fit a small loudspeaker of this type is to use the slightly longer sandwich box, where there is room for even a 2in. standard speaker unit. If this is fitted then a special single-ended transistor output transformer is required and the high impedance side is connected to tags Y and Z and the low impedance side to the speaker tags.

—continued on page 149

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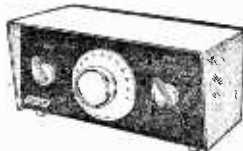
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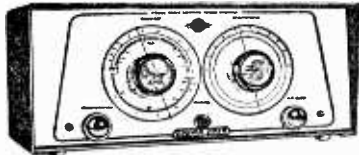
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Adding extra
ranges to
simple meter
movements
is one means
of making

BY GEORGE WAREHAM | PART 1

inexpensive multimeters

THE primary aim of many experimenters and constructors is to make working equipment—receivers, amplifiers, and so on—rather than test equipment.

Unfortunately, it is very difficult to put one's own designs—not to mention other people's—into operation *without* making measurements. Something usually goes wrong, and without test gear one can only guess at the cause. When this happens, even the crudest test instrument may be invaluable.

These articles will describe how an inexpensive milliammeter can be converted into a multirange instrument capable of making the majority of d.c. measurements the amateur constructor will find necessary.

Choice of Meter

A multirange meter must, basically, be fairly sensitive. For reasons which need not be repeated here, the only type which is sensitive enough for our purpose is the moving coil variety of instrument. Even then one has to be selective. It is hardly possible to use a meter with a full-scale deflection (f.s.d.) current of more than 5mA, since a meter which draws even this current from the circuit under test may upset that circuit severely. (A 5mA movement cannot provide a voltmeter sensitivity of more than 200Ω per volt. Compare this with the 20,000Ω/V of many commercial instruments.) Nevertheless, even a 5mA meter is vastly better than no meter at all, and one can often think of a way of using it which doesn't upset the circuit under test too much.

The first requirement, then, is an f.s.d. of 5mA or less. But this doesn't mean that *any* meter with the right f.s.d. will be usable. For example, thermo-couple meters, which can be picked up cheaply, may be sensitive enough when the thermocouple is removed. But thermo-couple meters have non-linear scales, and they are always underdamped—the needle wavers back and forth for several seconds before settling down in the final position. Such a meter is useless for our purposes.

Meter Scales

Then there is the question of scales. A 2mA meter with a scale 4in. long is just as sensitive, in terms of pointer movement, as a 1mA meter with a

2in. scale. But can it be read with the same precision? If each meter has a scale divided into 100 units, then one division represents 10μA in the 1mA meter and 20μA on the 2mA meter. But if the smaller (1mA) meter has only 50 divisions, it may not be possible to read to any greater accuracy than the 2mA meter. Some of the pros and cons of meter scales are illustrated in Fig. 1.

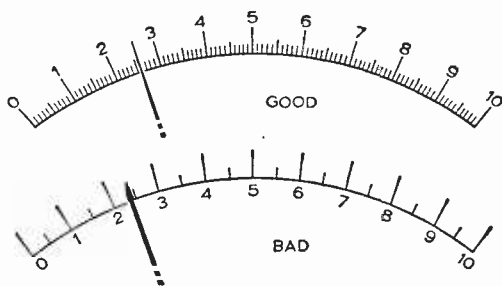


Fig. 1: Good and bad meter scales

Voltmeter or Milliammeter?

A moving-coil voltmeter is just a milliammeter with a series resistance. There is no reason why it should not be modified to read current. But how sensitive is it? The scale may tell you. It may be marked with the f.s.d. current or in "ohms per volt". (A 500Ω per volt meter (500Ω/V) has an f.s.d. of $1V \div 500\Omega = 2mA$.)

Many surplus "voltmeters" turn out to be simply milliammeters, designed to be used with an external series resistor ("multiplier"). Again, the scale may tell you this. Look out for cryptic lettering like "Use Ext. Res.", "EXT. MULT.", "Ext. Ser. Res.". (Similarly, current meters may be *more* sensitive than is implied by their scales. If this is the case, they are usually marked in small print, with the true f.s.d., the meter resistance, and the instruction "Use External Shunt".)

Method of Mounting

For most purposes, the flush-mounting type of meter, fixed by three or four bolts or, less frequently, a rear mounting clip, is most useful.

Some specimens are marked "calibrated for use

on a steel panel". If this is not so, and you want to use a steel panel, check the meter calibration *in situ*. The projecting type of meter is more vulnerable to accidental damage, since it sticks out from the panel, but is sometimes useful because it takes up little space inside the cabinet. Plug-in types cannot be used as such unless you have one of the special sockets, but since they can also be clip-mounted this is no great drawback.

Meter Repairs

Generally speaking, meter repairs are too difficult for amateurs. The aim should always be to obtain a sound working instrument in the first instance. The following hints may prove helpful in some cases, but remember to treat these instruments with great care.

It is a good rule never to open up a meter unless it is absolutely necessary. It only lets in dirt, or worse still, magnetic particles—iron filings from the work bench.

If the pointer sticks at one place it *may* be because magnetic particles have already been picked up by the magnet and have entered between the magnet and the moving coil. In this case there is no help for it but to take out the meter and prod them out with a fine wire, a piece of plasticine also is a useful aid for extracting and collecting extraneous particles.

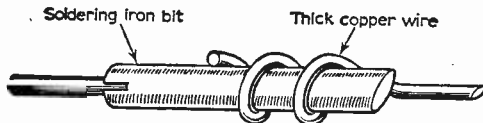


Fig. 2: An extension to a soldering iron bit for meter movement repairs.

An open-circuit meter can *sometimes* be repaired by going over the joints at each end of the moving coil with a soldering iron. Use some thick copper wire wrapped round the bit as a slim extension bit (Fig. 2). Be very careful not to apply pressure, which may damage the bearings.

A broken pointer can sometimes be replaced by a thin dried grass stalk pushed over the stub.

Vital Statistics

Assuming we have obtained a suitable meter (f.s.d. 5mA, clearly calibrated scale, and suitable mounting), how can the range be extended? One can do nothing without knowing the vital statistics of the instrument. These are:

- Coil resistance,
- Damping resistance,
- True f.s.d. current.

The f.s.d. current should always be measured, because the true value may differ from the nominal value. The coil resistance, if marked on the scale, can be taken as accurate.

What is the damping resistance? Well, some meter movements are inadequately damped—the pointer takes so long to come to rest that measurements become tedious. The damping can be improved—at the expense of sensitivity—by connecting a low resistance across the meter coil.

If the unshunted meter is inadequately damped, the amount of additional shunt resistance needed

must be determined by experiment before the design of the multirange instrument can proceed. It follows from this that, if we set 5mA f.s.d. as a lower limit of usable sensitivity, then a 5mA meter must be satisfactorily damped *without any additional shunt resistance*, since adding a damping resistor would reduce the sensitivity to an unacceptable level.

The intending purchaser may make a rough check on damping by twisting the meter suddenly so that the pointer swings. A well-damped pointer will swing forward slowly and return gently. A badly damped one will swing forward violently and return to the end-stop with a bang. Note, however, that meters are sometimes fitted with a shorting wire across the terminals, to damp the movement to avoid damage during transport, and this may mislead you into thinking the damping is better than it really is.

Damping Resistance

The first thing to do is to get the damping right. Many milliammeters already have a shunt resistor inside the meter itself. The purpose of such a resistor is mainly to bring the f.s.d. to the correct value, but it often provides sufficient damping as well.

If external damping is needed, determine the *greatest* shunt resistance which will provide adequate damping by experiment. The precise value is not critical. Just connect ordinary low-value carbon resistors across the terminals and see how the needle reacts to a sudden increase or decrease in current. When a satisfactory value of resistance is found, make a note of it.

Coil Resistance

The coil resistance must be known if current ranges are to be added (although voltage ranges can be added without knowing the coil resistance).

If the resistance is not marked on the dial, measure it. What, you have no ohmmeter? Never mind, you can't use an ohmmeter anyway, because it would pass far too much current through the meter. (An indirect method which enables one to use an ohmmeter will be described in the next article.) Here is a technique which requires only a

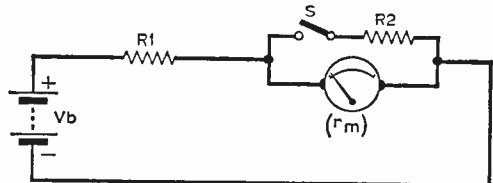


Fig. 3: The set-up used to determine meter coil resistance.

constant current (which need not be precisely known) and a known fixed resistor. NB: This method only works if the meter has a linear scale; i.e., a scale graduated in equal-length divisions.

Refer to Fig. 3. R_1 is chosen so that with the available battery voltage and the switch S open, the meter takes a current large enough to be read easily—half scale at least. Closing the switch puts R_2 across the meter. Try various values of R_2

until you find one that causes the meter reading to fall to about half the original value. Then obtain an accurate resistor ($\pm 1\%$ of this value), and make the following measurements:

1. Meter deflection with S open D1.
2. Meter deflection with S closed D2.

Then meter resistance $r_m = R2 \left(\frac{D1}{D2} - 1 \right)$

In practice, no switch is needed—it is easy enough to hold resistors across the meter terminals for the rough work, and to fix R2 for the final measurement.

Now, this method only works if the current taken from the battery is the same in both measurements—or virtually the same. There is bound to be a slight increase in current when R2 is in circuit, but if R1 is much greater than the meter resistance (say 100 times as large) then the current will be constant within 1%, which is near enough. If the rough measurements show that the meter resistance is more than, say, a twentieth of R1, then use a higher voltage and a higher R1.

F.S.D.

The constant-current technique can be used to check the f.s.d.

We need a known voltage and a known resistance, high enough to swamp the effect of the meter resistance. If the meter scale is linear, we can check at less than full scale. For instance, assume we have a "1mA" meter with a coil resistance of 80Ω. If we use a 9V battery and a 10kΩ ($\pm 1\%$) resistor we get 0.9mA, and this is what the meter should read.

Suppose, in fact it reads 0.92mA. Then the true f.s.d. must be $1\text{mA} \times \frac{.92}{.9} = 1.02\text{mA}$. It is then up to

the user to decide whether this 2% error can be ignored. (One would be well advised to ignore it. The battery will give more than 9V: one particular "9V" grid bias battery produced 9.35V at a room temperature of 62° F. This would more than account for the 2% "error" but it would not have accounted for, say, a 10% error.)

Practical Applications

Once the "vital statistics" of a meter are known one is in a position to turn it into a multi-range instrument by adding current shunts and voltage "multipliers". A practical example will be given in the next article, but let us first consider a typical case.

Suppose one has a meter of nominal f.s.d. 1mA, scaled 0—250, with a coil resistance of 80Ω. Suppose the measured f.s.d. is 1.1mA and that this discrepancy is too large to be accounted for by errors in the test voltage and test resistance. We must assume that 1.1mA is the true f.s.d. current.

Let us suppose further that the meter is not very well damped and needs a damping shunt of 70Ω. The net resistance of meter and shunt is then

$$\frac{70 \times 80}{70 + 80} = 37.3\Omega$$

What is the new f.s.d.? Well, the voltage across

the meter coil at f.s.d. is a constant. It is, in fact, $1.1\text{mA} \times 80\Omega = 88\text{mV}$. The new f.s.d. is thus $88\text{mV} / 37.3\Omega = 2.36\text{mA}$. Now our meter is scaled 0—250, so if we make the lowest current range 2.5mA we can use this scale easily. And since 2.5mA will call for a lower shunt resistance than 70Ω we know that damping will be satisfactory.

But we also need good damping on the voltage ranges. The obvious tactics are to connect a shunt permanently across the meter so as to make the f.s.d. 2.5mA and then go on to design the voltage multipliers using this new f.s.d. Thus a 1kΩ multiplier will give a range of 2.5V (ignoring the meter resistance), 10kΩ will give 25V and so on.

If we want a lower range than 2.5V, say 0.25V, we cannot ignore the meter resistance. The net meter resistance with the 2.5mA shunt will be

$$\frac{88\text{mV}}{2.5\text{mA}} = 35.3\Omega$$

The total resistance for f.s.d.=0.25V is $\frac{0.25\text{V}}{2.5\text{mA}} = 100\Omega$, so

the actual multiplier must be $100 - 35.3 = 64.7\Omega$. One might feel justified in using a 68Ω close tolerance resistor, though two 33Ω resistors in series would be closer and 18Ω+47Ω closer still.

But the general strategy is quite clear. We design voltage multipliers on the basis of 2.5mA f.s.d. (400Ω/V) and arrange our current shunts to give 2.5mA, 25mA, 250mA, etc.

Next month we shall consider how to apply this kind of design strategy to an actual meter of a type which can sometimes be obtained on the "surplus" market.

"JUNIOR" CRYSTAL + 2

—continued from page 144

Miniature Ear Plugs

Crystal-type ear inserts will work well on the diode receiver without any alteration or special wiring. On the one-transistor receiver the phone terminals may be shorted and the insert connected across the 2.2kΩ collector load resistor or alternatively connected as detailed below.

When two transistors have been added a crystal-type insert will not work without special provision. The phone terminals must in this case be bypassed by a low-value resistor of about 330Ω. The insert is then connected across this resistor. The author found that 300Ω generally gave optimum results but some inserts worked better with values between 100Ω and 1,000Ω. No harm can come by experimenting with this resistor and crystal inserts.

Although reed-type low-resistance phones undoubtedly give best results the author often uses miniature inserts for convenience. It is possible that 200Ω inserts will work satisfactorily with the two-transistor version but not otherwise.

This brings the "Junior" series to an end and it is hoped that any readers who have built the various stages have learnt from the experience and now have a useful portable receiver. ■

PERSPEX

and the constructor

A guide to the use of this versatile material in radio construction.

BY J. HUGHES

PERSPEX and similar forms of acrylic resin sheet can be of great assistance to the amateur constructor and, surprisingly enough, use of this extremely adaptable material does not appear to be as widespread as one might expect.

Most retailers of plastic sheeting, tubing and Formica and some handyman's stores sell offcuts of Perspex sheet in many varied colours, sizes and thicknesses at very reasonable prices. Thicknesses vary from one twenty-fifth of an inch upwards but our chief interest is in material having a thickness of $\frac{1}{8}$ in. to $\frac{1}{4}$ in.

When buying offcuts a point to bear in mind for most of us is that the price is usually related to weight and it doubles with the thickness purchased,

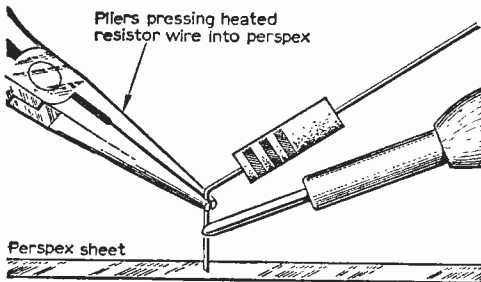


Fig. 1: Anchoring a component to a Perspex board.

i.e. on a square foot basis. Five shillings a pound is a typical price to pay. However, as our principal interest lies in the use of quite small quantities for the construction of chassis, tagboards and small cases, even buying from stock sheets need not be prohibitive. Messrs Vogue Plastics Ltd., 63 Paradise Street, Liverpool 1, retail Perspex and other plastics from large stocks.

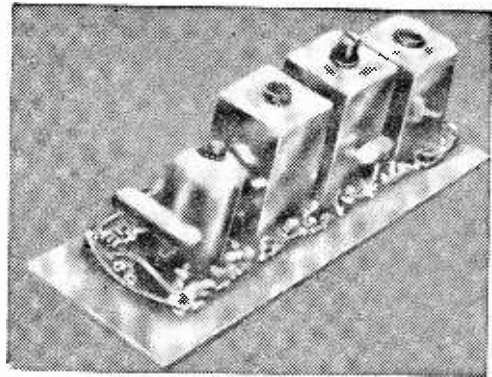
Tagboards and Chassis

To the writer, the use of a Perspex strip instead of a conventional tagboard or other form of

chassis forms the ideal method of providing anchorage for components in any form of layout. This is especially true for transistor circuitry. With Perspex the often encountered disadvantage of not having a tag just where it is needed never occurs—we just make one.

All that is required to secure, say, a resistor, to the board is a pair of long-nosed pliers, or for finer work a pair of tweezers and a soldering iron.

The resistor wires are bent down to a right angle, gripped with the pliers and placed over the selected point on the Perspex board, the bit of the iron is applied and as the wire heats a little downward pressure sinks it into the Perspex.



A three-stage i.f. strip built on a clear Perspex panel.

If only top surface wiring is required the wire end need only just dimple the under-side of the board for a sufficiently firm grip. A short pause to allow the Perspex to set after the iron is removed and the job is done—see Fig. 1.

A little practice will soon make perfect. The aim should be to get heat quickly on to the wire and a light tinning helps. Of course the thicker the Perspex and the stouter the gauge of wire the longer the iron will need to be applied for the drive in.

If wiring is to be carried out on both sides of the board the component being placed can have its lead pushed right through to provide a soldering point on the underneath face. For wiring on the same side as the component, especially if more than one lead is to be jointed, it helps if the tail of the component is doubled back on itself as shown in Fig. 2.

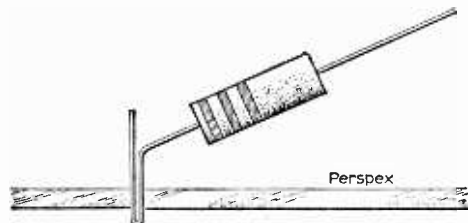


Fig. 2: Connections can be made to a component mounted as shown from either side of the board.

Tags may be provided at any position to receive transistors (the thinness of the average transistor lead and the length of time heat has to be applied make it inadvisable to secure direct by the method described) or to provide points for other leads simply by driving in a fairly stout short stub of wire—cut off ends of resistors come in well here.

It will be found that a very neat and compact layout can be readily obtained and long trailing wires become a rarity as in most cases one component can link directly with its neighbour, all of which assists in circuit stability.

Where metal screened components are mounted on the board one must remember to wire up the screening cans to an earth point, as there is no metal chassis to maintain earthing.

Coloured or clear Perspex can be used according to the constructor's choice. Opaque coloured boards look very clean and attractive but clear

chemists in small quantities. It is an excellent degreasing agent, switch cleaner and very nearly a universal solvent—very useful for removing grease from one's clothing!

When making up cement be careful not to introduce too much Perspex otherwise you will find you have a bottle full of interesting looking jelly which just will not be coaxed out of the bottle.

This form of cement dries more quickly. To use, apply cement to each face of the joint and ensure that close contact is maintained between faces for about fifteen minutes, after which time the joint should hold itself together prior to ultimate hardening. True faces produce the strongest joints and no great pressure need be applied. Glue blocks are simply strips of Perspex dipped in the cement and laid in the internal angle of the joint.

Other Fixing Methods

The reader is no doubt aware that holes can be readily drilled in Perspex and circuit boards can be easily bolted to the case.

Removable backs are best fitted inside the perimeter of the case and secured on one edge by pins driven hot into the edge of the back piece, and locating holes are drilled in the case to coincide.

A chromium-plated 6B.A. bolt through the case on the opposite side can locate into a $\frac{1}{4}$ in. thick block of Perspex cemented to the inside face of the back by drilling and tapping.

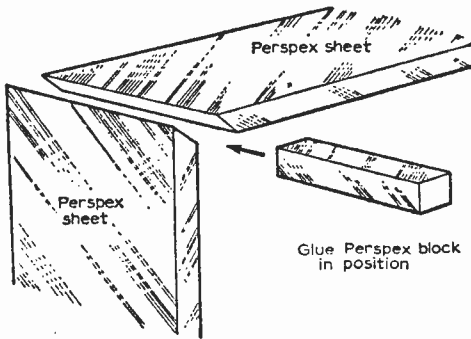


Fig. 3: Forming a mitre joint between two sheets of Perspex.

sheet enables wiring to be visible from either face which can help servicing. For boards up to 2in. x 5in. $\frac{3}{8}$ sheet is suitable, but larger boards require to be thicker or, alternatively, thinner sheet can be stiffened by ribs cemented on.

Cases and Boxes

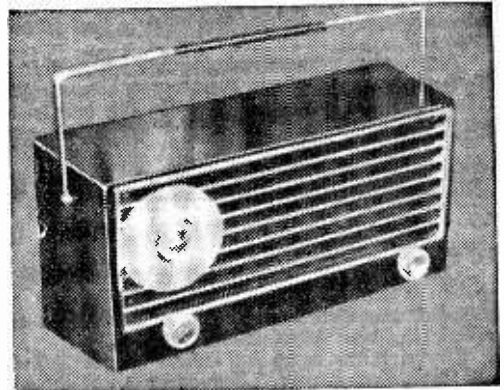
Due to the ease with which Perspex can be sawn, drilled, tapped, filed, bent, cemented and polished the amateur is able to make cases for receivers which can be as attractive as commercial products.

Methods of construction depend to some extent on the style of the case required. In general flat sides are cut out, each side being separate. So that joints on the abutments are invisible the meeting edges are filed to a 45° mitre and glue blocks inserted to ensure a stiff joint on the corners of the case (Fig. 3).

There is no need to hesitate in forming joints in Perspex as good Perspex cement actually welds the surfaces together, no other agent, such as rubber, being employed in the cement.

Perspex Cement

Perspex cement may be bought already made up or the constructor can make his own by dissolving clear Perspex chippings in trichloroethylene ("Trico" can usually be obtained from the



A Perspex cabinet for a portable receiver.

If a suitable tap is not to hand a nut sunk in by heat and doped in cement holds quite well. A hole for the nut should be drilled under-size to help it to penetrate. It is also advisable to cut slots in the faces of the nut to assist the Perspex and cement to key to the metal.

For those who prefer a case with rounded corners, the outer perimeter of the case can be formed in one length to the width required making a butt joint on the bottom reinforced with a glue block. The Perspex strip should be heated where the bend is to be formed in front of an electric or gas fire etc., until softening takes place sufficiently for the strip to be bent into an angle incorporating the round required. (When heating do not

—continued on page 174

two stage

V.H.F. Feeder Un

FOR 45-108Mc

It is thought that this receiving unit might prove of interest to beginners and newcomers to v.h.f. work since it does make possible a means of exploring the "2" and "4" metre amateur bands for a ridiculously small cash outlay. In amateur circles higher and higher frequency working has always been a challenge and this trend will undoubtedly continue for a long time to come; because of this "Two" and "Four" are unlikely to become less densely populated!

This unit can be used to receive transmissions over a frequency range of about 45-180Mc/s merely by choosing appropriate coils; this range embraces all BBC-1 TV, BBC v.h.f./f.m. transmissions and, of course, the 70Mc/s and 144Mc/s amateur bands.

The specified detector valve is supposedly able to function up to about 300Mc/s in some applications, but the specimen used in the test model, although new, could only be coaxed into action up to about 200Mc/s and thereby set a limit. Incidentally, at the present time both valves used can be purchased for the inclusive sum of 4s. 6d.!

Circuitry

The circuit of the receiver is given in Fig. 1, where it will be seen that V1 functions as a pre-detector amplifier/buffer stage and V2 as a self-quenching super-regenerative detector.

The circuitry is by no means unique and will be familiar to many. Uniqueness is not the most important consideration, however, for although it is comparatively simple to draw a circuit diagram for such a unit, it is considerably less easy to lay it out well physically since if it is not "leadless" (has no leads in its signal-carrying circuits) it will tend not to function at all. In the prototype no signal lead is longer than $\frac{3}{8}$ in.

The "heart" of the unit lies in the circuitry around V2, which is allowed to oscillate at a supersonic frequency due to valve action and the externally connected items in the anode-grid network. Periodic interruption of the oscillations is effected by choosing suitable items for R5 and C6, together with C8, the result of which is that a strong hiss is heard when a pair of headphones is connected to the output at "X". The oscillating condition is largely dependent upon r.f. choke L2 and the setting chosen for VR1. R6 is

the output load resistor. The electrolytic capacitor C9 acts as a reservoir whilst also helping to reduce noise from VR1 slider as this is adjusted.

L1 is fixed tuned by C1. L3, on the other hand, is tuned by a split-stator capacitor VC1, VC2 driven by a panel-mounted reduction drive mechanism. Although there is no "sharp" tuning present there is always a point where maximum signal response occurs. Detectors of this kind are notoriously unselective, although this can be advantageous if wide-band TV signals are desired. Regenerative detectors are also efficient radiators and for this reason *the circuit must on no account be used (1) without V1 buffer stage or (2) without being contained in a metal box of the type to be described later.*

Briefly then, signals are picked up at the aerial socket, amplified by V1 and fed to V2, where detection and audio amplification occur to permit them to be heard at point "X" via phones. Power for the unit is taken from any suitable power pack via a three-core cable.

The Valves

The 954 acorn pentode has seven lead-out wires, each about $\frac{1}{8}$ in. long. Direct soldered connections can be made to these lead-outs provided a heat shunt is used during the process.

The DET20 valve is on the international octal base but only three of its pins are used (heaters and cathode), whilst at the top of the envelope two "top caps" are fitted to grid and anode respectively. The grid is the one that on inspection shows an internal connection going to a central electrode. Since L3 is associated with these two electrodes very short wiring results. The heaters of both valves are fed from a standard 6-3V source via chokes L5, L6.

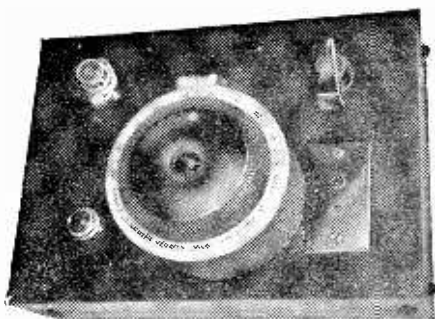
The Chokes

All the r.f. chokes are home-made items.

L2 and L4 each consist of some 100 turns of fine enamelled copper wire wound random fashion on $\frac{1}{2}$ W resistors of, say, 500k Ω (or higher values), the lead-out wires being used to anchor the winding endings.

L5 and L6 are each made by taking some 26in. of reasonably thick enamelled copper wire and close winding it on a $\frac{1}{8}$ in. diameter former. After

it



BY A. SYDENHAM

"doping" the winding, the former is removed when a suitable time has elapsed.

Constructional Notes

The simplest assembly method is to purchase a ready-made six-piece chassis comprising of four sides and two top plates made of 16s.w.g. aluminium.

Only one of the top plates is initially required, for by fitting to it a 2in.-wide aluminium shelf the whole unit can be rapidly built. On completion the "shell" of sides can be placed around the construction and the remaining top plate affixed to the underside to form a complete screening box of size 7in. x 5in. x 2in.

As may be seen at Fig. 2, the box face carries the controls and outlets. If preferred, a jack

COMPONENTS LIST

Resistors:

- R1 8.2kΩ
 - R2 100kΩ
 - R3 100kΩ
 - R4 180Ω
 - R5 2.2MΩ
 - R6 33kΩ
- All ±10%, 1/4W carbon

VR1 500kΩ potentiometer

Capacitors:

- C1 10pF ceramic or silver mica
- C2 0.01μF ceramic
- C3 0.01μF ceramic
- C4 0.01μF ceramic
- C5 5pF silver mica
- C6 100pF silver mica
- C7 0.01μF ceramic
- C8 5,000pF ceramic
- C9 8μF electrolytic 350V
- C10 2,000pF ceramic
- C11 2,000pF ceramic
- VC1, 230 + 30pF split stator variable (Jackson)

Inductors:

- L1 Aerial coil
 - L2 R.F. choke
 - L3 Detector coil
 - L4 R.F. choke
 - L5 R.F. choke
 - L6 R.F. choke
- (see text)

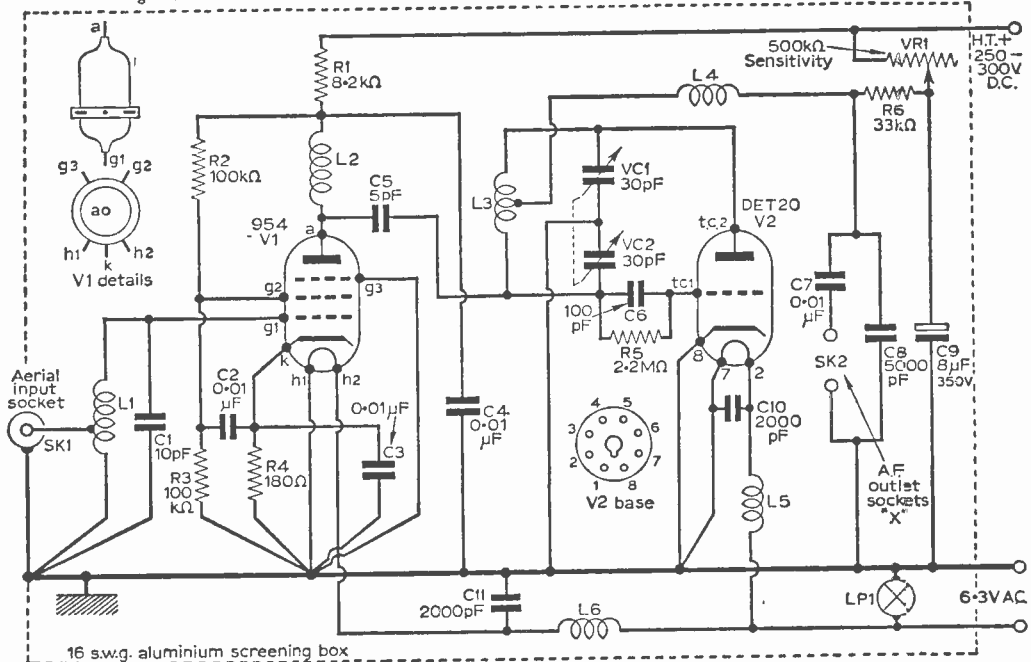
Valves:

- V1 954 acorn pentode
- V2 DET20 triode

Miscellaneous:

Chassis 7in. x 5in. x 2in. (in six sections—Home Radio). Dial and drive (see text). Panel lens and lamp 6.3V 0.15A (LPI). Coaxial socket (SK1). Valveholder, I.O. Stand-off insulators, tag strips. Phone socket strip (SK2). Spine clip, paxolin, aluminium, copper wire, solder, tags, nuts and bolts.

Fig. 1: The receiver circuit.



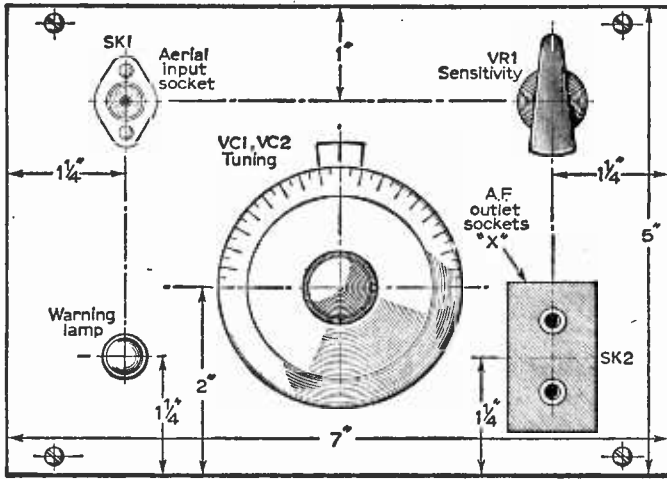


Fig. 2: The layout of controls on the front panel.

stiff wiring employed, will ensure the necessary rigidity.

In wiring the unit do not hesitate to cut off all component lead-out wires to their minimum length. Solder C5 directly between V1 anode and VC2. Use a heat shunt when soldering to the valve lead-outs.

Testing

Immediately the assembly is finished the shell of sides should be placed in position and secured from outside by self-tapping screws. Conventional safety tests using an ohmmeter should then be made prior to switch-on and a power source and headphones connected.

Coils now need to be made and for these use the thickest copper wire available, but in any case not thinner than 28 s.w.g. Initially, L1 can be made up of, say, five turns wound around a 3/8 in. diameter rod and the rod then removed. A tap for the aerial should be made at one turn from the chassis-connected end.

Coil L3 is the most critical of the pair and it is recommended that several samples be prepared using stretched copper wire of the thickest size

socket may be used in lieu of the two-way socket strip shown.

The dial and reduction mechanism is a Muirhead unit pruned from an ex-Government surplus RF27 unit, but other specimens may be used equally well—for example, types available from Jackson Bros., Eddystone, or Eagle products.

The inside of the front panel is shown at Fig. 3, where the 2in.-wide shelf used to carry the bulk of the assembly is clearly shown.

The split-stator unit VC1, VC2 occupies the whole width of the shelf and is held securely at the rear by a simply constructed L-shaped bracket of aluminium. Care is necessary to ensure that this bracket does not foul either of the split-stator "live" connectors in any way or the unit will not function, and to this end it is advisable to fit thin paxolin washers prior to inserting the fixing bolts.

Mounting the valves

V1 is mounted through the shelf as shown and its input and output circuits are thereby automatically screened from each other.

V2 is "dropped through" also to about the depth of its bakelite base by mounting its holder on 1/2 in. spacers; this brings the top caps close to VC1, VC2 and assists in keeping leads short. The holder for V2 should also be orientated in such a way that its top caps lie in the plane shown and close to the appropriate tags on VC1, VC2. Note how easy it is to change L3 or adjust the turns spacing.

To anchor the small components a couple of simple tag strips are required and these should, of course, be isolated from the chassis.

The under-shelf wiring may be seen at Fig. 4, and here it should be noted that a rectangle of thin paxolin is required to insulate the various electrodes of V1 lest they foul the chassis. When preparing this piece of insulant, drill it only just large enough for the valve body to pass through, for if a tight fit is aimed at, this together with the

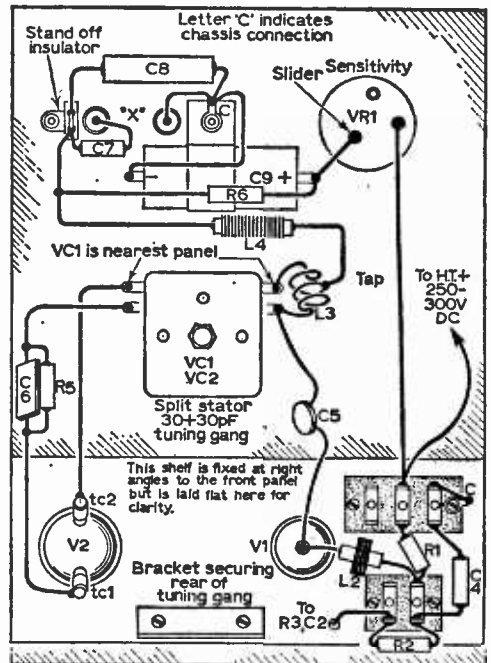
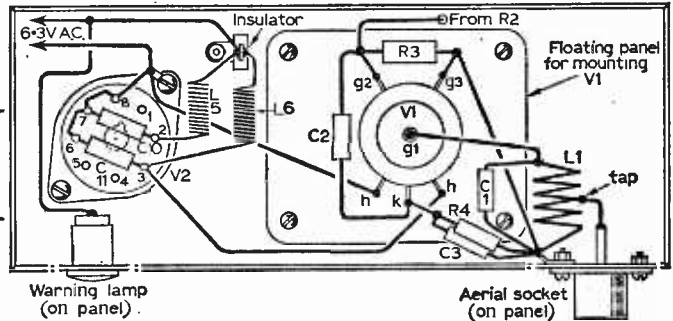


Fig. 3: Wiring and connections to the rear of the front panel and to the components on top of the chassis.

available. This wire should be wound on a $\frac{3}{8}$ in. former and the latter afterwards removed. These trial coils can be of three, four, seven and nine full turns each and they should have the shortest possible lead-outs, whilst the turns should be spaced from one another by the wire thickness. Each coil is centre-tapped, of course, and this may be done either by applying a blob of solder to the central point when the wire is out straight or by making the connection afterwards.

In the prototype the nine-turn coil enabled BBC-TV Channel 5 signals to be heard, whilst for 144Mc/s the four-turn specimen was needed. Between these extremes lie the BBC v.h.f./f.m. and 70Mc/s amateur bands.

Fig. 4: The underchassis wiring diagram. Note the rectangle of paxolin ensuring V1 pins do not meet the chassis.



A Dipole Aerial

In the absence of a suitable v.h.f. aerial an experimental dipole can be constructed from wire flex, metal rod or cable along the lines depicted in Fig. 5. Normal long-wire domestic aerials are not very good for use at v.h.f. and a simple resonant dipole, even if used indoors, can often be satisfactory.

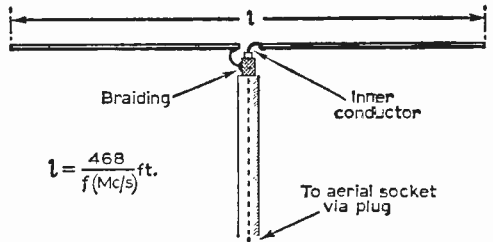
If no special band is being aimed at the overall length l may initially be about 7ft 6in. The coaxial cable running from the dipole to the unit may be any length. The dipole should be mounted as high as possible and it can be arranged vertically to receive TV signals and horizontally for others.

If, however, a particular band is desired the required aerial length, l , may be found from the

Fig. 5: A dipole aerial, suitable for experimental purposes.

introduced. If signals are now heard the indication is that the coil requires a turn less for the particular frequency received. The inductance of the coils can also be altered slightly by compressing or expanding the turns-spacing, the latter operation causing the inductance value to be decreased.

As a point of interest L2 can be made a hairpin loop of about $2\frac{1}{8}$ in. long and spaced about $1\frac{1}{4}$ in. for 144Mc/s. The ends of the hairpin are



$$l = \frac{468}{f(\text{Mc/s})} \text{ ft.}$$

simple formula:

$$\text{Length } (l) = \frac{468}{f(\text{Mc/s})} \text{ feet, or } \frac{5616}{f(\text{Mc/s})} \text{ inches.}$$

For a frequency of 145Mc/s therefore

$$l = \frac{5616}{145} = 38.73 \text{ inches.}$$

In the absence of measuring gear, some patience is required to locate a band, particularly in poor signal areas, but a "tuning wand" will be found most useful. This is merely a sliver of wood (a wooden meat skewer, for example) fitted at one end with a section of brass rod and at the other with a dust iron core.

If when the tuning dial is fully rotated no signals are heard, do not immediately exchange L3 but instead set the dial so that the capacitor vanes are fully enmeshed. Now slowly introduce the dust iron cored end of the wand into the coil and if signals are heard adjust VR1 carefully.

connected to grid and anode circuits, whilst L4 is connected to the centre of the loop. Oddments of coaxial cable can also be utilised as high "Q" resonators, but the h.t. tap is not easily arranged.

Conclusion

Once the desired band is found L1 can be adjusted for optimum results, and using L3 as a guide allow one extra turn. This coil will tend to tune flatly due to the aerial (which may be tapped in at one turn from the chassis end) but once again the tuning wand will prove useful.

The aerial can also be made to resonate more closely to the selected frequency as described earlier. When all the adjustments are complete, signals should be receivable clear of background hiss.

A Transistorised Inverter

A COMPACT UNIT TO PROVIDE
230V A.C. FROM A 12V D.C. SUPPLY

for Electric Shavers

By E. Lavington

NOW that electric shavers are so widely used it comes as something of a shock when we find ourselves in a locality bereft of mains electricity. There is, however, no reason why the usual electric shave should not be indulged in where a 12V d.c. supply is available, such as in a car, boat, caravan or cottage.

This article describes a simple, cheap, and very effective 12V d.c. to 230V a.c. inverter. The unit operates from a normal 12V accumulator or car battery. The output, while not being a pure sine wave, is an alternating supply of approximately 230V at a frequency of 50c/s, which will adequately drive the normal mains voltage electric shaver.

The basic circuit is shown in Fig. 1. The principle of operation is that two transistors are connected in a push-pull arrangement, so that when one is conducting the other is cut off. The circuit is so arranged that as the conducting transistor reaches a peak, voltages are induced through the transformer into the other transistor circuit. The second transistor is thus caused to conduct and

voltages are induced which tend to reduce the current of the first transistor, thus producing a cycling effect. The frequency of this effect is determined by the capacity of C1 and the inductance of the primary winding.

A satisfactory transformer to suit this circuit is made by Repanco Ltd., and the lay-out chosen is

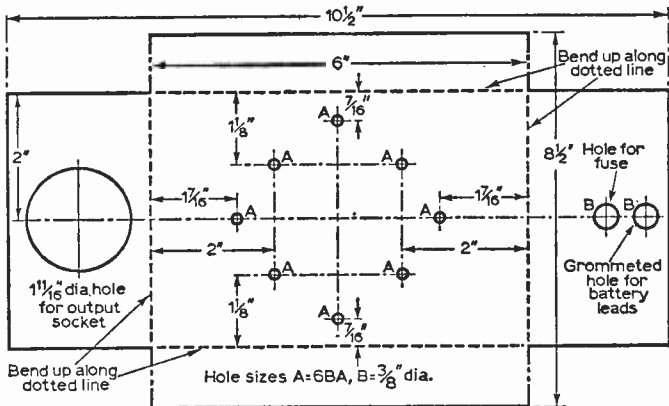


Fig. 2: The standard aluminium chassis used to house the unit.

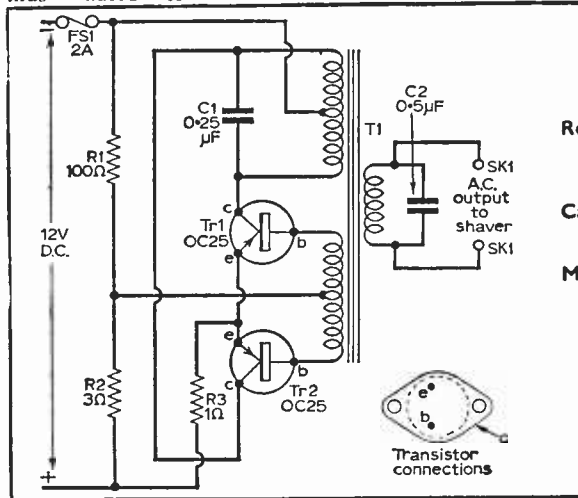
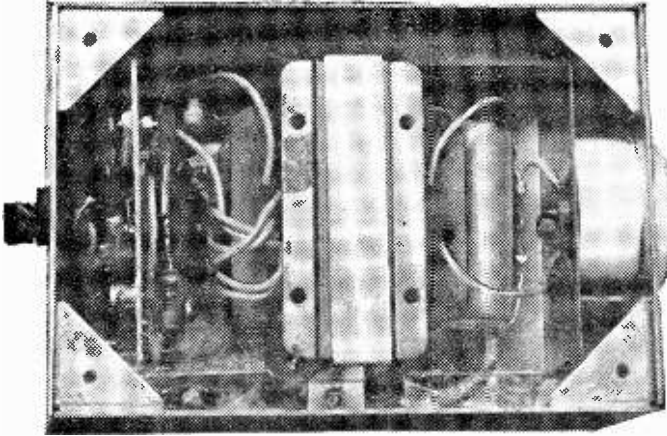


Fig. 1: The inverter circuit.

COMPONENTS LIST

- Resistors:**
 R1 100Ω 3W ww
 R2 3Ω 3W ww
 R3 1Ω 10W ww
- Capacitors:**
 C1 0.25μF paper 150V
 C2 0.5μF paper 500V
- Miscellaneous:**
 T1 Transformer (Repanco Type TT51)
 Tr 1, 2 OC25 with insulating bushes and mica washers.
 FS1 2A fuse cartridge
 SK1 5A mains socket, surface type fuse-holder. Rubber grommet, 3/8 in. Aluminium chassis 6 in. x 4 in. x 2 1/2 in. Nuts and bolts, wire, sleeving, adhesive, plastic fabric.



A view of the prototype unit completed.

and bracket. Similarly, the insulating bushes for the soldering connections must be pushed into the appropriate holes before the fixing screws are inserted.

For readers not familiar with the button type of transistor it is easy to locate which pin is which if it is noted that the connection spills are not set symmetrically in the base. Reference to key diagram under Fig. 1 will make the connections clear.

Having assembled the transistors, take the "three tag" strip and wire up the components as shown in Fig. 5a, then the transformer as indicated in the same figure.

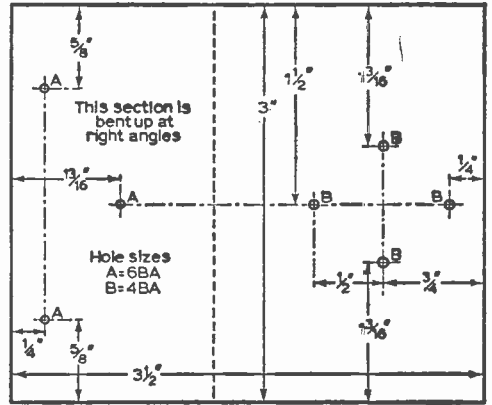
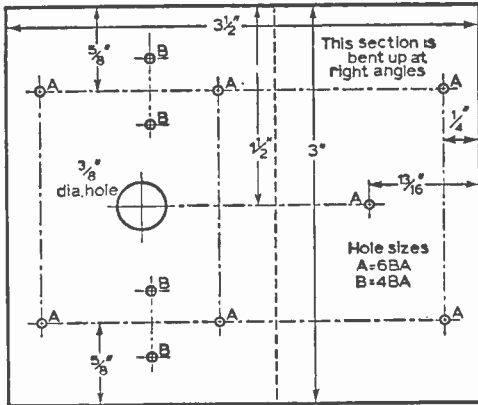


Fig. 3a (left), b (right): Drilling dimensions for the two aluminium mounting brackets.

designed round this and two Mullard OC25 transistors.

Constructional Details

The inverter is housed in a normal aluminium chassis measuring 6in x 4in. x 2 1/4in., which should be drilled as shown in diagram Fig. 2

Two right-angled aluminium brackets are required, one to carry the transistors and primary components, and the other the output socket and capacitor C2. The brackets are made from aluminium sheet cut and drilled according to Fig. 3a and 3b.

The clamp to keep the transformer in position is shown in Fig. 4.

The resistance R3 can best be made from approximately 2ft. of radiator element wire coiled round a pencil into a short "spring". One word of warning, make sure that the wire you choose solders easily; some resistance wire does not.

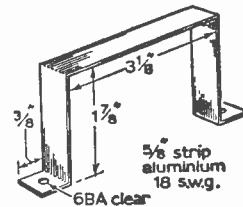


Fig. 4: The transformer clamp.

Assemble the two-way 5A output socket on the other right-angled bracket made according to Fig. 3b, with two 4in. 4B.A. screws, and connect to the tag-strip with two pieces of tinned wire suitably sleeved as shown in Fig. 5b. Similarly wire capacitor C2.

Wiring and Assembling

First mount the transistors on the right-angled bracket made according to Fig. 3a. This bracket acts as a heat sink to keep the transistors cool. The mica washer supplied with each OC25 must be carefully placed in position between the transistor

Assembly into Chassis

Position the rubber grommet and the fuse holder in the appropriate holes. Connect the black or negative battery lead to the tag on the fuse holder. Wire from the other side of the fuse to right hand

tag of the three way tag strip.

Now assemble the bracket carrying the transistors to the chassis with the three 1/4 in. 6B.A. screws. The tag-strip should be anchored by the centre screw. To facilitate assembly the transformer may be turned upside down and rested on the corner of the chassis whilst the screws are being tightened.

Next assemble the other right-angled bracket to the chassis using three 1/4 in. 6B.A. screws. Finally, fit the transformer clamp (Fig. 4) securing by two 1/4 in. 6 B.A. screws.

All that is left to do now is to connect the output leads of the transformer (numbered 1 and 2) to the outer tags on the tag strip shown in Fig. 5b.

Testing

When the unit has been completed and checked, connect a 12V battery being careful to see that the red lead goes to the positive or red terminal and the black to the negative. *Note that a reversed connection will cause components to be burned out and the unit to fail.* If 50 cycles is being generated, a very slight hum can be heard from the transformer if held close to the ear.

Next check the voltage on no load. It should be of the order of 260V which drops to 230 when the shaver is connected.

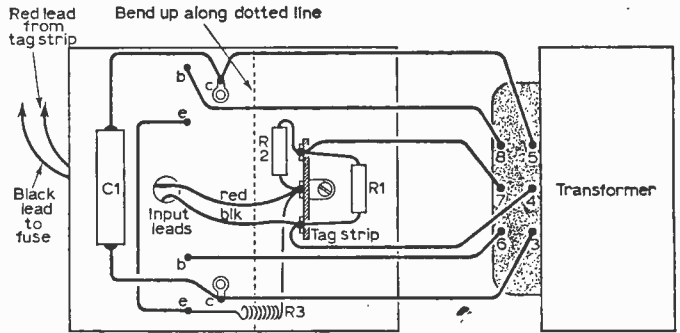


Fig. 5a (above): Wiring the "three tag" strip and the transformer.

Fig. 5b (below): Wiring the two-way output socket.

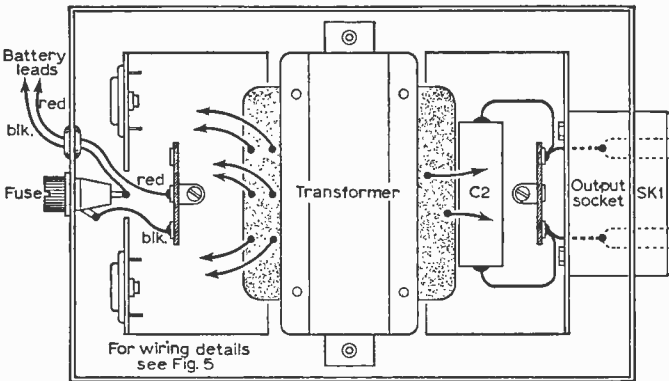
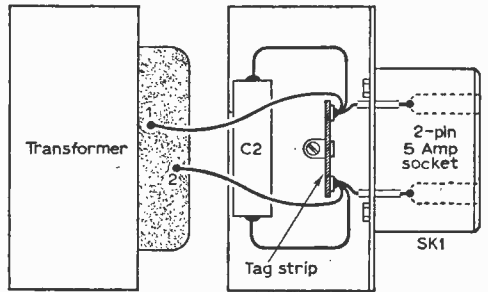


Fig. 6: A general view of the unit, indicating the remaining wiring to be carried out extra to that shown in Figs. 5a and b.

The circuit as it stands, if correctly assembled and wired, will be quite suitable for driving the majority of electric shavers and no further adjustments should be necessary.

External Details

When the unit is complete and working, a base plate of 16 gauge aluminium measuring 5 1/4 in. x 4 1/4 in. can be made and fixed to the corner supports of the chassis by nylon press grips obtainable from a car accessory dealer.

To improve the appearance of the unit it can be covered with contact adhesive plastic which is readily available; about a shilling's worth being required. There are several designs in a polished wood pattern which enable the unit to be fitted under the dashboard of even the smartest car quite unobtrusively. Before applying the plastic adhesive fabric it is essential to see that the aluminium chassis is clean and free from grease.

Fitting in a Car

The unit can be permanently wired to a suitable point in the electrical system of any car which has a 12V battery, provided that an on/off switch is included. The switch can be mounted on the dashboard or on the unit itself and should be connected in the non-earthed lead.

When making the connections care must be taken to see that the red lead goes to the positive side of the battery which is usually connected to the chassis. In older cars and some originating from the Continent it will be found that the negative side of the battery is connected to the chassis and not the positive, but this will in no way effect the unit.



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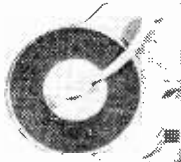
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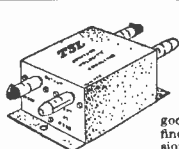
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AUDIO FAIR COMMENT

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A Report from the International Festival and Fair held at the Russell Hotel in London from 2nd to 5th April

by Henry Maxwell

“INITIATION” was the theme of the 1964 *International Audio Festival and Fair*, we were told by the director, C. Rex-Hassan.

Initiation ceremonies tend to be painful. Certainly it seemed that half the 40,000-plus visitors to this year's fair at the Russell Hotel, London, trod on your correspondent's toes as he jostled to view some of the exhibits on the cramped stands in the main body of the hall. Upstairs was little better: leaning against a corridor wall for a welcome respite and chat to a colleague was an invitation for a queue to form. There is surely a case for a more roomy venue now that enthusiasm for audio matters has grown.

MULTIPLEX STEREO

Despite this there was no depreciation of standards. This was a specialists' show, attracting 30 or so foreign exhibitors, some of them unveiling their new treasures for the first time anywhere. In addition the BBC had been forced into awareness of the audio enthusiast's existence. The result was recorded stereo programmes using the Zenith-GE Multiplex system, broadcast from Wrotham, using the Third Programme transmitter, outside its normal broadcasting hours on its normal 91.3Mc/s frequency. Although international politics befog the issue and a regular service in this country awaits CCIR decisions—the next plenary meeting will not take place until 1966—the BBC made a brave effort to demonstrate to potential listeners the quality that could be obtained in home listening.

Several firms have been ready for the innovation of stereo multiplex broadcasting for some time and were quick to take advantage of this link. **Acoustical Manufacturing Co.**, for example, with the well-proven *Quad* range, were showing for the first public time their prototype decoder unit, fully transistorised and matching the established range of equipment.

Armstrong also took advantage of the transmissions to show their multiplex decoder, while **Pioneer Electronic Corporation** of Japan, under the aegis of *C. E. Hammond*, who are also distributors of *Revox* tape recorders, demonstrated some interesting a.m./f.m. tuners with multiplex circuits as well as the complete SM-G 205

integrated stereo tuner-amplifier with variable i.f. bandwidth, switchable a.f.c. and built-in ferrite aerial. Price 85 gns. (Multiplex adaptor at 16 gns.).

AMPLIFIERS

The transistor invasion goes on: advantages of smaller construction, less heat dissipation, better noise figures and a general improvement in quality are claimed by most manufacturers. Messrs. **Leak** and **Truvox** pressed the point with the literature displayed with their fully integrated transistorised stereo amplifiers, giving 10W from each channel into 15Ω loads. Prices: *Leak Stereo 30*, £49 10s., and *Truvox TSA100*, 49 gns.

That word “integrated” has become the cult word of this year's Fair; just as grey, black and silver appear to have crept in as the colour scheme of the most recent releases. By “integrated” the manufacturers imply that the power supplies, main amplifiers and control sections are all incorporated on a single chassis.

Derritron Ultrasonics with the *Chapman* range, **Armstrong Audio**, **Sherwood Electronic Laboratories**, **Elektroimpex Hungarian Trading Co.**, with the **Qualiton** stereo integrated amplifier (valves and silicon rectifiers) and even **Grundig** had very impressive equipment to unveil.

The last-mentioned company aroused great interest with the *SV50 Stereo Amplifier* and the *RT50 Tuner Unit*. The *SV50* has 27 transistors and two semiconductor rectifiers with 2 x 20W output, while the *RT50* is a medium and v.h.f. tuner unit of hybrid design with switchable a.f.c., noise suppression and stereo decoding for stereo f.m. reception, completely matching the *SV50*. In tasteful slim walnut cases 11½ x 10½ x 6in.

In contrast to this paring down into bookcase, shelf-mounting dimensions the loudspeaker assemblies into which this tuner and amplifier were fed were of ambitious construction. The *Box 70* has one 12in. bass and three mid-range/treble speakers, while the *Box 100* has a 12in. bass, two mid-range and no less than six treble speakers.

LOUDSPEAKERS

Loudspeakers generally followed established lines with various improvements and changes in

enclosure design. Four new products were shown on the **Goodman** stand. Most noteworthy for the average domestic listener was the *New Maxim*. In an enclosure only $10\frac{1}{2} \times 5\frac{1}{2} \times 7\frac{1}{4}$ in. there are two direct radiators with a reputed frequency range (at minimal deviation) from 45—20,000c/s, giving 8W, fully loaded, at 15Ω. Price: £15, plus £2 10s. 6d. purchase tax. Demonstrations indicated that this small unit gave forth all it claimed—and, what is equally important, no more!

Also on show was the now-famous *Eleganzia*, improved into a Mark II version with an improved overall performance but no increase from the super-slim dimensions. For the chap who hates his neighbour 'or, more realistically, the P.A. dealer, the *New Audiom* 91, replacing the *Audiom* 90, was shown. This is an 18in., single-cone unit handling 50W in standard and bass versions. Ideal for the would-be Beatles. Another newcomer to this range is the *Triaxiom* 122OC, a three-unit, 12in., 20W design which sells at £18 10s.

Other first-timers were shown by **Fane Acoustics**. Of especial interest was the *Fanfare* with a four-speaker design, using rear horn-loading for the bass unit, stated to be effective down to 17c/s—and it felt like it, what's more.

Making more of their claim to "three-dimensional sound" were **Lansing**, well known in the U.S.A., showing for the first time in England. A wide range of transducers with some unusual magnet systems and edge-wound ribbon speech coils were shown. There was also the *Paragon* cabinet system, almost 9ft long, weighing more than 6cwt, with two theatre speaker assemblies—a "sooper-woofer".

Other exhibitors stood upon their established reputations, Messrs. **Wharfedale**, **Whiteley Lowther**, **Leak** and **Kelly** need no explanation and gave the impression that in appearing at the Russell Hotel they were welcoming old friends rather than dispensing publicity.

But we noted a departure from convention on the Lowther stand, where a high-quality broadcast receiver with transistorised f.m. tuner and pre-amplifier and valve output giving 12W was to be seen. And visitors to Leak, who had not seen or heard the *Sandwich* speaker before, would have been pleasurably surprised.

Leave cannot be taken of the subject of loudspeakers without mentioning the *Jordan-Watts* square module with acoustic damping on the **Boosey** and **Hawkes** stand. The speaker is reputed to be weather and insect (Beagle?) proof and is almost entirely of metal. Popular form of employment is as a "building brick" with assemblies capable of providing a high-fidelity output at almost any power rating that is wanted. Shelf and wall mounting units were also on show as well as reflex enclosures.

Quality equipment of rugged design could be seen, too, on the **K.E.F.** stand from the miniature *Celeste* to the LS5 monitor. This firm also held an interesting ambistereo demonstration with the **Radford** pre-amplifier and **Grampian** reverberation unit.

This last is a mechanical spring line device employed to liven a dead acoustic studio condition by using two signal paths, one direct, unmodified,

the other via the reverberation unit, adjustable from zero to one-to-one. Battery and mains operation is now provided.

Most unusual loudspeaker enclosure this year must surely be the *Sound-Globe* arrangement on the **Clairtone Project G** stereogram, seen in all its grandeur on the **Argelane** stand. The loudspeakers are mounted in 18in. spun aluminium globes, painted a forbidding black and rotatable on shock-proof ball bearings through 340°.

Mounted at the ends of the rosewood cabinet, they gave a definitely "space-age" look to the Audio scene. Not so obvious was the completely solid-state circuitry, four-speed transcription turntable with *Elac* cartridge and f.m. tuner unit ready for stereo transmissions of quite ambitious specifications.

TAPE RECORDERS

Tape recorders included both the household names, the British "steadies" and a number of freshly imported foreign models. From Japan both **Sony** and **Akai** had good things to offer. The former, imported by **Tellux**, showed a complete new range which included a 79 gns. two-speed, four-track stereo-mono system and a stereo deck and amplifier for the constructor.

Pullin Optical Co., who import the **Akai** products, were at pains to point out that their most opulent model was not just a "show model" but a practical professional machine with some unique features. Among these is the repeat device and the Instantaneous Resettable Automatic Protection circuit which guards against damage to the transistors by ambient heat, etc. Remote control facilities are included and the reel limit has been increased to $10\frac{1}{2}$ in. by extension arms. The price? A mere £208 19s.

More within the range of the average pocket is the **Butoba** MT5, reduced from its original price to 59 gns. on opening day, and the very adaptable MT7, recently reduced to 38 gns. The same importers, **Denham** and **Morley**, handle the **Siemens** range, whose models 10 and 14 are now 69 gns.

Making a world debut was the *Dual* TG12A four-track stereo tape recorder with multi-play and multi-track facilities and a claimed frequency response at the highest speed of 40-20,000c/s. Also exhibited by **Celsa** was the new *Dual* 1009 stereo record player, which is said to have the lowest tracking pressure, approximately $\frac{1}{2}$ gram, of any on the market.

In fact this pick-up arm is so delicately balanced that the deck can be tilted up to 45 deg. and still played. No more spirit-level installation. did I hear someone comment?

Another first-timer was the improved version of the **Planet** U1 tape deck and a complete assembly of this deck with stereo recording and playback amplifiers in a wood plinth sells at about £120. A high-quality British product of uncompromising design.

As staunchly British, both **Ferrograph** and **Brenell** had their well-known and well-respected machines on show and the other important "home product", the **Truvox** 90 series, featured improved key control, a magnet for many fingers.

PORTABLE TRANSISTOR RADIOS

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ROAMER SEVEN Mk III

● 9 stages—7 transistors and 2 diodes

Covers Medium and Long Waves, Trawler Band and two Short Waves to approx. 17 metres. Push-pull output for room filling volume from rich toned heavy duty 5in. speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M & L waves and telescopic aerial for S Waves. Simulated hide case with gill trim and shoulder and hand straps. Size 9 x 7 x 4in. approx. The perfect portable and the ideal car radio. (Uses PP9 battery available anywhere.)

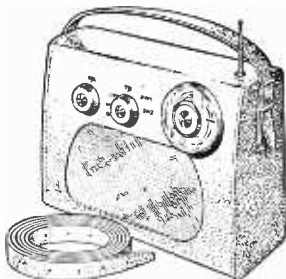
5 WAVEBAND PORTABLE OR CAR RADIO

Amazing performance and specification

Total cost of parts now only

£5.19.6 P. & P. 5/6

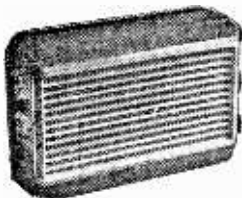
Parts Price List and easy build plans 3/-.



TRANSONA FIVE

"Home, Light, A.F.S. L., all at good volume," G.P., Intham.

● 7 stages—5 transistors and 2 diodes.



Fully tunable over medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser, volume control, new type fine tone super dynamic 2in. speaker etc. Attractive case. Size 6 1/2 x 4 1/2 x 1 1/2in. with red speaker grille. (Uses 1289 battery available anywhere.)

Total cost of all parts now only **42/6** P. & P. 3/6.

Parts Price List and easy build plans 2/-.

TRANSONA SIX

NEW!

● 8 stages—6 transistors and 2 diodes

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade Ferrite magnet 3in. speaker makes listening a pleasure. Push-pull transformers for ample power. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6 1/2 x 4 1/2 x 1 1/2in. (Uses PP4 battery available anywhere.) (Carrying strap 2/- ex.)

Total cost of all parts now only **59/6** P. & P. 3/6



Parts Price List and easy build plans 1/6

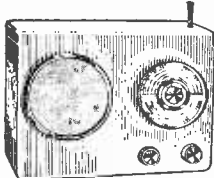
SUPER SEVEN

● 9 stages—7 transistors and 2 diodes

Covers Medium and Long Waves and Trawler band. Completely portable—has built-in Ferrite rod aerial for wonderful reception. Push-pull output, 3in. speaker will drive large speaker. Size 7 1/2 x 5 1/2 x 1 1/2in. (Uses 9v. battery, available anywhere.) (Telescopic Aerial for Trawler Band optional extra 6/11.)

Total cost of all parts now only **£3.19.6** P. & P. 3/6

Parts Price List and easy build plans 2/-.



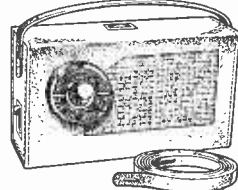
MELODY SIX

FREE!

Miniature Earpiece, plug and socket (value 9/6) and details of conversion to private listening.

"... amazed at volume and performance... has really come up to my expectations." S. G., Stockton-on-Tees

● 8 stages—6 transistors and 2 diodes.



Our latest completely portable transistor radio covering medium and long waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker. Top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. ferrite rod aerial. Push-pull output. Wonderful reception of B.B.C. Home and Light, 208 and many Continental stations. Handsome leather-look pocket case, with gill speaker grille and supplied with hand and shoulder straps.

size case, only 6 1/2 x 3 1/2 x 1 1/2in. approx. Total cost of all parts only **£4.9.6** P. & P. 3/6.

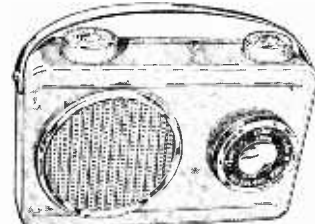
Part: Price List and easy build plans 2/-.

ROAMER SIX

FREE! Miniature Earpiece, plug and socket (value 9/6) and details of conversion to private listening.

● 8 stages—6 transistors and 2 diodes.

Listen to stations half a world away with this 5 waveband portable. Tunable on Medium and Long waves, Trawler Band and two Short waves. Sensitive ferrite rod aerial and telescopic aerial for short waves. Top grade transistors, 3-inch speaker, handsome case with gill fittings. Size 6 1/2 x 4 1/2 x 1 1/2in. (Uses 1289 battery available anywhere.)



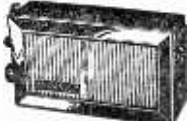
Total cost of all parts now only **£4.19.6** P. & P. 3/6.

Parts Price List and easy build plans 1/-.

POCKET FIVE

● 7 stages—5 transistors and 2 diodes.

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round super-sensitive Ferrite Rod Aerial and fine tone 2 1/2in. moving coil speaker, built into attractive black case with red speaker grille. Size 5 1/2 x 1 1/2 x 3 1/2in. (Uses 1289 battery available anywhere.)



Total cost of all parts now only **42/6** P. & P. 3/6.

Parts Price List and easy build plans 1/6

All components used in our receivers may be purchased separately if desired. Parts price lists and easy build plans supplied free with sets of parts or available separately at fixed prices stated.

Radio Exchange Co.

61 HIGH STREET, BEDFORD, Tel. 2367
Callers side ent. Barratts, Shoe Shop. 9-5 pm. 10-1 pm. Sat.



THE SKYROVER AND SKYROVER De Luxe

General Specification for both models

7 transistors and 2 diode superhet—6 waveband portable receiver, covering the full Medium Waveband (180-576M) and Short Waveband (31-94M) and in addition 4 separate switched Band Spread Ranges on 13M, 16M, 19M and 25M bands—with manual Band Spread Tuning for accurate Station selection, 1 F. frequency 470Kcs. Output 500MW, 5in. Ceramic Magnet P.M. Speaker, Telescopic and Internal Ferrite Rod Aerial. All Mullard Transistors and Diodes. The coil pack and tuning heart is completely factory assembled wired and tested. The remaining assembly can be completed in three hours from our detailed and easy to follow instructions. Operates on four 1.5V torch batts. (U2 or equivalent).

THE SKYROVER. Individual Details—controls: Waveband Selector. Volume Control with on/off switch. Tuning Control with easy to read Dial Scale. In attractive plastic cabinet, size: 10 x 6 1/2 x 3 1/2 in., with metal trim and carrying handle.

MAY BE BUILT FOR £10.19.6 All Parts Sold Separately.

H.P. Terms 22/- deposit and 11 monthly payments of 21/-. **THE SKYROVER De Luxe. Tone Control Circuit** is incorporated with separate Tone Control in addition Volume and Tuning Controls and Waveband Selector. In sturdy wood cabinets, size: 11 x 5 1/2 in. covered in washable material with plastic trim and carrying handle. Also Car Aerial socket.

MAY BE BUILT FOR £12.19.6 All Parts Sold Separately.

H.P. Terms 26/- deposit and 11 monthly payments of 24/-. Circuit diagram and data for each set 2/6 extra, free if all parts bought. Four U2 batteries included FREE. Add 5/- P. & P. on each set.

THE PETIT A.C. ELIMINATOR AND P.&P. 9V. BATTERY CHARGER 18/6 1/6.
FULMIR (approx. same size as PP3 battery).

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Seven transistor portable receiver—full L. and M. waveband coverage, 4in. speaker. Full description last appeared April '64. **MAY BE BUILT FOR £5.19.6** All parts sold separately. **CAN BE BUILT FOR £5.19.6** Battery 3/6 extra. P. & P. 4/6

Also De Luxe Model with superior PVC covered wood cabinet and full view tuning dial. **MAY BE BUILT FOR £6.19.6** All parts sold separately. **FOR** Battery 3/6 extra. P. & P. 4/6

THE "SPRITE"

6 transistor mini pocket receiver. Full L. and M. waveband coverage. Size only 4 x 2 1/2 x 1 1/2 in. In sub assemblies, 3in. speaker. **CAN BE BUILT FOR 79/6** Leather case, **FOR** **12/6** extra. All parts sold separately. P. & P. 3/6.

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2 transistor pocket radio—complete with earpiece, telescopic aerial, battery and case. Medium waveband. **42/-** Post Size 4 x 2 1/2 x 1 1/2 in. Complete with accessories. **Free** Also 6 transistor model. Long and medium waveband. Fully built complete with earpiece, battery and leather **79/6** **Free** carrying case.

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7in. Stand. play, 1,200ft. 12/6	MESS. AG. TAPES 15/-
7in. Long play, 1,800ft. 19/6	3in.—150ft. 3/6
7in. Double play, 2,400ft. 25/-	3in.—225ft. 4/11
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5in. Standard play, 600ft. 8/6	All other makes, types and 5in. Standard play, 850ft. 11/6
P. & P. 1/- extra per reel. 4 reels and over Post Free.	

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IF11	7/6	6D2	4/-	16A5	9/1	EB41	7/6	EZ40	6/8	TT15	27/6
IF10	5/6	6F12	4/-	19A05	9/1	EBF80	8/6	EZ60	6/-	U76	7/6
IF11	6/-	6H07	2/-	25L6GT	6/1	EC081	4/-	EZ81	6/8	U78	5/-
IK5	5/6	6K7G	6/6	30C1	7/6	EC082	6/6	HYR3	9/6	U142	7/6
IK5	5/6	6K9G	6/6	30L1	7/6	EC083	6/6	KY33G	6/6	U76	4/6
IT4	2/-	6Q7G	5/6	35L6GT	7/6	EC084	6/6	KT66	13/6	UBC41	8/6
IU5	5/6	6SL7GT	6/-	35W4	8/8	EC085	7/6	N17	5/8	UF41	8/6
IQ4	5/6	6SN7GT	7/6	35Z4GT	8/1	ECF50	6/6	N18	5/6	UL41	8/6
2S1	5/6	6V0G	7/6	57B3	7/8	ECF82	7/6	N19	6/-	UY41	7/6
3V4	6/-	6X4	5/-	50	6/1	ECH42	9/-	N709	7/-	W17	2/-
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5Z4G	6/6	7Y4	6/-	DAF98	7/6	ECL81	9/6	PCF80	7/6	W143	8/6
6AK6	5/6	6D3	4/-	DF91	2/-	ECL82	7/6	PCF82	6/6	X17	5/6
6AL5	4/-	6D7	9/6	DF96	7/6	EF41	9/-	PCL82	6/8	X142	9/6
6AM6	4/-	12AD6	7/6	DH76	7/6	EF80	8/-	PCL84	5/9	X150	9/-
6AT6	5/-	12AH3	10/-	DE37	5/6	EF86	9/-	PL81	9/6	Z77	4/-
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Postage and packing 6d. Over 62 post free. C.O.D. 4/-



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TWIN FEEDER. 300 ohm twin ribbon feeder, similar K25, 6d. per yard K35 Telecon (round) 1/6 per yard. Post on above feeder and cable 1/6 any length.

COPPER WIRE, 14 G., H/D 140ft. 17/-; 70ft. 8/6. P. & P. 2/6. Other lengths pro rata.

RIBBED GLASS, 3in. aerial insulators, 1/9 each. Shell ins 2in. 9d. each. P. & P. 2/-. Up to 12.

CERAMIC FEEDER SPREADERS. 6in. type F.S. 10d. each. P. & P. 2/-.

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SUPER AERAXIAL CABLE. 75 ohms, 300 watts, very low loss, 1/8 per yard. P. & P. 2/-. 50 ohm, 300 watt coax, very low loss, 1/9 yard. P. & P. 2/-.

ABSORPTION WAVEMETERS. 3.00 to 35.00 Mc/s in 3 switched bands, 3.5, 7, 14, 21 and 28 Mc/s. Ham bands, marked on scale. Complete with indicator bulb. **A MUST** for any Ham shack, 22/6 post free.

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SETS OF VALVES for AR88 (14) £3.10.0 post free.

METERS, 3 1/2in. with 2 1/2in. scale, 0-10 mA, 15/-; 0-100 mA, 15/-.

THERMO, 2 1/2in. round 0-2.5 amp, 7/6 each. P. & P. 1/6.

170-172 CORPORATION ST. BIRMINGHAM 4

Telephone CEN 1635

More remote and of interest academically was the professional equipment demonstrated by **E.M.I.** This included the well-known TR52, the RE301, a two-channel system for special studio use and the high-quality broadcasting job, the 311. Not far away was the **Clarke and Smith** demonstration, where the transistorised models, 634 (Wright and Weaire deck) and 635 (Truvox deck) were to be seen. These have had a great success in the educational field and it is only lately that they have become available to the general public.

Fi-cord, one of the pioneers of portability, showed that playback from Model 202 was equal to the high-quality sounds emanating from nearby rooms with banks of massive equipment. All from a combination of the handy-sized portable and a bookshelf-sized battery powered amplifier speaker. This must surely be the best money's worth, sound-for-size, on the market. To widen the scope of this machine even further, **Fi-Cord International** were showing a battery powered, transistorised mixer unit with high and low impedance outputs.

Of the foreign machines mention should be made of the **Philips EL3548**, unveiled here at the very competitive price of 39 gns. (although by this time we should perhaps regard Philips as a naturalised British member of the tape-recording fraternity). A double dose was possible by visiting **Peto Scott**, where a comprehensive range of Philips sound studio equipment was exhibited, including the EL3566 transportable (*sic*) tape recorder as used by the BBC and the EL3624 Console record player based on a BBC design.

Telefunken were showing their existing range and included the *Magnetophon* 300, an 8lb battery-mains model with several novel features. Among these a one-thumb operation, leaving the hand free for microphone; very stable tape drive mechanism, allowing the machine to be swung without noticeable speed variation, and a profile said to be the slimmest on the market. Price: 59 gns., including microphone. The styling was a distinct break from the Continental look.

It was perhaps the old-fashioned appearance of buff and gold and fluted plastic that drew us to the **Stuzzi Tricorder**, but there were other interesting things to see such as the *Disc-Corder* (someone should have warned the firm that **DISCORDER** is an unfortunate way of displaying the title!)—a battery operated portable machine with all three facilities: tape recorder, radio receiver and recorder, and turnover to make it into a record player. Other machines on display featured the radio addition which has become a **Stuzzi** speciality.

MICROPHONES

Microphones were abundant with new or improved models from almost every maker. **STC** had no less than four additions to their established range, including the remarkably low priced 4114. This is an omni-directional moving-coil microphone of 200 Ω impedance selling at £3 13s. 6d. There were also the 4113 with breath noise reduction a special feature, the 4118 of lightweight tubular design, and the close-talking ribbon-type for public address applications, type 4115.

In the **Grampian** range the well-proven DP4 was surrounded by GR1 and GR2 ribbon microphones and a complete range of accessories, including booms and the bird fancier's secret weapon, the parabolic reflector.

Beyer microphones were shown and demonstrated by **Fi-Cord**, including two new models. The M69 is a 200 Ω moving coil microphone with good front-to-back discrimination at all frequencies, a cardioid pattern and 50—16,000c/s frequency response. The M88 is a studio type with a wider frequency response and a greater useful signal output, also at 200 Ω impedance.

Lustraphone showed for the first time the *Radio-Mic*. Since its approval by the G.P.O. this combined microphone-transmitter has been in great demand. The designer informs us that the problem of "body noise" and clothes rustle has been virtually eliminated. It has been developed in combination with several receivers for cableless operation and should be a boon to our modern, highly mobile "pop" performers.

On the **Reslosound** stand there were two additions to the already wide range. One, a pencil dynamic-type PD, has a miniature dynamic insert in a lightweight, tapered housing, and the other is an even smaller version, the MDP.

A.K.G. went to town with a vocalist and small orchestra to show off the *Echo Microphone* DX11. This has a built-in reverberation element, a transistorised amplifier, control unit and battery—total weight 1lb. Other new models were the dynamic cardioid microphone with integral windshield and the condenser microphone C12A, which has a pre-amplifier circuit based on a **Nuvistor** in place of the valve design previously employed.

S. G. Brown displayed a device called the *Personal Auditorium* consisting of a two-channel mixing unit with user controls applied to the famous *Diplomat* ceramic transducers. The listener is enabled by judicious adjustment to "position" himself aurally. Highly effective, and as attractive as the usual **Brown** products, in a zipped case.

RECORD PLAYERS

Record playing units continue to improve. The principal innovations are better motors and pick-up arms with some very original features. **Garrard** were exhibiting an improved version of the popular AT6 unit, calling it the 3000—we shall hear much more of this deck. There was also a battery operated version of the *Autaslim* with a new drive motor taking less current than a flash-lamp.

Goldring displayed a pick-up arm which could be balanced in all planes no matter what cartridge was fitted. This firm also showed the wide range of replacement cartridges, attractively packaged as usual, and three transcription units of high quality.

The well-known name of **Thorens** was adequately represented by a new model, the *Masterpiece* transcription record changer unit. It

handles the records individually—which is perhaps the answer to the purist's criticism of the auto-changer.

Among the cartridges on show were the new ADC-3 universal stereo moving magnet cartridge from **Audio Dynamics Corporation**, which adapts to most tone arms; the **Sonotone 9TA** high compliance dual stylus ceramic unit; and, it almost goes without saying, both the **Shure Dynetic** Cartridge and a very fine **Decca** contribution to hi-fi listening in the Mark III pick-up head with elliptical diamond.

Ortofon also had the elliptical stylus with their stereo SPU/GT cartridge and the range of fine arms by this company included type RMG212, a shortened version of the 309. This was fitted with the Ortofon *Hi-jack*, a spring-loaded friction system which gives air-cushioned lowering of the manual pick-up arm and a positive vertical lift. The lowering speed can be adjusted by a thumb-screw. The simplicity of this device and its single-hole fixing should make it a temptation to the audiophile who is aware of his own clumsiness.

MIXERS

Mixers were well to the fore not only from the regular firms but also from the Truvox, Gramplan and a newcomer to the Fair, **Elcom**, of Northampton, with units which included a ten-channel mono-stereo mixer available in either table-top or twin pedestal desk style. Principal feature here was an electronic fader system, said to be a great improvement on resistive types.

TAPE

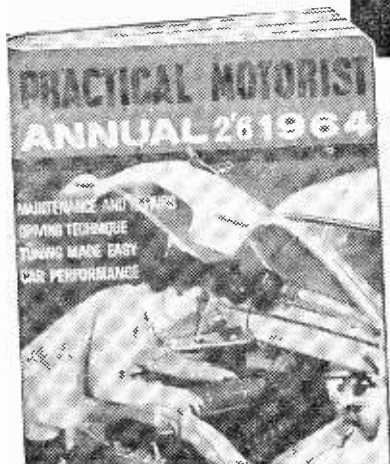
Tape, quite naturally, was well to the fore. In addition to their display of various tapes **M.S.S.** offered a film showing the production of tape from raw oxide to deck. **Zonal** tapes had several new specialities, including coloured leader and timing tapes, splicing tape and metallic foil "autostop" tape, in 100ft. lengths. **B.A.S.F.**, as usual, had a novel demonstration. Pre-recorded talks on "Historical Interest", "Sound Effects", "Slide Synchronisation" and other matters of interest to audio enthusiasts. The subject is selected by the listener and he could then take a copy tape, free of charge. **Kodak**, too, had a fine display. The new, high-quality $\frac{1}{4}$ in. tape, in four types to suit both amateur and professional, was very colourfully displayed.

As for the other bits and pieces essential for the audio enthusiast many could be found on the **Metrosound** stand, and a fine range of plugs, sockets, jacks, etc., were shown by **Ferroglyph** under the *Rendar* trademark. It was perhaps unfortunate that neither of these companies had a catalogue available when the Fair opened.

This tour around has not included such well-known names as **Luxor**, **Loewe-Opta**, **Celestion**, **Revox**, **Rogers**, **Tandberg**, **Tannoy** and **Vortexion**. Space prevents a detailed discussion—and one can only say thank you to the *Audio Fair* organisers who were able to solve most of their space problems and present such a comprehensive exhibition. ■

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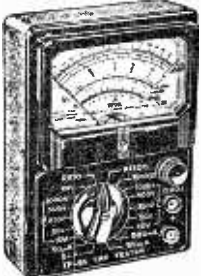
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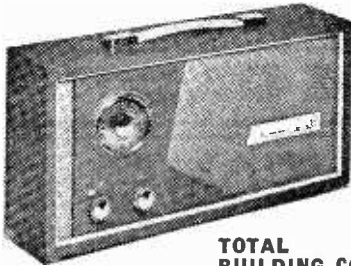
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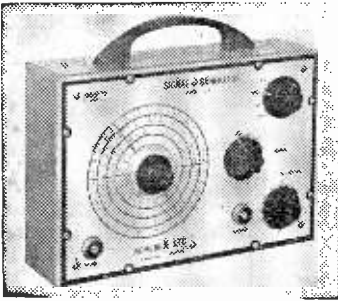
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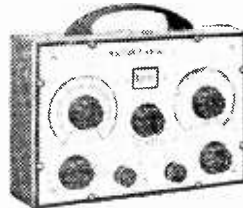
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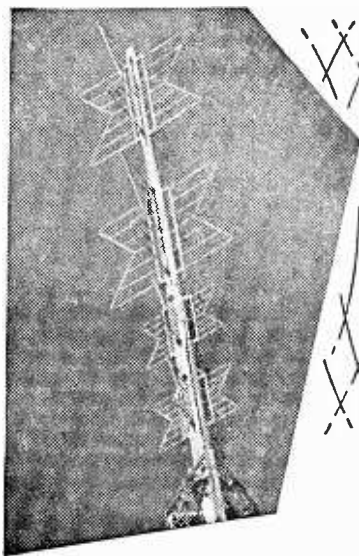
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On Your Wavelength

By THERMION

Transmitting licences are also granted for certain other purposes such as private mobile radio telephones, model control and radio microphones. There is no examination in such cases but when applying for a licence the intending user must satisfy the authorities that he has a genuine need for the facilities requested and only G.P.O.-type approved equipment is permitted to be used.

No, upon reflection I don't think many of us really want "freedom" on the radio waves. The prevailing congestion on many bands is fair warning of the wonderful chaos that would certainly ensue if existing restrictions were relaxed.

AT the risk of boring some of my readers I must pursue further the theme of licences and all that into which I plunged last month. So, if you are still with me, let us now have a look at the transmitting side of the business. The position is that *all* forms of wireless transmission are strictly controlled by the G.P.O. and can only be performed by properly licensed operators. It is an erroneous belief (apparently held by some) that transmission below a certain power can be made by unlicensed persons. The plea that "it's only a small one" just won't wash.

Those who are really keen on communications will get down to studying for the Radio Amateurs' Examination and leave the moaning to their weaker-willed brethren. The Amateur Radio Licence is, in fact, a qualification that one can take pride in possessing, since it is only issued to those who have passed the R.A.E. or who have some equivalent technical qualification. Quite understandably licensed hams are jealous of their rights and have no sympathy for pirate operators whose equipment is confiscated when they are caught.

Transmitters Galore

The large amount of transmitting equipment readily obtainable on the "surplus" market is undoubtedly the root cause of increased pirate activity and also for the clamour that has arisen from certain disgruntled individuals who seek relaxation of the licensing regulations.

The strange thing is that the authorities have never insisted on a warning being given to all would-be purchasers of transmitting equipment. This would be effective only to a degree but it would at least ensure that the purchaser was aware of the legal position; for I am sure that some unwittingly become "pirates" through ignorance of the law.

North Sea Pirate

Having just written this admonitory piece for the benefit (I hope) of the amateur fraternity I have been somewhat chastened by the news that a pirate broadcasting station is being operated by a commercial concern from a ship anchored just outside the three-mile limit off Felixstowe Bay. Really, we expect a better example from the professionals!

According to the G.P.O. this station has been interfering with local ship-to-shore radio services, but as it is moored outside territorial waters no action can be taken. The final outcome of this interesting situation involving international law is anyone's guess. It will anyhow be a decision of some importance, since there are ominous hints that other ships are being fitted out as broadcasting stations with the intention that they also should take up off-shore positions along the east coast.

I say a plague on these maritime juke boxes! The medium wave band is already seriously overpopulated with legitimate broadcasters without these interlopers with their gratuitous "service" of commercials interspersed with pop records.

Should this sort of activity be declared "legal" and the programme fare served up prove acceptable to a large mass of the listening public, I fear this will be prejudicial to the BBC's hopes of an additional 5s. on the sound licence to finance the proposed extension of broadcasting hours. And, of course, goodbye to any early prospect of a stereophonic broadcasting service.

A final comment on this subject: what a pity the Postmaster-General is unable to devise a system to catch these mean or thoughtless listeners and viewers who avoid paying for their entertainment. It is estimated that there are three million of these pirates and this represents a loss in revenue of £12m. per year!

mechanical repairs to TAPE RECORDERS

BY R. J. BARRETT

THE purpose of this article is to assist the owner of a tape recorder to make simple mechanical adjustments and repairs to his machine, thus keeping it in good working order. It does not propose to deal with complex electrical faults, which obviously need the attention of a skilled service engineer, but a number of mechanical faults can be cured with a few tools, providing the following instructions are carefully followed.

It should be appreciated that a tape recorder is a somewhat complicated device, mechanically and electrically, and care should be exercised in all adjustments that are made.

HOW A TAPE RECORDER WORKS

A brief description of how a tape recorder works may be of interest to some readers, and perhaps help to clear up one or two points which the normal Instruction Manual issued with the machine may not include.

The recording tape is covered with a magnetic material (iron oxide) which is capable of being magnetised by a varying current in the record head. The tape is drawn at a constant speed across the surface of the record head and the magnetic field in the head is varied by means of a high gain amplifier preceded by the microphone. A high frequency alternating current, considerably higher than the highest audio frequency, is also fed to the record head: the purpose of this is to provide bias on the tape in order to improve the recording characteristics of the tape.

In order to play back the recording, the tape is drawn across the playback head at the same speed as that at which the recording was made (in most machines the same head is used for record and playback). The magnetised surface of the tape induces a varying current in the playback head, which in turn is amplified and finally passed to the loudspeaker.

Erasing a recording from the tape is effected by superimposing an alternating magnetic field on to it from the erase head, this latter head generally being positioned by the side of the record/playback head. The erase head is normally in operation when the instrument is switched to record, thereby automatically wiping the tape clean before the new recording is superimposed upon the tape.

Mixing is accomplished by merely turning off the erase head. A separate switch is normally provided for this purpose, marked "Mixer" or "Erase off".

The tape is only capable of being magnetised on one side, but in a twin track machine half the

width of the tape is used initially, after which the tape may be turned over, and a recording made on the remaining half of the same side of the tape. Many instruments are four track tape recorders. In this case only a quarter of the width of the tape is used at any one time. On such instruments very careful alignment of record and erase heads is essential, otherwise recordings will become superimposed on the wrong tracks or wanted recordings may be erased.

For recordings of music it is advisable that the faster tape speeds be used, as some loss of quality will result on the slowest speed, although this is usually quite adequate for voice recordings.

REMOVING THE TOP COVER

Access to the tape deck itself may be obtained in the majority of cases by removal of the top cover. In order to do this, control knobs and switch levers must first be removed. These are normally held in place by small grub screws, but if careful inspection does not reveal a screw, they are probably of the push-on type held in place by a spring clip. This type of knob should be grasped firmly and pulled straight off, care being taken to retain the spring clip which may fall out as the knob is removed.

It is a good plan to place all small parts such as knobs, screws etc., in the removable lid of the instrument, or they should be kept in a small box, as they can be easily mislaid. Any fixing screws should now be removed and then the top cover can be gently eased off. It may be necessary to depress keys on the instrument in order to free the cover, and care should be exercised here, because some of the plastic mouldings are quite fragile and easily broken.

CLEANING THE RECORD/PLAYBACK HEAD AND ERASE HEAD

The heads should be frequently examined to ensure that no particles of oxide from the tape have adhered to them. This will show up as a thick brown deposit on the surface of the heads, and will result in recordings being considerably reduced in volume.

The heads should be carefully rubbed with a match-stick moistened in methylated spirits, or a piece of string first dipped in methylated spirits can be drawn over the surface of the heads. At the same time the tape guides, shown in Fig. 1, should be examined for oxide particles as these can cause friction as the tape passes over them, giving rise to uneven tape speed and squeaking noises. The guides should be cleaned in the same manner as

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2½	7000	80	8/-	4	7000	35	11/-	5	7000	3	8/8	6½	7000	3	11/-
3½	7000	35	8/8					5	7000	5	8/8	6½	8500	3	11/6
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Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price
5 x 3	8000	3	7/8	5 x 3	9000	25	11/-	8 x 2½	8500	5	9/8	8 x 2½	8500	5	9/8
5 x 3	7000	3	8/-	6 x 4	6000	3	8/8	8 x 2½	9500	3	10/8	8 x 2½	9500	3	10/-
5 x 3	9000	3	8/8	6 x 4	7000	3	9/-	7 x 3½	9500	3	10/8	8 x 2½	9500	4	10/-
5 x 3	9000	25	9/6	6 x 4	8500	3	9/8	8 x 2½	8000	3	9/8	8 x 2½	9000	5	10/-
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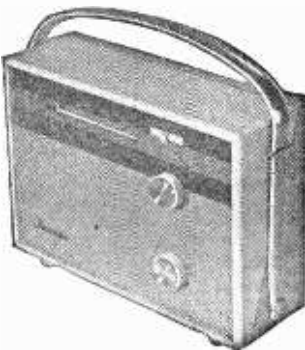
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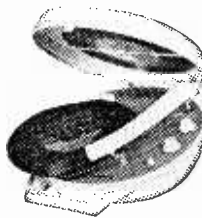
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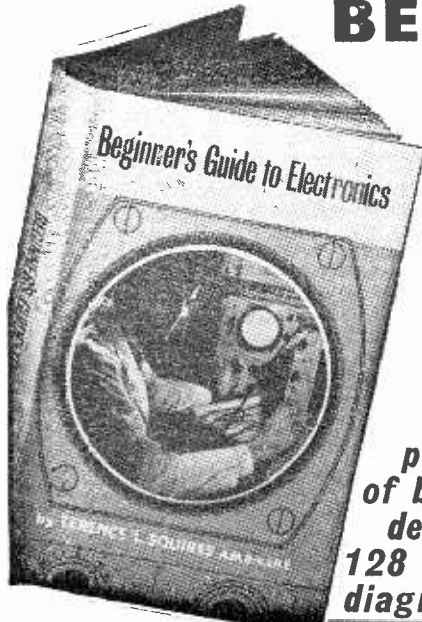
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the heads; probably the string method will be found the more convenient.

The tape is held on to the surface of the record/playback head in many instances by a pressure pad of felt. This pad only moves into position when the machine is switched to record or playback and is disengaged in the rewind position. The felt should be examined for oxide particles, and

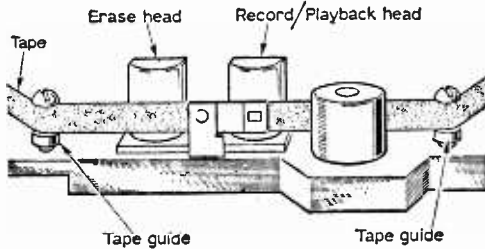


Fig. 1: The arrangement of erase and record/playback heads on a domestic recorder.

this can be cleaned with a rag moistened in methylated spirits. If it has become hardened, the surface of the pad can be roughened with a small file or piece of sandpaper.

WARNING

A word of warning is appropriate at this point. On no account should any cleaning fluid other than methylated spirits be used for these operations. Cleaners which contain carbon tetrachloride act as solvents to the plastics that are used in the construction of the heads and permanent damage will result if these are used.

DRIVE BELTS

It is often found that a tape recorder performs quite well when recording and playing, but slows down when in the rewind position. This can be due in many cases to faulty drive belts on the machine. If your machine is fitted with belts, examine them closely and see if they have become hard.

In bad cases quite a large kink will appear in the belt generally where it has been round a small pulley. This type of belt will often harden like this when the machine is stored in a cold place, and sometimes a complete cure can be effected by running the machine in the fast rewind position for about half an hour. This softens the belt and returns it to the original shape and size. If this does not cure the trouble then heat will have to be applied to the belt in some other way.

Before removing the belt, it is worth trying the effect of blowing warm air from a hair dryer upon it. This often does the trick, but if it still appears slack and slips, it will have to come off.

Some belts come off quite easily. Inspection will show that they can be merely eased off the pulleys. But the main drive belt often appears to be covered by a mass of switchgear and seems almost inaccessible. A point to remember is that the manufacturer got it in there in the first place, and so it shouldn't be too difficult to get out. In many cases the removal of three or four screws supporting the bracket on which the record head and its control mechanism are situated will enable the bracket to be

lifted clear without unsoldering any wires, and the belt can then be removed.

Any grease on the belt should be wiped off with a clean dry cloth, and it should be immersed in very hot water for a few moments. In most circumstances the belt will rapidly regain its natural shape and softness. It should be wiped perfectly dry before refitting.

If all these methods have proved unsuccessful, then the belt will require replacement. Many manufacturers are providing belts of greater elasticity to overcome the stretching and hardening problems, and it is worth enquiring if one of these is available for your machine.

One or two machines use metal spring belts and these are joined by means of a small plastic insert as shown in Fig. 2. Should they break they can be rejoined by giving both ends of the belt a slight anticlockwise twist, placing the plastic joining piece in each end, and allowing the spring to screw itself on to the joining piece.

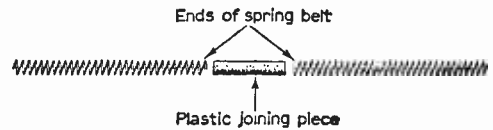


Fig. 2: Spring belts used on some machines are joined by a plastic insert.

IDLER WHEELS AND PULLEYS

An idler wheel is used on many models to transmit power from the motor pulley to the main fly-wheel. Oil or grease on a rubber idler wheel can cause incorrect running speeds. Quite often these idler wheels can be cleaned, without removing them from the machine, with a piece of clean rag pressed against the driving surface whilst the wheel is rotated by hand.

If the machine runs at a different speed than that indicated by the speed control knob, it is possible that the stepped pulley normally fitted to the motor spindle has slipped out of position. These are frequently held in position by two grub screws, and both should be securely tightened if it is necessary to move the pulley along the motor spindle.

CLUTCHES

To prevent the spools from free-wheeling and to ensure a smooth take up on the rewind spool, clutches are employed, and these usually take the form of rotating felt rings attached to the spool holders, which engage with stationary plastic or metal surfaces.

Any jerkiness in the take-up spool can generally be attributed to clutch trouble, and they should be carefully dismantled and the clutch surfaces examined. The clutch felt should be clean and soft, and its surface may be slightly roughened with fine sandpaper if necessary. The surfaces on which the felts rotate should be clean and dry and free of oil. No attempt should be made to score or roughen these surfaces, as the clutch must have a certain amount of slip to work correctly.

Clutch assemblies take many forms, and to describe all types would be impossible. Most of them can be dismantled, after careful inspection, from

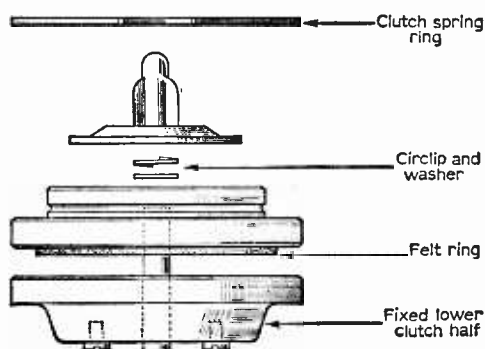


Fig. 3: A typical clutch assembly.

the top of the tape deck. They are usually held together by means of circlips and spring retaining rings, both of which can be prised off with a small screwdriver or a pair of long-nosed pliers. Fig. 3 shows a typical clutch assembly, as is used on very many machines. Care should always be taken to re-assemble the clutch in the correct order. A diagram should be made when the clutch is dismantled or the parts may be laid down in the correct order for re-assembly.

FUSES

Should the tape recorder not function at all when switched on, the fuses should not be overlooked. Generally these are fitted at the rear of the machine, but some manufacturers fit them

underneath the top cover. The point about fuses is that if one has blown there is generally a reason for it, and an electrical fault beyond the scope of this article should be suspected. If you do not feel competent to carry out the appropriate tests and checks of the circuitry, you should consult your local dealer.

However, if you wish to try a new fuse, one of the correct type and rating should be used. Fuses are often of the anti-surge type designed to stand momentary overload. Care should be taken to see that this type is fitted should it be required.

MAGIC-EYE INDICATOR

Most types of tape recorders are fitted with a magic eye to assist the operator to record at the correct level. This occasionally becomes knocked off centre, and can easily be returned to the correct position, merely by sliding it along in the spring clip, or adjusting the small bracket which supports it.

GENERAL REMARKS

Tape recorders should be stored in a warm dry place. Cold and damp are both enemies to the instrument. It should be kept clean from oxide, particularly the area around the record head, a soft brush being useful for this purpose. The microphone should be kept in a box, and tapes should be stored in a cool place to avoid print-through, which produces echos when played back. Care of your instrument will repay you both in the performance obtained and in prolonging the life of the recorder. ■

PERSPEX and the constructor

—continued from page 151

hold too near a flame or the sheet may blister.)

To maintain equal bends on all corners the strip may be formed around a piece of wood dowel or a broom handle. When bending be sure that you do not attempt to force when the strip starts to cool and stiffen. If this starts to happen hold the strip into the angle so far obtained and heat again before continuing. There is quite a degree of latitude in the amount of heat required for bending, but over-heating tends to form streakiness in the texture of the sheet.

Surface scratches, filing marks and the like can be readily removed with emery and metal polish and a high sheen may be obtained. Hinges and catches for Perspex boxes made to hold components may be obtained from handyman's stores and are known as "cigar box fittings".

Other Applications and Suggestions

Having the fortune to have the use of a lathe, the writer found it simple to turn up various knobs and tuning dials. It is a little more difficult to cut out a circle by hand but by scribing deep with a pair of sharp engineering dividers a reasonable disc can be produced. A cursor line can be ruled on the back face of a dial and the line filled in with drawing ink or paint. The disc can be screwed or stuck on to the back of a small knob which contains a

grubscrew. Some rich effects can be obtained by gluing pearly plastic furniture knobs on to dials.

Pilot light covers and the like can be moulded by the use of a stiff alloy plate holed to the size required. A timber dolly is made by rounding off the end of a piece of square section batten to form half a sphere (Fig. 4). This has to fit into the hole in the plate and allow sufficient room for the thickness of the Perspex sheet (which should be not more than one-sixteenth of an inch). The Perspex is heated until soft, placed over the hole and pressed through by downward pressure on the dolly. When sufficiently cool remove the dolly, cut out the bubble and clean up with a file. Warming the metal die is advised to maintain the heat during the actual moulding.

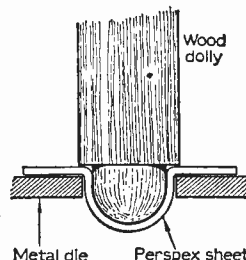


Fig. 4: Pressing out a pilot light cover.

Perhaps a word of advice might be offered here for those inexperienced in cutting Perspex. Use a fairly fine toothed saw and hold the sheet firmly, preferably in a vice with cardboard inserts to protect from marking. Saw gently with a raking cut. If the blade jams it usually means a split in the sheet. ■

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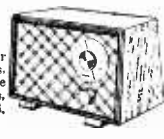
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3.	3/11	4/1	5/2	5/8	6/8	7/1	7/6	9/6	10/1
3.	4/8	5/4	6/2	7/1	7/10	8/8	9/5	12/-	12/10
5.	5/2	6/2	7/8	8/3	9/4	10/4	11/2	14/6	15/6
6.	5/9	7/-	8.8	9/8	10/9	12/-	12/2	17/-	18/3
7.	6/5	7/10	9/4	10/9	12/8	13/8	15/1	19/6	20/11
8.	7/-	8/8	10/4	12/-	13/8	15/4	17/-	22/-	23/8
9.	7/8	9/6	11/5	13/3	15/4	17/-	18/10	24/6	26/4
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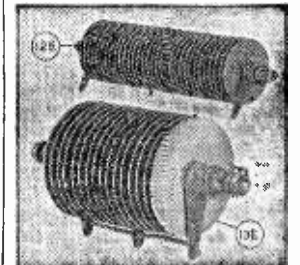
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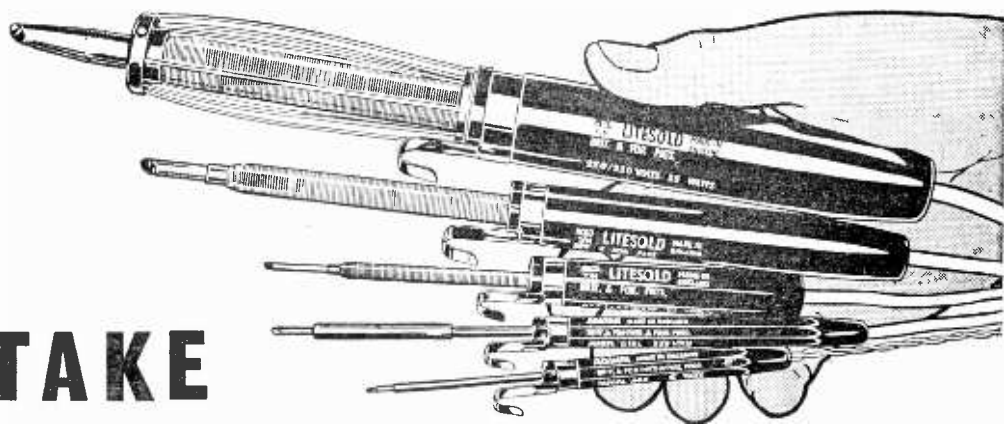
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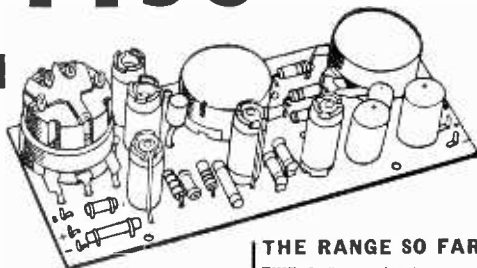
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BLOCK LETTERS

P.W.6

CLUB

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, 188 Gunnersbury Avenue, Acton, London W.3.

Preparations for the Club's participation in National Field Day are to be discussed at the next meeting on 12th May.

BRADFORD RADIO SOCIETY

Hon. Sec.: E. G. Barker, G3070, 63 Woodcot Avenue, Baildon, Shipley, Yorkshire.

"Simple Transmitters" was the title of a lecture given by D. M. Pratt at a meeting of this Society on April 7th. At the end of the month, a number of members made a visit to the Emley Moor television station of the I.T.A.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, "Field House," 19 Kingsley Road, Gt. Boughton, Chester, Cheshire.

The HRO receiver was the subject of the talk given by G3JAZ on April 14th. At the next meeting—April 21st—Norman Kendricks (G3CSG) judged the construction contest.

G3EWZ's lecture entitled "Getting Going on '2'" ended the month's activities on the 28th.

FLINTSHIRE RADIO SOCIETY

Hon. Sec.: A. Antley, "Fairholme," Fairfield Avenue, Rhyl, Flintshire.

Members who attended the meeting on April 14th, took part in a discussion on "Standardisation in Amateur Radio." Two weeks later, members enjoyed the interesting demonstration of amateur television given by GW3JGA/T and GW3PCZ/T.

MELTON MOWBRAY AMATEUR RADIO SOCIETY

Hon. Sec.: D. W. Lilley, G3DFD, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicestershire.

The evening's activities for 23rd April were provided by a visit of a group of members to the shack of G4MK.

MID-WARWICKSHIRE AMATEUR RADIO SOCIETY

Hon. Sec.: T. Inkester, 13 Dormer Place, Leamington Spa, Warwickshire.

At the April meeting of this Society members heard a talk given by Mr. John Royce (G3PZA); his subject being 'coils.'

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax.

The approaching summer months have caused increased activity among members busy with the preparation of JA stations. Although not quite a summer month, April saw its share of activity with the Society's Annual General Meeting, held on the 15th. Later in the same month, members heard a lecture on "Medium Wave DXing" by D. Howell.

PADDINGTON AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: G3JEA, Beauchamp Lodge, 2 Warwick Crescent, London, W.2.

Prospective members are welcomed to meetings of this Society which are held every Wednesday evening, beginning at 7.30 p.m. Among a variety of other events, meetings of this Society include more instruction for beginners, and members under the age of 18 years will not be required to pay club fees.

Activities for April included talks by G8PL and G3MHQ on "Certificates and Awards" and "Detection and Suppression of Spurious Harmonics" respectively. April meetings also included film shows and a talk presented by G3AWS.

PLYMOUTH RADIO CLUB

Hon. Sec.: R. Hooper, G3SCW, 2 Chestnut Road, Peverell, Plymouth, Devon.

Judging for the "G5ZT" trophy was the main event at the meeting for April 7th. A fortnight later, the Club met to hear a talk given by G3BRJ on "Safety in the Shack."

On May 5th, the Annual General Meeting of the Club was held.

RADIO CLUB OF SCOTLAND

Hon. Sec.: A. Barnes, GM3LTB, 7 South Park Terrace, Glasgow W.2.

This society allocates to each day of the week, one particular topic to form the basis of each meeting, and anyone who is interested



in these subjects can be sure to be welcomed any evening. The topics dealt with are as follows: Monday, tape recording; Tuesday, hi-fi/stereo; Wednesday, television; Thursday, radio; Friday, radio amateurs; Saturday, radio control and Sunday, radio astronomy.

READING AMATEUR RADIO CLUB

Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven," 9 Holybrook Road, Reading, Berkshire.

The centre of interest at the meeting for April 25th was the short wave listener and SWL members of the Club had the chance of discussing their subject and equipment.

REIGATE AMATEUR TRANSMITTING SOCIETY

Hon. Sec.: F. D. Thom, G3NKT, 12 Willow Road, Redhill, Surrey.

On April 18th, this Society met for the first time in its new headquarters, The George and Dragon in Cromwell Road, Redhill. At this meeting, members were entertained by a selection of films supplied by the library of the Electrical Development Association.

SCARBOROUGH AMATEUR RADIO SOCIETY

Hon. Sec.: P. B. Briscoombe, G8KU, "Roseacre," Irton, Scarborough, Yorkshire.

G3PEJ's talk on the HRO receiver on April 9th was followed a week later by one entitled "Light," given by G5VO.

At the meeting on the 23rd of the month, members began planning in preparation for National Field Day. Activities for April ended with visits to local amateur stations on the 30th.

SOUTH YORKSHIRE AMATEUR RADIO SOCIETY

Hon. Sec.: J. M. Heath, 235 Thorne Road, Wreatley Hills, Doncaster, Yorkshire.

Much of the Society's recent activity has been devoted to lectures and demonstrations for the benefit of members preparing to take the next R.A.E.

SPEN VALLEY AMATEUR RADIO SOCIETY

Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Leeds.

Members of this Society enjoyed a month of much activity during April, beginning with a visit to the Leeds-Bradford airport on the 9th. On the following Wednesday, a number of members were guests at a meeting of the Leeds Radio Club.

On the 16th, the club met to hear an interesting lecture entitled "Telstar", delivered by Mr. H. Tomlinson. On the 25th the Society's Annual Dinner was held and on the 30th Mr. T. H. Withers provided the last event for the month with this talk on "Amateur Radio Gear."

STOCKPORT RADIO SOCIETY

Hon. Sec.: R. T. Diamond, G3SFN, 102 Chatsworth Road, Hazel Grove, Cheshire.

Under the leadership of Bert Smith (G3AYT) arrangements for V.H.F. Field Day were discussed at the meeting on 8th April. Members who attended the next meeting, two weeks later, heard a lecture on first aid, when special attention was given to the treatment of electric shock.

STRATFORD-UPON-AVON AND DISTRICT RADIO CLUB

Hon. Sec.: H. W. Gannicott, 17 Highfield Road, Stratford-upon-Avon, Warwickshire.

During the commemorative Festival begun in April to mark the 400th Anniversary of the birth of William Shakespeare, this Club participated by operating a demonstration station with the call sign G82WS which was specially authorised by the Postmaster General. Operating on the 20, 40 and 80m. bands, the station exchanged greetings with radio amateurs the world over. A unique QSL card was issued for the occasion.

THANET RADIO SOCIETY

Hon. Sec.: J. Barnes, G3BKT, 18 Grange Road, Ramsgate, Kent.

This Society is to hold its fifth Mobile Rally on Sunday, May 10th. A cliff-top site has been chosen at Pegwell Bay, Ramsgate, and talk-in stations will be G3DOE on 160m, and G3BAC on 2m.

WEST KENT AMATEUR RADIO SOCIETY

R. Trevitt, 28 Dales Avenue, Tunbridge Wells, Kent.

The Annual General Meeting of this Society was held on April 10th when past activities were reviewed and future events discussed, and club officials for the next twelve months were elected.

T rade N ews

rade ews

Construction Board

A NEW product from R. & E. Lamb of London will be of interest to anyone who read the article in the May issue of P.W., "Unit Construction Boards". Their product takes the form of a laminated construction board perforated by 200 holes. The board, known as Eyelet-Board, is approximately $\frac{1}{8}$ in. thick and measures $4\frac{1}{2}$ in. x $2\frac{1}{2}$ in. It can be supplied with eyelets for inserting into the board to provide electrical contact with components and connecting wires which are soldered to them. The eyelets may be fitted in any of the 200 holes, so that component layout may be as straightforward as desired and, once in place, the eyelets cannot come out.

The cost of a perforated board is 2s., and packets of 40 eyelets cost 6d. each. Plain board for insulating or backing material is also available at 9d. a sheet. R. & E. Lamb, 17 Queens Road, Levistonstone, London, E.11.

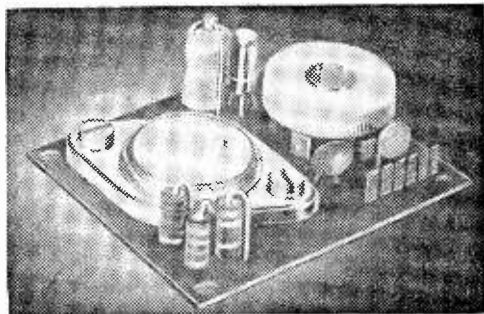
Valve Voltmeter Kit

NEW from Heathkit is the model IM-13U valve voltmeter available either as a kit or ready assembled. This mains operated instrument employs a two-valve circuit built on a printed board and even those not experienced in construction should find building the IM-13U possible with the aid of the instruction manual which accompanies each kit.

A function switch on the front panel of the instrument selects a.c. volts (r.m.s.), d.c. volts, resistance or decibels and another main switch selects the range. There are seven volts ranges from 0—1.5 to 0—1,500 and seven ohms ranges.

High quality components are used throughout with 1% precision resistors in the multiplier circuits and a 6 in. $200\mu\text{A}$ meter movement. A 1.5V battery for the ohmmeter section of the circuit is included in the cost of the kit, as are the test leads and prods.

This new Heathkit model is made by Daystrom Limited, Gloucester, and is sold for £18 18s.



Sinclair's new miniature amplifier

Miniature Amplifier

A COMPANION unit to the Sinclair "Micro-Six" receiver has been announced (Trade News, March issue) which will amplify the output of this receiver (or of any other suitable source) for feeding into any standard 25 to 35Ω loudspeaker.

The TR.750—as the amplifier is known—is available either ready-assembled or in kit form. The two-transistor circuit is built on to a printed circuit board and incorporates its own volume control and on/off switch.

When assembled, the TR.750 measures 2 in. x $1\frac{1}{2}$ in. x $\frac{1}{4}$ in. and provides an undistorted output of 750mW. A frequency response of 30 to 20,000c/s is claimed for its transformerless output stage.

The TR.750 kit—price 39s. 6d.—is available from Sinclair Radionics Limited, 69 Histon Road, Cambridge.



A stereo tape recorder made by Celsa Electric Co. Ltd.

Stereo Tape Recorder

THE TG12A stereo tape recorder is new from the Dual Division of Celsa Electric Company Limited, who exhibited this model recently at their stand at the Audio Festival and Fair held in London.

The recorder operates at three speeds and will record on four tracks, which allows the facility of superimposition. For stereo, the twin loudspeaker

continued on page 182

ELECTRONICS

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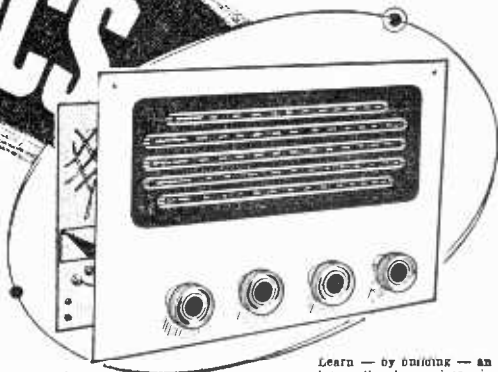
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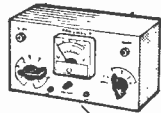
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- A.M.Brit.I.R.E. EXAMINATION
- RADIO AMATEURS' LICENCE EXAMINATION.
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OTHER COURSES

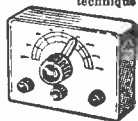
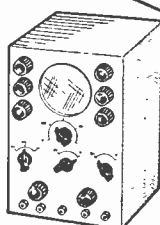
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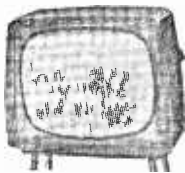
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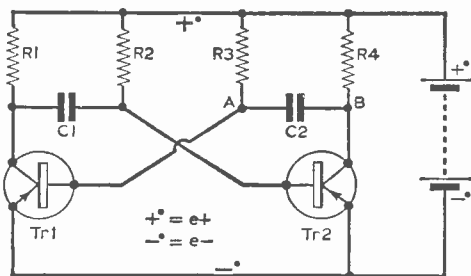
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LETTERS TO THE EDITOR

A NEW WAY OF THINKING

SIR,—For some while I have been training myself to misread English. When I see the word "positive" I say "e-negative"; likewise e-positive, e-volts, e-current and e-charge. In short, I have inverted the incorrect + and - signs so that my reading corresponds with the real direction of electron pressures and fluxions. During the experimental period I have lived in "cuckoo land"; now I have got used to it. It was well worth while. It makes things clear and simple. For example, consider the story of the multivibrator as follows:

The zinc pole of the cell charges the power line e+ (see diagram). Through R2 e-current (eI)



The explanatory diagram for Mr. Hilton's letter.

flows to the base of Tr2, which is therefore conducting and is bottomed. Through R4, collector eI is flowing, and the recent drop of eV at point B has emptied C2 of e-charge (eQ). This has dropped the eV at point A and an enhanced eI is flowing down R3 and is replacing the eQ in C2. Because of the low eV at point A (Tr1 base) eI is below cut-off and it is not conducting. Meanwhile C2 is filling up. Finally its eV rises and the flow of base eI into Tr1 is resumed. At once Tr1 conducts. Its collector eV falls sharply; eQ is drawn out of C1. Tr2 at once cuts off. The half-cycle is then complete, to be resumed when eQ returns to C1 via R2.

When read several times, this account will appear simple and clear. The reason for its simplicity and clarity is that it describes what actually happens. Note how the action of a capacitor is described: eQ is drawn out from one side of it and eQ flows in at the other to make good. That is how a capacitor actually works. Some eQ is sucked out; the proton matrix remains; it drags

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.

The Editor does not necessarily agree with the opinions expressed by his correspondents

some eQ back on to the other side. This e-system shows that process clearly. A conventional description would not.

Some day, somehow, a change has to be made. Students' time and effort has to be saved by straightforward thinking. It would be noteworthy if the change began in the pages of PRACTICAL WIRELESS. It would be practical indeed.—FRANK HILTON (Yarmouth, Isle of Wight).

STONE DEAF BUT STILL APPRECIATIVE

SIR,—Although made lightheartedly I would disagree with Mr. Jameson's criticisms—made in a letter in the April issue—of P.W.'s turn to the field of music. I feel that I am eminently suited to speak because there can be few of your readers that are as tone deaf as myself.

Will I ever build a tremolo unit or an electronic organ for my own use? Not I: but I built the metronome published in the February, 1963, issue for a musically minded friend. I have thoroughly enjoyed reading the articles to which Mr. Jameson referred, building them not with aluminium and solder but with pen and paper. What I feel your correspondent forgets is that although the average readers of P.W. have not the time, inclination or finance to build everything that appears in your magazine, it does not mean that pleasure is lost. If it did your magazine would have been readerless long ago.—GEDDES REID (Barton-on-Trent, Staffordshire).

A DEARTH OF INFORMATION

SIR,—Although not an "aspiring Beetle" I do derive great pleasure both from playing an electric guitar and from building radio and electronic equipment. Until the recent spate of "musical" articles in P.W. there has been a singular dearth of information available about the construction of electric guitars and their associated equipment, and with a risk of boring your correspondent, Mr. Jameson, I look forward to more such articles.

However, I agree with his remark that other musical instruments could benefit from the application of electronics. Since it is easy to fit pick-ups to string instruments, I am surprised that nobody has produced an electric piano. However, the construction and effective use of pick-ups for wind instruments is a problem which I believe has not yet been tackled, although if a few P.W.

readers were to put their thinking-caps on we might soon have that electric bagpipe amplifier.—R. WILLIAMSON (Walton-on-Thames, Surrey).

Sir—I would be grateful if any reader could sell or loan me . . .

. . . the March, April and May 1961 issues of P.W.—L. BRADFORD, 17 Seymour Avenue, Morden Park, Surrey.
. . . the circuit or valve line-up of an Eddystone 659.—D. C. THOMAS, 66 Bridge Street, Llandaff, Cardiff, Glamorgan-shire.

. . . the circuit or any information on the R.1355 receiver.—J. J. STEVENSON, 81 Brompton Park, Crumlin Road, Belfast 14.

. . . the issue of P.W. giving modification details of the No. 19 set.—C. RICHARDSON, 27 Cauldwell Lane, Monk-seaton, Whitley Bay, Northumberland.

. . . circuits of the R.1155A and the Pye P.M.121.—V. D. TENNANT, High Park, Stanhoe, King's Lynn, Norfolk.

. . . the circuit and wiring details of the Halli-crafters S.38B short wave receiver.—P. ABRAM, 31 Third Avenue, Fazakerley, Liverpool 9.

. . . the May 1961 issue of P.W.—M. A. MARTIN, "Kentmere", Crag Bank Lane, Carnforth, Lancashire.

. . . any information on the 62B Admiralty receiver, manufactured by Murphy.—A. MCROBERTS, 12 Banner Road, Knightswood, Glasgow W.3.

. . . the April 1958 issue of P.W.—B. HITCHEN, 36 Inkerman Street, Blackburn, Lancashire.

. . . the circuit and any other details of the Kolster Brandes superhet receiver KB 885.—J. SWARBICK, 107 Garstang Road, Preston, Lancashire.

. . . the issues of P.W. from January to April 1963 inclusive, and the June, July, September and October 1963 issues of *Practical Television*.—M. G. ROBINSON, 24 High Park Road, Kew Gardens, Surrey.

. . . the circuit and component values for the type BC-454B receiver.—K. FRANCE, 36 Carteret Road, Luton, Bedfordshire.

. . . a circuit diagram of a Mk. III "A-Z" f.m. tuner unit made by Sound Sales Ltd.—P. R. JOHNSTONE, 36 Upper East Hayes, Bath, Somerset.

. . . the February 1958 issue of P.W.—C. FUNNELL, 43 Theydon Park Road, Theydon Bois, Essex.

. . . circuit diagram or service sheet for the H.M.V. television-radio receiver, model 905.—P. P. SKIVINGTON, 16, Bowood Road, Enfield, Middlesex.

. . . the circuit of the R.206 receiver.—B. ATKINSON, "Brada," Beadwell, Chathill, Northumberland.

TRADE NEWS

—continued from page 178

units may be positioned for best effect. The TG12A has a frequency response of 40 to 20,000c/s.

The Dual Division of *Celsa Electric Company Limited*, *Celsa House, Kelway Place, London, W.14*, are the makers of this new recorder.

A TUBULAR steel mast for aerial erection has been made available recently by John Smith & Co. (London) Ltd. This new mast has been designed for use by radio amateurs and is construc-

ted in two sections; an upper tube section sliding up or down between twin tubes of the lower section.

When fully extended, the top of the mast reaches a height of 30ft. and at the extreme top a spindle is fitted to take either a rotator unit or a pulley. Two sets of three guy lines hold the mast steady on its heavy galvanised steel base plate, and a rope and pulley system is incorporated to raise and lower the upper section.

The price of the mast complete is £25 and the manufacturers are *John Smith & Co. (London) Ltd., Hainault Works, Hainault Road, Chadwell Heath, Romford, Essex.*

OUT NOW!

PRACTICAL HOUSEHOLDER

SPRING ANNUAL 1964



AN UP-TO-THE-MINUTE GUIDE
TO IMPROVEMENTS IN THE HOME

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2/6 from all Newsagents and Bookstalls

BIG DEMAND! HURRY FOR YOURS!

ADVERTISEMENT

Sinclair

NEWS

No. 2

MAY/JUNE 1964

AND NOW AN AMPLIFIER FOR THE MICRO-6

This month, we announce a new design for constructors—the Sinclair TR.750. Basically, it is intended as a companion design to the Micro-6, but whoever builds this amplifier will find it useful for many more applications also. The TR.750 is a micro-miniature instrument with enormous power. It is so small, that you could put it with the Micro-6 into an empty 20-cigarette packet, and have room to spare: yet the TR.750 incorporates its own volume control and on-off switch, and has an undistorted output of three-quarters of a watt. Using the TR.750 with the Micro-6 enables you to have a first-class car radio, a unique two-unit portable or home receiver with loudspeaker. High-fidelity standards are easily obtained. Two TR.750s can be used in stereo. In fact, wherever extreme compactness is required together with power and quality, you will find the Sinclair TR.750 the very job for you.

ago and states, "Not only was I able to build your set straight off, but the initial price was a pound less, and in sensitivity, selectivity and indeed every other way was fantastically better." From *G.J., Nottingham*: "I very much enjoyed the four or five hours' work necessary to complete it (The Micro-6) which was accomplished almost without swearing, unlike most other sets I have made. It was in fact easier to make than many bigger sets and when finished, worked at once. I consider the conception brilliant and am very pleased with it. It has aroused much interest amongst my friends."

As with all letters from which we quote, the originals may always be seen at our offices.

NEVER ANYTHING LIKE IT

Now with longer days to look forward to, the Micro-6 is going to be your constant companion, outdoors as much as in. For unobtrusive, private listening, there has never been anything like it. If you want others to share in its stupendous performance, all you require is our new TR.750 power amplifier with speaker suitably arranged, and you have a first rate car, portable or table radio.

TWO-WAY PROTECTION

Remember, when you buy a Sinclair design, you are fully protected by our unique guarantee whereby should you not be immediately satisfied with your purchase, your money is refunded without question. For those whose building may need some servicing, our own technical service department can quickly put things right for you.

AFTER THE LAUNCHING, THE DELUGE

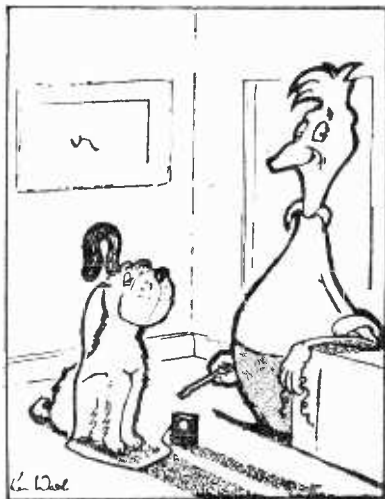
The Micro-6 has met with an even more enthusiastic response from set builders than did our original Slimline, which nevertheless continues to be very popular, particularly with newcomers to transistor building. It will come as no surprise therefore, to constructors who already know what Sinclair stands for, to learn that letters of praise and appreciation are now pouring in daily as more and more builders make and use the smallest radio set in the world. Here's a typical cross-section of what they tell us:

F.W., Luton writes—"Am very pleased with the quite remarkable results obtained."

J.C.F.M., London W.14 says: "The set worked very well indeed and I congratulate you on its performance." Similarly, *D.F. of Monkseaton, Northumberland*, congratulated us on the design and continues, "The performance is quite unbelievable, I have shown it to a number of my friends and they have all been very impressed."

From *Abingdon, Berks., S.H.L.* recalls difficulties he had with a set from another supplier three years

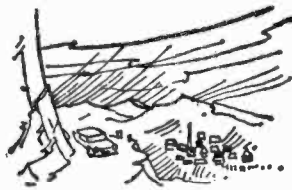
Says
MIKE
FARAD
Sinclair's
special
favourite
customer,
"He buries it
in the garden
if he doesn't
like the
programme!"



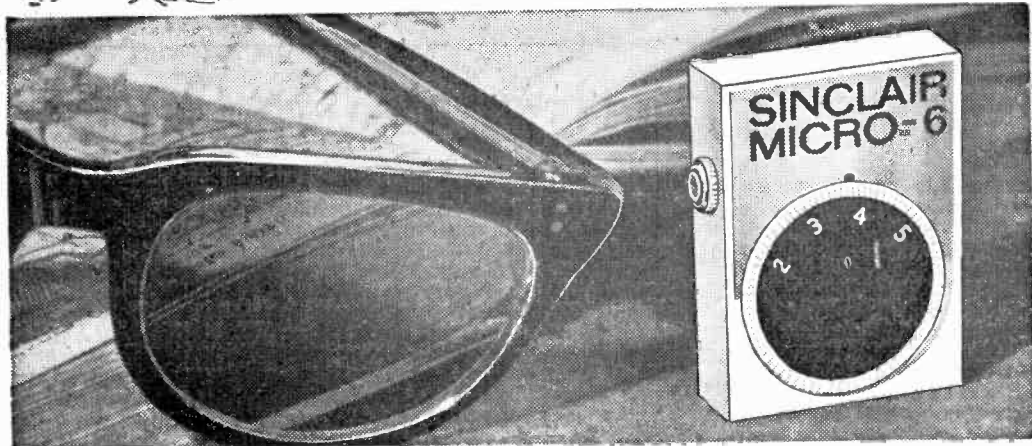
MICRO-6 A SENSATION IN 1964

PARIS ELECTRONIC COMPONENTS SHOW

When exhibited at the 1964 Paris Electronic Components Exhibition, the Micro-6 created an instant sensation amongst all who saw it. Nothing like it had ever been seen or heard in Europe before, and now demand for this amazing receiver is growing rapidly on the Continent too. Later it is expected that the world's smallest radio will be on show at the New York World Fair.



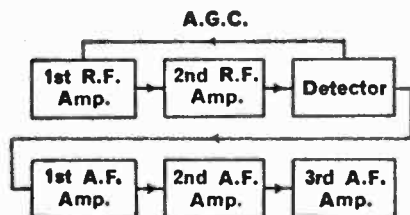
BUILD FOR



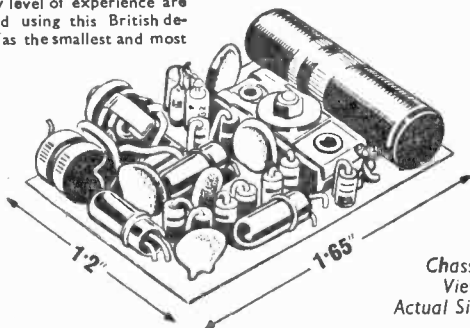
ACTUAL SIZE

THE WORLD'S SMALLEST RADIO

When you have built your Micro-6, you will find it a constant companion everywhere—indoors and out—in car, bus, train—wherever you want to listen. Its power and sensitivity are such that it ensures good reception under the severest listening conditions, yet this amazing receiver measures only $1\frac{1}{8} \times 1\frac{3}{16} \times \frac{1}{16}$ in. and **WEIGHS LESS THAN ONE OUNCE** complete with batteries. Tuning covers the entire medium waveband with band spread over the high frequency end for better separation of Continental stations. You listen with the lightweight high-quality earpiece provided, which switches the set on when plugged in. Now constructors at every level of experience are enthusiastically building and using this British designed set, acclaimed by all as the smallest and most efficient receiver of its kind on earth.



**WEIGHS
LESS THAN AN
OUNCE WITH
CASE AND
BATTERIES!**

Chassis
View-
Actual Size

6-STAGE POWER AND SELECTIVITY

The Micro-6 uses Micro-Alloy Transistors in a completely new circuit as follows:—Two stages of R.F. amplification are followed by an efficient double-diode detector which drives a high-gain 3-stage A.F. amplifier. Powerful A.G.C. applied to the first R.F. stage ensures fade-free reception from the most distant stations tuned in. Everything including ferrite-rod aerial and batteries is contained within the elegant tiny case.

BUILD IT IN A SINGLE EVENING!

The Micro-6 is simplicity itself to build when you follow the meticulously detailed instructions. All parts including MAT transistors, case, lightweight earpiece and instructions come to

59/6

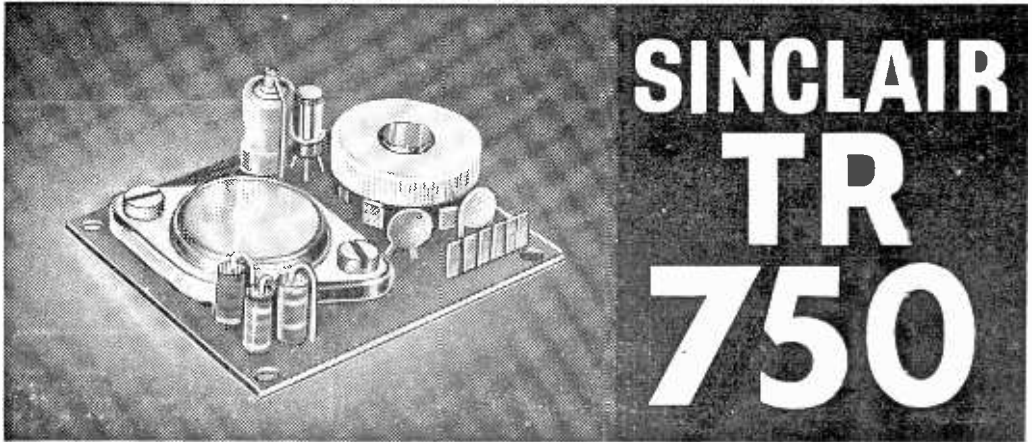
MALLORY MERCURY CELL TYPE ZM312-1/11 EACH.

SINCLAIR MICRO-6

WORLD BEATING BRITISH DESIGNS BY
SINCLAIR RADIONICS LTD., 69 HISTON ROAD, CAMBRIDGE.

TELEPHONE 53965

SUMMER DAYS



SINCLAIR TR 750

ACTUAL SIZE

... AND A NEW SINCLAIR POWER AMPLIFIER TO MATCH THE MICRO-6

This is a high-quality power amplifier contained within extremely compact dimensions ($2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ "), having sufficient output to drive a full-size loudspeaker with more than enough volume for all possible requirements. It includes combined finger-tip operated volume control with on-off switch, and is easily mounted in whichever way is most convenient. Together with the Micro-6, it makes a thoroughly efficient car radio or portable loudspeaker set. Other applications will readily suggest themselves to the keen constructor, ranging from record players, hi-fi installations and intercom systems to baby alarms.

Performance characteristics are brilliant— $\frac{1}{2}$ watt transformerless output with frequency response within ± 1 dB from 30 to 20,000 c/s—hi-fi by any standards! Input—10mV into 2K ohms for 750 milliwatts output for any standard 25 to 35 ohms loudspeaker. Operating requirements from 9 to 12 volts. Full building instructions are supplied with parts for the TR.750, which include latest type Micro-Alloy driver and our exciting new "Magnagain" output transistor, micro-miniature components volume control and on-off switch, printed circuit board and input plug for connecting to Micro-6.

Parts for building
39/6
Ready built and tested
45/-

★ OTHER SINCLAIR CONSTRUCTIONAL DESIGNS

Sinclair Micro-injector

Using two MATS it generates and injects a test signal into any part of equipment at any frequency from 1 kc/s to 30 Mc/s to locate faults rapidly.



$1\frac{1}{2} \times 1\frac{3}{10} \times \frac{1}{2}$ in. excluding probe. All parts with instructions come to

27/6

Ready built and tested **32/6**

Sinclair Micro Amp.



Smaller than a 3d. piece. Frequency response 30 to 50,000 c/s ± 1 dB, power gain 60dB (1,000,000 times)—makes a superb broadband R.F. amplifier also a subminiature hi-fi ampl. with an output suitable for any earpiece or even loudspeaker. With MAT transistors and all parts. 28/6

Slimline Micro Receiver

Has self-contained ferrite rod aerial and takes standard PP5 battery, yet measures only $2\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ in. Tunes over the medium waveband. Great power and quality.



Building is particularly easy, and instructions All parts, in-coming royal ta **49/6**

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AND
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A.1. POST FREE BARGAINS. Guaranteed set tested valves. AF80, EB91, 10F1, 9d. each, 3 for 1/6. L35, EOL80, 2/- each. PY31, PZ30, 3/-, PY80, PY82 3/3. EOC81, EOC82, 3/6. PL82 3/9, P36, POF80, PL83, 20P1, 4/-. EBF80, N37, 4/3. PL33, 4/6. PL81, 4/9. 30F5, 6/-, 53KU 6/6, 185BT 7/-. Send for full list of cheap valves. A.1. RADIO COMPONENTS, 14 The Borough, Canterbury, Kent.

RESISTORS! You can't resist this! 1W, 1W, 2W Polythene wrapped on cards of 10. Mixed values and wattages. £2/10/- per 1,000. Your selection 10/- per 100. G F MILWARD, 17 Peel Close, Drayton Bassett, Staffs.



RECEIVERS

V.H.F. RECEIVERS, P104, 100-150Mc/s. 13 valves. B.F.O., A.G.C., R.F. and L.F. Gains Tuning Meter. In good condition. £3/10/-, carriage 5/-. Matching 230V a.c. power unit. £2/5/-, carriage 10/-. Receiver Section of Walkie-Talkie 68T, 3-6Mc/s, contains 4 valves, 3 of ARP12, 1 AR8, 25/- each, post paid. Spare valves 1/- each, post 3d. Part-stripped matching transmitter chassis, contains many useful parts, coils, condensers, switches, resistors, etc., 10/- post paid, 19 set power units, Mk. 2 (Canadian), vibrator/rotary type, 45/-, carriage 5/-. 22 set vibrator pack, 17/6, post 5/-.



RATES: 7/3 per line or part thereof, average five words to line, minimum 2 lines. Box No. 3/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless", Tower House, Southampton St., London W.C.2.

RECEIVERS & COMPONENTS

(continued)

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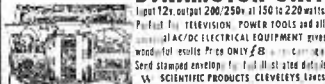
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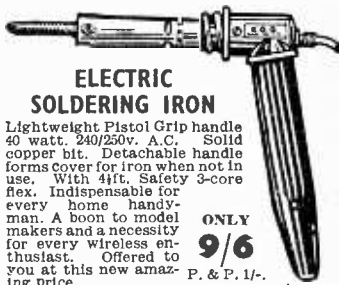
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WORLD'S SMALLEST

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EP50 Valves 1/3. Regret all V/Voltmeters SOLD.
Large range of Radar Equipment to callers only. Please add small amount P. & P. Cat. 1/-, List S.A.E. FREE—Foreign Stamps if requested with orders. (See advts in W/W P/T, etc. for other lines.)

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14-valve double superhet crystal controlled. From 60 to 100 meg. according to crystal used. Built-in stabilised P.P. internal speaker phone output. Brand new. Supplied with circuit and modification details. For 72-144 meg. etc.

£3.10.0 Post Free.

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High Stab Resistors. 5% 6d., 2% 9d., 1% 1/-, Every six packed in 7-compartment linen finish component box. Unmarked

Assorted Resistors, 50 carbon plus 50 high stab. My choice 7/6.

Reflected Power Meter or Standing Wave Ratio Indicator Unit, and other kit including 500 micro amp. meters, plugs, sockets, leads, switch, circuit, instructions, 144 meg. Complete 35/-.

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Speakers, 3 ohm P.M. 5in. 5/-, 6in. 6/-, 7 x 4in. 7/-, 8in. 8/-, 10in. 12/6.

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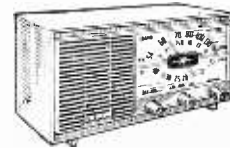
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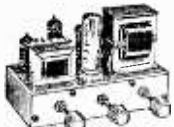
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4-SPEED PLAYER UNIT BARGAINS SINGLE PLAYERS

B.S.R. TU/12.....£3.10.0 Carr. 3/6
B.S.R. GU7 with unit mounted pick-up arm £4.18.8. Carr. 4/-

AUTO CHANGERS

B.S.R. UA14.....£6.8.6
Latest B.S.R. UA16.....£7.2.6
LATEST GARRARD AUTO-SLIM. With heavy duty, 4-pole motor. PEW ONLY £7.7.0. (Standard Auto-Slim £6.17.6) Carr. 5/- on each.

NEW CARTRIDGE BARGAINS!

B.S.R. TC88. High output compatible Stereo Cartridge. Brand New. Complete with Stereo LP/78 sapphire stylus and universal mounting bracket. Original price 44/11. OUR PRICE 22/6. P. & P. 1/-.

RONETTE STEREO 105 CARTRIDGE. Stereo/LP/78. Complete with two sapphires. Original list price 67/9. OUR PRICE 24/- P. & P. 1/-.

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

FURTHER HUGE PURCHASE enables us to offer these at

67/6 P. & P. 4/6.

Heavy 8 1/2in. metal turntable. Low flutter performance. 200/250 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

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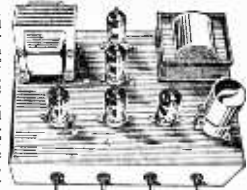
COLLARO STUDIO DECK. £10.10.0 plus 5/6 carr. and ins.

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10/14 WATT HI-FI AMPLIFIER KIT



A stylish 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. all records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15ohm speaker and independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, EOC83, EF88 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts). All parts sold separately. ONLY **£6.19.6** P. & P. 6/6. Also available ready built and tested complete with standard input jack sockets. £8.16.0. P. & P. 6/6.

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BRAND NEW Strongly made wooden construction, tough yvynite covered, complete with carrying handle. Overall size 13 1/2in. wide x 9in. deep x 5in. high with sloping front panel. Weight only 4 1/2 lbs. Ideal for our 10/14 watt amplifier, and many others. **HALFGAIN PRICE 28/6** P. & P. 4/6.

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FEW ONLY



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● P.M. tuning head by design of our maker. ● Guaranteed non-drift. ● Perfect tuning. ● Frequency coverage 85-100 Mc/s. ● OASI balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3 1/2in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used EOC83, two EF80's, and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5 1/2in. ● All parts sold separately. Set of parts if purchased at one time £5.10.8, plus 8/6 P.F. and ins. Circuit diagram and instructions 1/6 post free. Mark II Version as above but complete with magic eye, front panel and brackets. £6.12.6. P. & P. 8/6.

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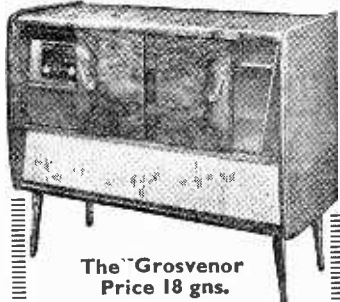
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P. & P. 5/- per cabinet

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READY BUILT RECORD PLAYERS. Smart cabinets with B.S.R. units and quality amplifiers.
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Single player. Cabinet size 13 x 9 x 4 1/2 in. high. B.S.R. 4-speed turntable takes up to 12in. records. ONLY £8.10.0. Plus 5/- P. & P.
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Ready built amplifier suitable for record players. Complete with valves. ONLY 21/6. Speaker to suit 6/6 each P. & P. 2/6.

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PYE V4, VT14, VT17, CTM4, McMICHAEL MP14
ALL AT 7/6 EACH P. & P. 2/6.

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Choice of PYE, PHILIPS, EKCO and SOBELL well packed—but at owners' risk. £2 EACH. Also few 17in. TV sets £4.10.0 EACH. Price carriage and packing Inner London 10/-. Elsewhere 15/-.

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Transformer to suit the above: Input 200-240 A.C. Output 12 Volt A.C. 36 watt. 16/6. P. & P. 2/6. Input 200-240 A.C. 12 volt A.C. 60 watt. 22/6. P. & P. 3/6.
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12 v. D.C. Reversible Motor with tremendous power weight ratio. 3 position switch. Weight 2.1 ounces. Size 1 1/2 x 1 1/2 in. Speed 7,000 r.p.m. Self lubricating. 15/- plus 1/- P. & P.

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Kit of parts, including ORP .12 Cadmium Sulphide Photoconductor, Relay, Transistor and Circuit, etc., price 25/- plus 2/6 P. & P. ORP 12 including circuit, 10/6 each plus 1/- P. & P.

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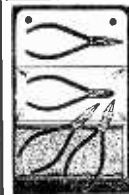
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A precision set of tools comprising of side cutter, round, snipe and flat nose 4 1/2" tools. Handles P.V.C. coated for comfort. Complete in plastic wallet 30s. plus post and packing 2s. 6d.

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● P.W. GUITAR AMPLIFIER

Detailed list available for the amplifier described in May issue.

● GUITAR LOUDSPEAKERS

GOODMANS Audiom 51 12in. 15 watts £9.2.8; Audiom 61 12in. 20 watts £14.7.8.
WHARFEDALE WSP/EG 12 in. 15 watts £10.10.0; W15/EG 15in. 20 watts. £17.10.0.

● SPECIAL LOUDSPEAKER BARGAINS

E.M.I. 13 x 8in. Elliptical. 10 watts, 3 ohms. 39/6. P. & P. 2/6.
RICHARD ALLAN 12in. 5 watts, 3 ohms. 27/6. P. & P. 2/6.

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Morganite ganged potentiometers as specified for the Mullard circuits. ★ Log/Anti-Log. 500k, 1 meg., 2 meg. ★ Log/Log. 50k, 250k, 1 meg., 2 meg. ★ Lin/Log. 250k, 500k, 1 meg., 2 meg. All 10/6 each. Postage extra.

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Table with columns: Model Name, Cash Price, Deposit, Hire Purchase, Mthly/Pmts. Includes Garrard Autostim and B.S.R. models.

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We stock all parts needed for the construction of these excellent tuners. All parts can be supplied separately but we can offer attractive reductions in price if all items are purchased at same time as follows:

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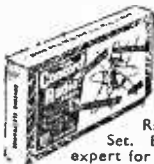
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122/10A	Dual	10-15000	15	32 or 75	20	20,000	100,000	Aluminium	12in.	11in.	6lbs.	6 gns.
122/12	Single	25-5000	15	32 or 75	20	12,000	160,000	Copper	12in.	11in.	6lbs.	7 gns.
122/12A	Dual	30-15000	15	32 or 75	20	12,000	160,000	Aluminium	12in.	11in.	6lbs.	8 gns.
122/14	Single	25-5000	15	32 or 75	22	14,000	186,000	Copper	12in.	11in.	7lbs.	9 gns.
122/14A	Dual	30-15000	15	32 or 75	22	14,000	186,000	Aluminium	12in.	11in.	7lbs.	10 gns.
122/17	Single	25-6000	15	32 or 75	25	17,000	226,000	Copper	12in.	11in.	10lbs.	£11.17-6
122/17A	Dual	30-17000	15	32 or 75	25	17,000	226,000	Aluminium	12in.	11in.	10lbs.	£12.17-6
152/12	Single	25-3500	15	30 or 75	20	12,000	160,000	Copper	15in.	13in.	8lbs.	12 gns.
152/12A	Dual	30-15000	15	30 or 75	20	12,000	160,000	Aluminium	15in.	13in.	8lbs.	13 gns.
152/14	Single	25-3500	15	30 or 75	22	14,000	186,000	Copper	15in.	13in.	9lbs.	14 gns.
152/14A	Dual	30-15000	15	30 or 75	22	14,000	186,000	Aluminium	15in.	13in.	9lbs.	15 gns.
152/17	Single	25-4000	15	30 or 75	25	17,000	226,000	Copper	15in.	13in.	12lbs.	16 gns.
152/17A	Dual	30-17000	15	30 or 75	25	17,000	226,000	Aluminium	15in.	13in.	12lbs.	17 gns.

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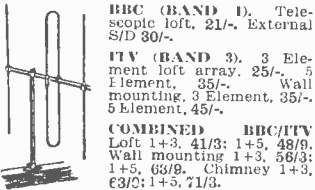
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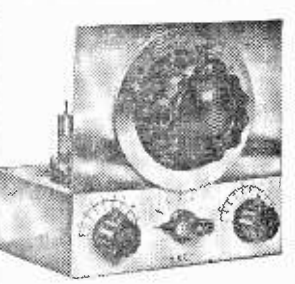
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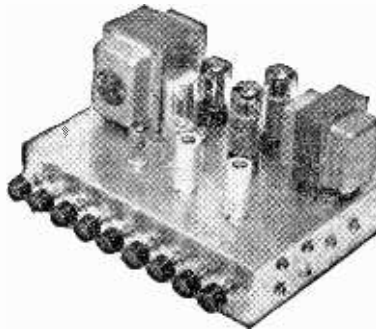
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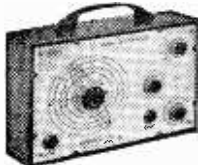
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Practical Wireless

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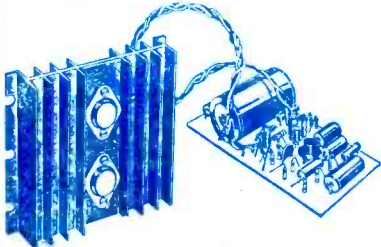
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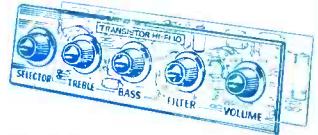
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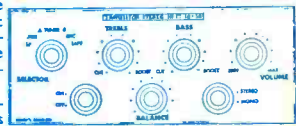
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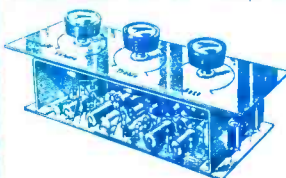
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