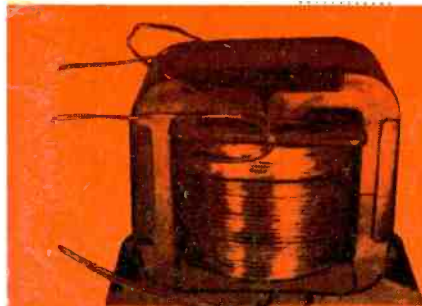
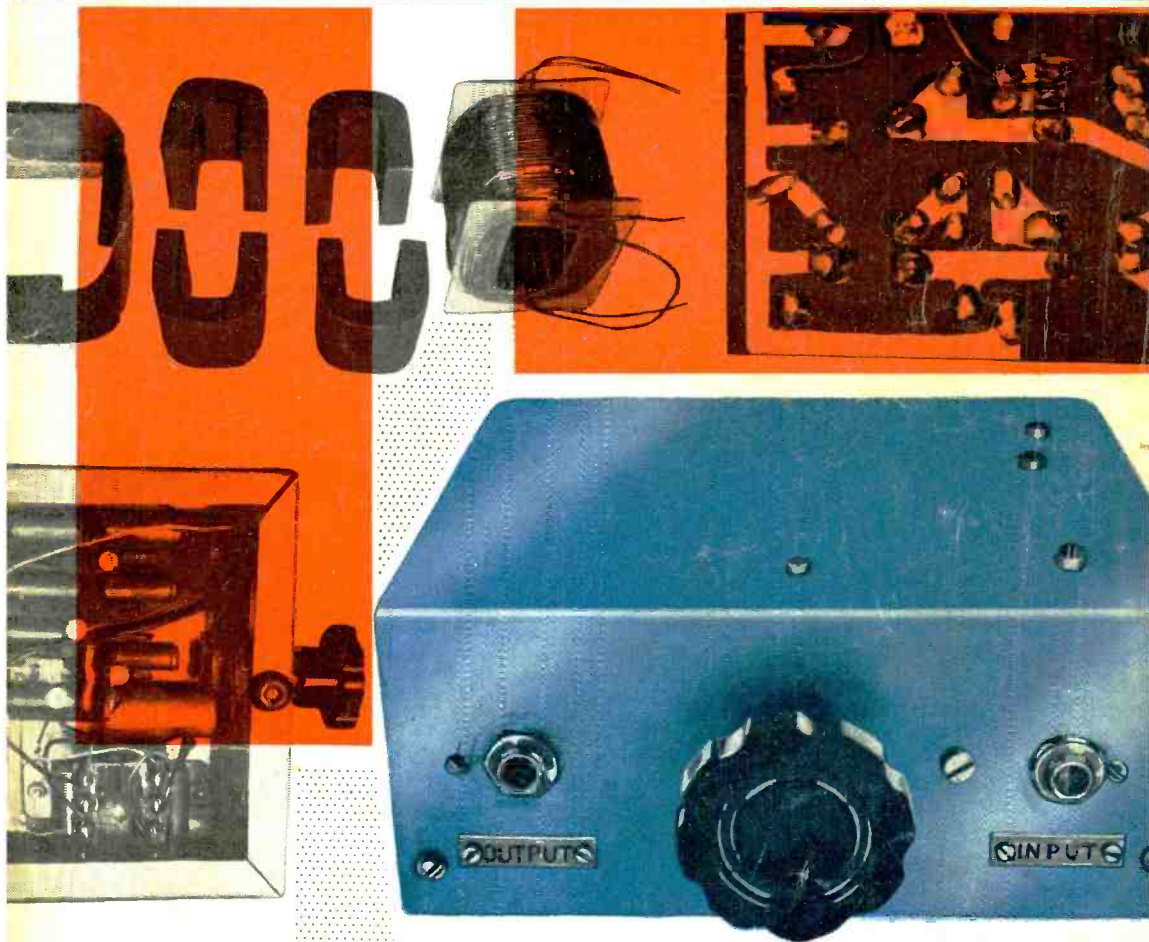


PRACTICAL WIRELESS

JULY 1964

2¹/₂



TRANSISTOR
25 Watt P.A.
AMPLIFIER



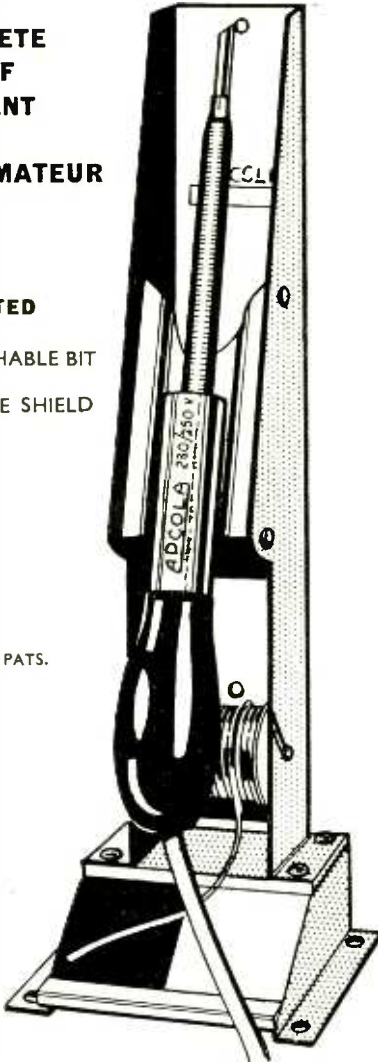
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**A COMPLETE
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FOR THE
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List 64.
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IN
PROTECTIVE SHIELD
List 700



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BAND I

- 3 Element Senior. Head only with clamp... 48/1-
- 3 Element Senior. Chimney Mounting Complete ... 89/6
- 4 Element Senior. Head only with clamp 56/3
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BAND III

- 3E Wall or Universal Clamp Mounting ... 15/9
- 5E Wall or Universal Clamp Mounting ... 19/6
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- Twin 6 Head Only with Universal Clamp... 43/6
- Twin 8 Head Only with Universal Clamp... 50/1-

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- Dipole + 3 Loft Mounting ... 10/6
- Dipole + 5 Loft Mounting ... 11/6
- Dipole + 3 Chimney Mounting Complete 27/3
- Dipole + 5 Chimney Mounting Complete 29/9
- Dipole + 7 Head Only with Universal Clamp ... 22/3
- Dipole + 7 Chimney Mounting Complete 32/3
- H + 5 Head Only with Universal Clamp ... 32/1-
- H + 5 Chimney Mounting Complete ... 42/1-
- H + 7 Head Only with Universal Clamp ... 34/6
- H + 7 Chimney Mounting Complete ... 44/6
- H + 9 Head Only with Universal Clamp ... 37/1-
- H + 9 Chimney Mounting Complete ... 48/6
- H + Twin 6 Head Only with Universal Clamp ... 57/9
- H + Twin 6 Chimney Mounting Complete 112/6

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Telephone: Marlborough 657/8

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CLEAR PLASTIC PANEL METERS

First grade quality. Moving Coil panel meters available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows. Type MR. 32P.

50µA	32/6	1A. DC	22/6
100µA	29/6	5A. DC	22/6
200µA	29/6	3V. DC	22/6
500µA	25/-	10V. DC	22/6
50-0-50µA	29/6	50V. DC	22/6
100-0-100µA	27/6	100V. DC	22/6
1mA	22/6	150V. DC	22/6
5mA	22/6	300V. DC	22/6
10mA	22/6	500V. DC	22/6
50mA	22/6	750V. DC	22/6
100mA	22/6	15V. AC	22/6
150mA	22/6	50V. AC	22/6
200mA	22/6	150V. AC	22/6
300mA	22/6	300V. AC	22/6
500mA	22/6	500V. AC	22/6
750mA	22/6		

Type MR. 32P. 2 1/2 sq. fronts.

50µA	47/6	10mA	32/6
100µA	47/6	100mA	32/6
500µA	37/6	100mA	32/6
50-0-50µA	57/6	1A. DC	32/6
100-0-100µA	47/6	300V. DC	32/6

300V. AC 32/6

Type MR. 45P. 3 1/4 in. fronts.

50µA	59/6	1mA	35/-
100µA	49/6	10mA	35/-
500µA	39/6	100mA	35/-
50-0-50µA	59/6	1 A. DC	35/-
100-0-100µA	49/6	300V. DC	35/-
VU Meter	59/6	300V. AC	35/-

POST EXTRA



BAKELITE PANEL METERS

First grade quality. 3 1/4 in. square

25µA	65/-	1A. DC	29/6
50µA	42/6	5A. DC	29/6
100µA	39/6	1A. AC	29/6
500µA	35/-	30A. AC	29/6
50-0-50µA	52/6	30V. AC	29/6
100-0-100µA	39/6	300V. DC	29/6
1mA	29/6	300V. AC	29/6
10mA	29/6	300V. AC	35/-
100mA	29/6	VU Mtr.	49/6

Moving iron, all others moving coil.

ILLUMINATED 'S' METER
1 21/32 in. sq. front. Cal. in S units. 6V lamp. 29/6. P.P. 1/-.
Ditto 2 5/16 in. sq. 39/6. P.P. 1/-.

MORE METER BARGAINS
100µA. 2 1/4 in. Flush r. 42/6
30-0-30µA 2 1/4 in. " " 9/6
300V. AC 2 1/4 in. " " 25/-
300V. AC 2 1/4 in. " " 25/-
1mA Meter Rectifiers 8/6
Post Extra.

4 1/2 IN. 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.

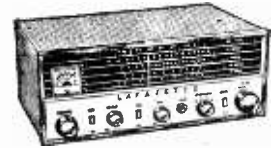
TELEPHONES TYPE H
Sound powered, generator bell ringing 2 line connection. Fully tested. 24-18.6 pair. Carr. 5/-.

MAINS RECORD PLAYERS & AUTOCHANGERS
ALL GUARANTEED WITH ARM AND CARTRIDGE

GARRARD SRP-10 PLAYER	£4.17.6
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GARRARD AUTOSLIM DE LUXE	26.19.6
GARRARD AT6 CHANGER MONO	21.0. 9.6
GARRARD AT6 CHANGER STEREO	21.0.19.6
GARRARD 4 HF MONO	24.19.6
GARRARD 4 HF STEREO	215.15.0
GARRARD TYPE A CHANGER	217.15.0
GARRARD 301 STROBE NO ARM	218.0.0
B.S.R. GUT SINGLE PLAYER	24. 7.6
B.S.R. UA14 CHANGER	25.19.6
B.S.R. UA16 CHANGER	26.12.6

POSTAGE EXTRA

HE-40 DE LUXE 4-BAND COMMUNICATION RECEIVER



Frequency coverage 550Kcs to 30 Mc/s continuous. Operation 220/240 volt A.C./D.C. The perfect receiver for short wave listening. Special features include: Slide rule tuning dial—electrical bandspread—0-100 logging scale—improved selectivity—built in "S" meter—A.V.C.—Noise limiter—B.F.O.—Phone jack built in 5 in. speaker—tone control—standby switch—supplied with three aeriols, ferrite loop for broadcast band, adjustable 58 in. 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 ITI-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: 0-5-25-250-500-2500 V.
A.C. V: 0-10-50-300-1000 V.
Current: 0-50µA-25mA-250mA
Resistance: 0-80K-6MΩ
Capacity: 0.01-0.3mF (at AC 10 V)
Decibel: -20dB+22dB
Output range: 0-10-50-500-1000 V
Battery: 1.5 V U12
Size: 3 1/2 x 4 1/2 x 1 1/2 in.
Supplied complete with batteries, leads instructions. 82/6. Post 2/6.



MARCONI TPI44G/4 STANDARD SIGNAL GENERATORS
First release of this late mark. 85Kcs to 25Mc/s ± 1%. Output variable from 1µV to 1 volt. Internal sine wave modulation 400c/s up to 75% depth. Operation 200/250 volt A.C. Offered in really excellent condition, like new fully tested and guaranteed. 225. Carr. 30/-.

TE-20 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120Kcs-280Mc/s on 8 bands. Directly calibrated. Variable RF attenuator. Operation 200/240 V. A.C. similar in appearance to TE-46 Cr. Bridge. Brand new with instructions. 212. Carr. 5/- S.A.E. for details

NATIONAL H.R.O. RECEIVERS

SENIOR MODEL. Complete with a full set of 9 coils covering 50Kcs to 30Mc/s. Each receiver thoroughly checked and tested before despatch. Dual purpose rack model for table or 19 in. rack mounting. Extremely good used condition. 218.18.0. Carr. 21. 200/250 volt A.C. power supplies for H.R.O. also sold separately. 59/6. Carr. 5/- S.A.E. for full details.

ERSKINE TYPE 13 DOUBLE-BEAM OSCILLOSCOPE
Time base 20c/s-750 Kc/s. Calibrators at 1 Kc/s and 1 Mc/s. Separate Y1 and Y2 amplifiers up to 5.5Mc/s. Oper. at 110/230 volt A.C. Supplied in perfect working order. 227.1 0. Carr. 20/-.

TWIN MOTOR BARGAIN

200/250V. A.C. Twin concentric spindles. Either motor reversible. 14000 r.p.m. Brand new. 12/6. P.P. 2/6.

MICROAMMETERS

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

MINE DETECTOR No. 4A

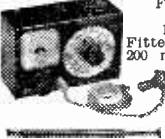
Will detect all types of metals. Fully portable. Complete with instructions. 39/6 each. Carr. 10/-. Battery 8/6 extra.

GEARED SLIDER RHEOSTAT

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

FIELD STRENGTH METERS

Frequency coverage 1-250Mc/s. Fitted with 200 microamp meter. Supplied with telescopic aerial, complete and instructions 69/6 post paid.



FIELD TELEPHONES



Type "L". Two line connection, generator bell ringing. Complete telephone intercom. Supplied in excellent condition, fully tested and complete with batteries. Only 69/6 per pair. Carr. 5/-. Type "R". As above but moulded bakelite case (as illustrated). Supplied complete with wooden transit case for field use. 24.19.6 per pair. Carr. 5/-.

9 TRANSISTOR TRANSCEIVERS TWO-WAY RADIOS

Complete with all accessories 225 pair. Just Arrived! 2 TRANSISTOR TRANSCEIVERS TWO WAY RADIOS. Complete with all accessories 112.6 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 cooled anti rust nickel plated brass and stainless steel operating parts. Size 6 1/2 x 3 x 2 1/4 in. Brand new. 24.19.6. 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.	250mA	7/6
800V. P.I.V.	500mA	5/6
200V. P.I.V.	200mA	3/-
400V. P.I.V.	3 amp	5/6
150V. P.I.V.	165mA	1/-
40V. P.I.V.	500mA	3/6
70V. P.I.V.	1 amp	3/6
95V. P.I.V.	3 amp	5/6

Post extra.

PLUGS AND SOCKETS

Painton 15-pin in-line printed circuit connectors. 7/6 pair. Large quantities available. Ditto 32-pin. 12/3 pair. Unifers, 4-pin. 2/6 pr; 8-pin 3/6 pr; 12-pin. 4/- pr; 18-pin. 4/6 pr. Painton Miniature Jones. 4 pin 3/6 pr; 6 pin 4/- pr; 8 pin 4/6 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. 10mF, 800V, 3/6; 10 mF, 1kV 10/6; 12 mF 15kV 15/-. Post extra.

L.T. METAL RECTIFIERS

FULL wave bridge connected. 12/18V 1A 3/9 23/36V 1A 7/3 12/18V 2A 6/3 24/36V 2A 13/6 12/18V 4A 8/6 24/36V 15A 45/- 12/18V 6A 12/3 36/48V 6A 35/6 12/18V 10A 22/6. Post extra.

L.T. TRANSFORMERS

For chargers, models etc. All primaries tapped 200/250V. (1) 3.5, 9 or 17V. 1 amp. 9/9; (2) ditto 2A. 14/3; (3) ditto 4A. 18/6; (4) ditto 8A. 25/3. 4.5, 6, 8, 10, 12, 15, 18, 20, 24 or 30V. 2 amp. 18/6; (6) ditto 4A. 30/-; (7) ditto 5A. 37/6; (8) 50V. 4 amp. 13/6; (9) 50V. 1 amp. 15/6. Post extra.

AUTO TRANSFORMERS

Step up or step down. Tapped 0/115/200/230/250V. 20W. 6/- 60W. 12/-; 75W. 15/6; 150W. 18/6; 200W. 27/6; 300W. 42/0; 500W. 67/6; 1,000W. 90/-; 1,500W. 26.3. 6; 3,000W. only 27.10.0; 7,000W. only 27.10.0. (all tapped 0/110/230V.) Post extra.

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

heads voltages up to 1,000 D.C. at 30,000 ohms per volt and A.C. at 15,000 o.p.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 5 1/2 x 6 1/2 x 2 1/4 in. PRICE 28.17.6



G. W. SMITH & CO. (RADIO) LTD.
1 & 34 LISLE STREET, LONDON, W.C.2.
SEE OPPOSITE PAGE

CONSTANT VOLTAGE TRANS.
95/130V. input. 115V. output.
500 watts. Can be used in series
for 230V. £4 each. Carr. 10/-.

**DUMONT KIOSIPI DOUBLE
BEAM C.R.T.**
Twin gun. 6.3V. new. boxed.
59/6. P.P. 3/6.

MAINS ISOLATION TRANS.
230V. to 230V. 50W. 18/6. P.P.
3/-; 100W. 29/6. P.P. 3/6; 1,000W.
£5. Carr. 10/-.

TM-59'er 'S' METER



Signal strength meter using VTVM principles. Calibrated in S units. Sensitivity and zero adjustments. For any superhet receiver with AVC. Requires 150/200V. and 6 or 12V. Complete with valve and full instructions. 82/6. P.P. 2/6.

VARIAC TRANSFORMER
24 amp. Pri. 230V. Sec. 185/250V. £12.10.0. Carr. 10/-.

MAINS MOTORS 220/240V
90 watts. 5,000 r.p.m. 4 1/2 x 3 1/2 in. spindle. 22/6. P.P. 2/-.

**MINIATURE LEAD ACID
ACCUMULATORS**
Brand new. 2V. 1.5A. 4 x 1 1/2 in. 5/6. P.P. 1/3. 12V. 0.75A. 4 x 3 x 1 1/2 in. 15/6. P.P. 1/6.

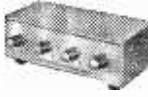
HEADSET & BOOM MICROPHONE
American type, low impedance, padded 49/6. P.P. 2/6.

200 KΩ INSTRUMENT POTS.
Wirewound, 3 1/2 in. dia. 5/6 each. P.P. 1/3.

MINIFLEX 3 TRACK TAPE HEADS
Set of three, record, playback, erase. Only 29/6 set. P & P. 9d.

**COLLAR/MAGNAVOX STUDIO
TAPE TRANSCRIBER**
Brand new. 3 speeds. 11. 3 1/2. 7 1/2 i.p.s. 3 motors. Digital counter. Complete with 2 spools. Instructions. 10 gns. Carr. paid.

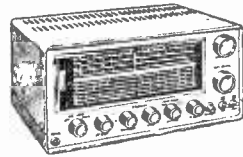
**4-CHANNEL TRANSISTORISED
MICROPHONE MIXER**
Add musical high lights and additional sound effects to your recordings. The MM-4 permits mixing of four signals such as microphone, records, tuner, etc. into single output. Input and output take standard plugs. Fully transistorised and self contained in handsome case. PRICE 59/6. Post Paid.



ROTARY TRANSFORMERS
12V. D.C. input. Output 310/360V. D.C. 30mA. New boxed. 10/-, P.P. 2/-.

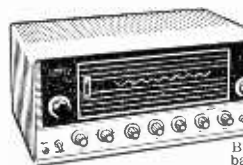
**LARGEST STOCKS OF
components, receivers and test
equipment in the country.**
Open 9 a.m. to 6 p.m. Every day.
Monday to Saturday. Trade
supplied. Send 1/- P.O. for full catalogue
and lists.

HE-30 SUPER AMATEUR COMMUNICATION RECEIVER



4 bands covering 550Kc/s to 30Mc/s (continuous). Operation 200/240 volt A.C. Special features include: Easy to read illuminated slide rule dial—Built in Q multiplier—Aerial trimmer—calibrated electrical bandsread on amateur bands—0-100 logging scale—noise limiter—AVC/MVC B.F.O. for clear CW and SSB reception—built in edgewise "S" meter. Output for phones or STD speaker. Supplied brand new and guaranteed with manual. £42 carriage paid. S.A.E. for full details. Part exchange welcome.

HE-80 14-VALVE AMATEUR COMMUNICATION RECEIVER

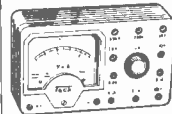


550Kc/s to 30Mc/s + 2 Metre Band. 14 to 146Mc/s. Two receivers in one. Continuous coverage from 550Kc/s to 30Mc/s and 144 to 146Mc/s. Dual conversion on 2 metres with extra HF and Mix. Special features include "S" meter. Crystal calibrator "Q" multiplier. B.F.O., Bandsread on all amateur bands, large illuminated dial with logging scale. Improved A.N.L. regulated power pack. Output for crystal calibrator at 1 mc/s. Operation 200/250 volt A.C. Valve line-up 4x 6A08, 3x 6BA6, 2x 6BE6, 1x 6BL8, 6AL5, 6A05, 6CA4, and OA2. Attractive grey steel cabinet. 17 x 7 1/2 x 10 in. Supplied brand new and guaranteed complete with instruction manual. 59 £ gns. Carriage paid. S.A.E. for full details. Part exchange welcome.

**NEW MINISTRY RELEASE
MODERN ARMY R.216 AM/FM V.H.F. RECEIVER**

**BRAND NEW 5 BAND—16 VALVE RECEIVER COVERING
19-157 mc/s CONTINUOUS.** An extremely well made receiver using miniature valves and components, pan-climatic and hermetically sealed. Special features include—8 PT film dial on each band, 2K.C.F. and H.P. stages (4.36 mc/s). B.F.O., N.L., crystal calibrator at 1 mc/s and 5 mc/s. bandwidth 50 Kc/s or 120 Kc/s, I.P. output, 600 ohm output or 150 ohms phone output. Size 12 1/2 in. x 9 in. x 8 1/2 in. Supplied complete with separate power unit and connecting cable for operation on 0/110/200/250/volt A.C. Price £29.10.0 complete. Carriage 30/-, S.A.E. for details. Circuit diagram supplied.

MODEL PT-34 1,000 O.P.V. MULTI-TESTER



Dependable and Easy to Read SPECIFICATIONS:
D.C. V. 0-10-50-250-500-1000V.
A.C. V. 0-10-50-250-500-1000V.
Current 0-1-100-500mA.
Resistance: 0-100kΩ Battery: 1.5V U12.
Size: 3 1/2 x 2 1/8 x 1 1/2 in.
Supplied complete with batteries, leads, instructions. 39/6. Post 1/6.

MODEL PV-58 VACUUM TUBE VOLTMETERS

Latest design with special circuit for stable and accurate measurements. Resistors used are all within 1% tolerance. Specially designed 4 in. 300kΩ meter. 11 meg input Ranges:
-D.C. V. 0-1.5-5-15-50-150-500-1500V.
+D.C. V. 0-1.5-5-15-50-150-500-1500V.
A.C. V. 0-1.5-5-15-50-150-500-1500V.
0-1 A-14-40-140-400-1400-4000 P.P.
RMS.
Resistance: 2 ohm to 1,000 megohm.
Decibels: -10dB to +65 dB.
Operation 220/240 volt A.C. Size 7 x 4 1/2 x 4 in.
Supplied brand new and guaranteed complete with probe and instructions. £13.19.6. P.P. 3/6.



TE-46 CAPACITANCE RESISTANCE ANALYSER



- * Factory wired and tested.
- * Capacitance bridge circuit.
- * Direct reading scales for capacitance and resistance.
- * Magic eye null indicator and meter.
- * Checks opens, shorts, leakage and intermittents.
- * Determines power factor of electrolytics.
- * 2 Turns ratio scales.
- * 2 Measures impedance.

Capacity 4 ranges 2pF-2,000 mF Resistance 4 ranges 2 ohms-200 meg. ohms. Turns, ratio and impedance ranges. Read insulation resistance direct on meter to 200 meg. Size: 10 1/2 x 7 x 5 1/2 in. Operation 200/240 v. A.C. Supplied brand new with instructions. £15. Carr. 7/6.

**LAFAYETTE BRAND
RECORDING TAPE**

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.
3 in. 300ft. L.P. mylar 4/-
3 1/2 in. 600ft. T.P. mylar 10/-
5 in. 600ft. std. plastic 8/8
5 in. 900ft. L.P. acetate 10/-
5 in. 1200ft. D.P. mylar 15/-
5 1/2 in. 1200ft. L.P. acetate 12/8
5 1/2 in. 1800ft. D.P. mylar 22/8
7 in. 1200ft. std. mylar 12/8
7 in. 1800ft. L.P. acetate 15/-
7 in. 1800ft. L.P. mylar 20/-
7 in. 2400ft. D.P. mylar 25/-
Postage 2/-. Over £3 post paid.

**TE-12 20,000 O.P.V.
MULTIMETER**



High quality multimeter, rugged design and wide ranges.
DC VOLTS - 0-0.6-6-30-120-600-1,200-3,000-6,000V.
AC VOLTS - 0-0.6-30-120-600-1,200V.
DC current - 0-0.06-6-60-600 mA.
Resistance - 0-6K-60K-60 meg.-60 meg.
Capacity - 50 pF - 0.2 mfd.
DECIBELS - -20 to +63 db.
SIZE - 6 1/2 in. x 3 1/2 in. x 1 1/2 in.
Supplied complete with test leads, battery and instructions. £5.19.6. Post 2/-.

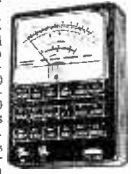
**NH-201 30,000 O.P.V.
MULTIMETER**



High quality, high sensitivity multimeter. DC volts - 0-0.25-1-10-50-250-1,000V.
AC volts - 0-10-50-250-1,000V.
DC current - 0-50 uA - 10-50 mA - 250 mA.
Resistance - 0-5K-50K-5 meg. Decibels - -10 to +22 db.
Size - 4 1/2 in. x 3 1/2 in. x 1 1/2 in.
Supplied complete with test leads, battery and instructions. £5.10.0. Post 2/-.

**TS.76 20,000 O.P.V. PUSH
BUTTON MULTI-TESTER**

Large clear plastic scale, simple operation. DC and AC volts up to 1,000V. Resistance up to 10 megohm Current up to 250 mA. Decibels -20 to +36db. Size 6 x 4 1/2 x 2 1/2 in. Complete with leads, batteries and instructions. £5.19.6. P. & P. 2/-.



**LAFAYETTE HI-FI
STEREO HEADPHONES**

Air Cushioned headband, soft foam rubber, softer ear pads, frequency response 25-15,000 cycles, high sensitivity, impedance 8 ohms per phone. Supplied complete with all cables, wires, overload junction box and 3-conductor plug. 89/6. P. & P. 2/6.



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

TECHNICAL TRAINING in radio television and electronics

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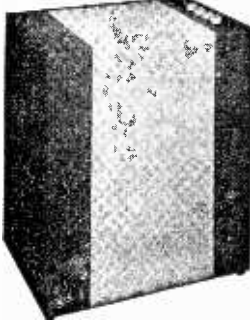
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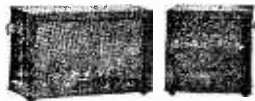
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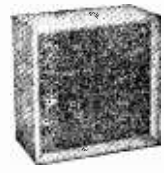
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LINEAR L634 GRAM AMPLIFIER. High quality. Separate Bass and Treble controls. Handsome appearance. Completely enclosed. Black/Gold Frontplate 6 gns.

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 high fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible but 71 dB down. 15 dB of Negative feedback is used. I.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) 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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336 ARGYLE STREET Now Open 238 EDGWARE ROAD Now Open 133 LEITH STREET Now Open

MULTI-METER, CARY M1. Sensitivity 2,000 ohms per volt. A.C. and D.C. £41.6. 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 8in. for 8 x 5in. or 10 x 6in. speakers. £2.9.6. **STANDARD MODEL.** Size 27 x 18 x 12in. for 8 or 10in. speakers. £4.11.6. **SENIOR MODEL.** Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below. Only 7 gns.



AUDIOTRINE HI-FI SPEAKER SYSTEM. Consisting of matched 12in. 12,000 line 15 ohm high quality speaker/cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating £4.19.6. Carr. 5/- or Senior 15 watt. £6.19.6. Carr. 7/6.

AUDIOTRINE EQUIPMENT CABINETS.

Size 33 x 15 x 18in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Unit removable baseboard. Depth above baseboard 5 1/2". Only 12 gns. Carr. 13/- Terms: Dep. 29/9, and 9 monthly pymts. 29/9



AUDIOTRINE HI-FI TAPE RECORDER KIT 25 ¹/₂ GNS. Carr. 17.6.

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR. Incorporating the latest 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 Vynair, 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, EZ31. High quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response + 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 PICK-UP PLAYING RECORDS. For MUSICAL INSTRUMENTS such as STRING BASS, LEAD OR RHYTHM GUITARS, etc.



OUTPUT SOCKET with plus 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 p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. ONLY 8 Gns. Carr. 10/- (Or factory built 5/- extra.)

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9 and 9 monthly payments of 24/9. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1, Switched Negative feedback equalisation. Positions for Record Lin., 3 1/2 in., 7 1/2 in. 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



Kit can be supplied assembled and ready to use for 59/6 extra.

A complete set of parts for the construction of a stereo amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ31. Outputs for 2-3 ohm speakers. Point-to-point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. ONLY 8 Gns. Carr. 10/- Full constructional details and price list 2/6. Carr. 10/-.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS



R.S.C. GRAM AMPLIFIER KIT. 3 watts output. Negative feedback. Controls for 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. 16/9. Acos Stereo-Monaural. 29/9. Ronette Stereo-Monaural 39/6. B.S.R. Stereo 39/9. BRADMATH RECORDING HEADS. High Impedance Record/Playback 22/- Low Impedance Erase. 12/6.

MARRIOTT RECORDING HEADS. High Impedance. Record/Playback 15/- Low Impedance Erase. 10/6.

PICK-UP ARMS. Complete and with latest Acos/hi-fi 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-fi Turnover head. Only £3.19.6.

B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. £6.19.6. Carr. 4/6. GARRARD AT10-SLIM 4-SPEED AUTO-CHANGERS with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. £7.17.6. Carr. 4/6.

GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS. Turnover GC8 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 1 1/2 x 2 1/2 in. Controls: Vol. and Tone with Switch. Only 59/6.

SENSATIONAL STEREO OFFER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head 19/9 extra with above only. 4 Gns.

HEAVY DUTY CHARGER KIT. 6/15 v. 6 amps., variable. Consisting of Mains Transformer 0-200-230-250 v.; F.W. (Bridge) Selenium Rectifier; Ammeter. Variable Charge Rate Selector Panels. Fuses, Fuses, Fuseholder and circuit. 59/9. Carr. 4/6.

R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months.

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

ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. Fused, ready for use with mains and output leads and battery clips. Carr. 4/6.	ASSEMBLED 6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused, ready for use with mains and output leads. Carr. 3/9.
59/9	39/9 Carr. 3/9.

Terms: Deposit 12/- and 5 monthly payments of 12/-.

BATTERY CHARGER KITS Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuseholders, Grommets, panels, Heavy Duty Clip circuit. Carr. 3/6 extra.

6 v. or 12 v. 2 amps.	22/9
As above, with Ammeter.	25/9
6 v. or 12 v. 2 amps.	19/9
6 v. or 12 v. 2 amps.	25/9
6 v. or 12 v. 2 amps.	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 with variable charge rate adjustment and ammeter. £4.19.6. Carr. 10/-.

R.S.C. MAINS TRANSFORMERS (GUARANTEED)

Interleaved and Impregnated. Primary 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.	18/9
250-0-250v. 100mA. 6.3v. 2a. 0-5-6.3v. 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.	26/9
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
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a.	27/11
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a.	27/9
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v.	33/9
1a. for Mullard 510 Amplifier.	37/9
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 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.	69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 354, etc.	4/6
Small Pentode. 5,000Ω to 3Ω	4/6
Small Pentode 7/8,000Ω to 3Ω	4/6
Standard Pentode 5,000Ω to 3Ω	5/9
Standard Pentode 7,000Ω to 3Ω	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω Push-Pull matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15Ω	19/9
Following types for 3 and 15Ω speakers: Push-Pull 10-12 watts 6V6 or EL84	15/9
Push-Pull 15-18 watts, 6L6, KT66	28/9
Push-Pull Mullard 510 Ultra Linear	28/9
Push-Pull 20 watts, sectionally wound. 6L6, KT66, EL34, etc.	49/9

MIDGET MAINS PRIMARIES 200-250 v. 50 c/s. 250v. 60mA. 6.3v. 2a. 11/9

250-0-250v. 60mA. 6.3v. 2a.	12/11
Both above size 2 1/2 x 2 1/2 in.	

FILAMENT TRANSFORMERS

All with 200-250v. 50 c/s Primaries 6.3v. 1.5a., 5/9; 6.3v. 2a. 7/6; 3v. 1a. 7/11; 6.3v. 3a. 8/11; 6.3v. 6a. 17/6; 12v. 1.5a. twice. 17/6.
--

SMOOTHING CHOKES

150mA. 7-10 H, 250 ohms	11/9
100mA. 10H. 200 ohms	8/9
30mA. 10H. 350 ohms	5/9
60mA. 10H. 400 ohms	4/11

AMPHIBIOUS TRANSFORMERS

All with 200-230-250v. 50 c/s Primaries: 0-9-15v. 11a. 17/9; 0-9-15v. 2a. 14/9; 0-9-15v. 3a. 18/9; 0-9-15v. 5a. 19/9; 0-9-15v. 6a. 23/9; 0-8-15v. 8a. 28/9.

AUTO (Step up/Step down) TRANS.

4/10/120-2.0(250v. 50c/s) watts 13/9;
250 watts. 39/9; 150 watt. 27/9;

MICROPHONE TRANSFORMERS

120:1 high grade, clamped. 8/9.

VALVES SAME DAY SERVICE

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SETS			1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94 Set of 4 for 15/- DAF96, DF96, DK96, DL96								
1A7GT	7/6	68L7GT	3/8	DAF96	6/8	ECL82	7/-	PCF84	8/-	U281	8/6
1D5	6/3	68V8GT	5/6	DCC90	6/9	ECL86	9/5	PCF86	8/-	U282	11/9
1H8GT	5/6	69V8GT	5/6	EF33	8/-	EF39	3/6	PCF86	14/-	U281	9/-
1N5GT	8/-	6V6GT	3/8	DF91	2/6	EF41	6/6	PCL82	6/6	U404	5/8
1R5	4/8	6X4	3/8	DF96	6/-	EF42	4/8	PCL83	9/-	U801	15/8
1S5	3/8	6X5GT	5/6	DH76	3/6	EF80	4/3	PCL84	7/6	U4020	4/9
1T4	2/8	7B7	8/-	H177	3/6	EF85	5/-	PCL85	8/6	UABC90	5/8
1U5	5/-	7C5	7/9	DK32	8/-	EF98	6/3	PEN4DD	8/6	UAF42	8/3
3A5	6/8	7C6	5/6	DK91	4/9	EF99	4/-	PEN4A	6/6	UBC41	6/3
3Q4	4/10	7H7	5/9	DK92	6/9	EF91	2/9	PENB4	17/6	UCB81	7/3
3S4	4/8	7S7	12/9	DK96	6/8	EF92	2/6	PENB4	17/6	UBF90	6/-
3V4	5/8	7Y4	5/-	DL33	7/3	EL38	12/6	PEN36C	8/-	UBF99	6/9
5V4G	4/6	10C2	12/3	DL35	6/8	EL41	7/3	PEN383	9/6	UBL21	9/6
5Y3GT	7/6	12AT8	4/8	DL32	4/8	EL42	7/9	PL38	8/9	UG92	5/6
5Z4C	7/6	12AT7	3/9	DL94	5/6	EL94	4/9	PL81	7/-	UCC85	8/9
6A8C	5/8	12AU7	4/9	DL96	6/-	EM34	7/11	PL82	5/6	UCC85	8/9
6AL5	2/-	12AX7	4/9	EABC80	5/3	EM8J	6/9	PL83	5/-	UCF80	6/6
6AQ5	6/-	12K7GT	4/8	EAF42	8/-	EM81	7/9	PL84	5/9	UCH42	7/6
6AT6	3/6	12K8GT	5/9	EB43	2/-	EM84	7/6	P44	5/6	UCH91	6/6
6BA6	8/-	12Q7GT	4/3	EB91	2/-	EM87	8/-	PX25	7/9	UCL83	7/6
6BE6	5/3	19B6G6	9/6	EB33	5/-	EY51	6/-	PY31	5/9	UCL83	9/6
6BG6G	12/6	20P4	12/6	EB41	7/3	EY84	7/-	PY32	9/-	UF41	7/3
6BH6	5/-	20P5	14/9	EB81	5/8	EY86	5/8	PY33	9/-	UF42	4/9
6C1G	5/6	25A4GT	10/6	EB90	5/9	EZ40	5/8	PY30	5/8	UF85	6/3
6CD6C	8/6	25U4GT	10/6	EBF83	7/9	EZ41	7/6	PY31	6/8	UL41	7/3
6F1	5/6	30L15	8/6	EBF89	6/-	EZ80	4/-	PY82	4/9	UL44	15/-
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6F14	9/-	30PL13	9/-	ECC40	7/8	EZ82	8/6	PY88	7/9	UI84	6/3
6F16	6/8	30L14	12/3	ECC81	3/8	KT32	5/-	H17	15/-	UU7	6/8
6G7G	1/6	35A5	14/-	ECC82	4/3	KTW1	4/9	T1D4	7/9	UY21	7/9
6K7GT	4/8	35L6GT	6/3	ECC83	7/-	MU14	5/-	TH2C	9/6	UY41	4/9
6K8C	4/3	35Z4GT	4/11	ECC84	6/3	MX40	8/6	TH2S	5/9	UY85	5/9
6K8GT	7/9	35KU	8/8	ECC85	6/8	N18	4/10	U22	4/9	VP4B	12/6
6L6G	5/8	AZ31	8/6	ECCF80	6/3	PC85	9/-	U25	8/8	VP41	4/9
6L6	7/6	B36	10/6	EF82	6/3	PC87	10/-	U26	10/-	W76	3/6
6P25	6/6	CCH35	12/3	EF86	10/8	PC88A	5/6	U47	8/6	W77	2/6
6P28	9/6	CL33	9/6	ECH35	6/-	PC85	6/9	U50	4/6	W729	16/8
6Q7G	4/9	CY1	12/6	ECH42	8/3	PC89	8/-	U52	4/6	X63	5/6
6Q7G	7/9	DAC32	8/3	ECH81	6/-	PC89	5/8	U78	3/9	X81M	19/6
6R7GT	9/6	DAF91	3/9	ECL80	6/3	PCF82	6/9	U191	8/6	X109	17/6

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HIGH QUALITY 5 WATT AMPLIFIER. For 220/240 v. A.C. mains or 6 v. car battery. Separate gram and mike inputs. Quality output transformer for 3, 8 and 16 ohm speakers. Fully enclosed in metal case 9 x 8 x 6 in. As new and unused, case may be slightly store soiled supplied complete with valves and tested. **REAL SNIP ONLY 87/6, post 8/-.** (Vibrator, required only for v. 7/6 extra).

PROGRESSIVE SHORT WAVE RECEIVER. Specially designed kits employing plug-in coils with exceptionally clear wiring diagrams and instructions to enable even the very beginner to construct a short wave radio with every confidence of success. A second and then a third valve can be added, the chassis supplied being punched to take all three stages. Can be operated from dry batteries or from a simply constructed mains transformer at price 32/6. Cost of all parts to build the 1 valve S/W Radio including one coil 40/100 metres only 35/-, post 2/-; 1/2 valve conversion stage 7/6; 2/3 valve conversion stage 10/4. Extra plug-in coils to cover 10/20, 20/40, 100/200, 200/450 metres, 4/- each. Plans supplied separately 1/6.

MULTI TAPPED TRANSFORMERS. Pri. 200/250 v. Sec. 30 v. tapped at 24-20-18-15-10-8-6-5-4-3v. Type MT92 for 2 amp loading, 22/8. MT94, 4 amp, 37/6. MT95 5 amp, 48/- Post all types 3/-.

RECORDING TAPE BARGAINS. By the famous Del-Clear Co. of Canada, high grade acetate base with fitted leaders, professional quality, as good as any but costing much less. Every tape guaranteed. 5in. Std. 600ft., 12/6. L/P 800ft., 15/-, 5 1/2in. L/P 1,200ft., 18/6. 7in. Std. 1,200ft., 18/6. L/P 1,800ft., 25/-. NEW 1/4 I.L.P. ELECTRIC MOTORS, 200/250 v. A.C. mains split phase induction type by Crompton Parkinson. Spindle 2 x 1/2 in. dia., 14J r.p.m., reversible, with mounting plate and bosses for vertical or horizontal mounting. **BARGAIN PRICE ONLY 79/6, carriage 3/-.**

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Also see facing page

ANOTHER HARVERSON BARGAIN!

REMOTE CONTROL UNIT AND SPACE CONTROL AMPLIFIER

Originally intended for remote channel changing and volume control of TV Receivers by supersonic waves. Comprises of remote hand control unit, super-sensitive mike and amplifier with 3 Mullard valves (2-EB/C83, EB91, PC989, EZ250). Supplied complete in makers original cartons, brand new and unused with full circuit diagrams, etc. Easily adaptable for hundreds of uses where remote control of apparatus is required without direct connection.

Makers' list price 18 gns. **LIMITED NUMBER AVAILABLE AT 37/6** P. & P. ONLY

The relays, valves, mike & transformer and components are worth for more than our price for the complete units and due to the very high value and the limited number we regret that no correspondence can be entered into regarding these items.

BRAND NEW 3 OHM LOUDSPEAKERS

2 1/2 in., 12/8; 3 in., 12/8; 4 in., 15/-; 6 in., 21/-; 10 in., 25/-; 12 in., 27/8; (12 in. 15 ohm 30/-); E.M.I. 2 1/2 in. tweeter... 10/6

10 in. x 6 in. ceramic magnet... 26/-

Latest type E.M.I. 181 2 1/2 in. with high bias ceramic magnet, 11,000 gauss. Aluminium centre cone. 10 watt. 50 c/s to 10 K/c/s., 42/-.

P. & P. up to 6 in. 10/6; over 6 in. 2/6 per speaker.

SPEAKER AND CABINET FABRIC

Oatmeal or Red and Gold Vynair for speaker and cabinet covering, also Red Rexine for cabinet covering only. All 5 1/2 in. wide and usually sold a 3 1/2 yard.

OUR PRICE 13/6 per yard length, plus P. & P. 1/9. (Minimum order 1 yard) send S.A.E. for samples.

TAPE DECKS

COLLARO STUDIO DECK. £10.10.0 plus 5/4 carr. and ins.

B.S.R. MONARDECK. Single speed, 3 1/2 in. per sec., simple control uses 3 1/2 in. spools, 26.15.0 plus 5/4 carr. and ins. (Tapes extra on both.)

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BARGAIN CORNER

MAINS TRANSFORMER

Drop thru type. Tapped primary 110v., 260v., 230v., 240v., 320-0-320v. at 80mA and 6.3v. at 3 amps. Generous core. Stock size 3 1/4 x 3 1/4 in. Weight 4 lbs. **ONLY 15/-** P. & P. 3/9

ACOS CRYSTAL MIKES.

 High Imp. For desk or hand use. High sensitivity, 18/6. P. & P. 1/8. Our price 18/6. P. & P. 1/8.

CARBON MIKE INSERTS.

 Brand new, 2 1/2 in. dia., 3/6. P. & P. 9d.

STANDARD COLVERN 50K W/W Pre-set Pots.

 2 for 4/-, P. & P. 1/-.

T.C.C. SUPPRESSOR CONDENSERS.

 250 v. A.C. 0.05 + .005 x 1 in. tubular can 1 1/2 in. long x 1 1/2 in. dia. 2 for 3/-. Post free.

TRANSISTOR DRIVER AND O/P TRANSFORMERS.

 (Tapped 3 ohms and 15 ohms output), plus 4 suitable Transformers giving approx. 1 watt. output, 30/-, P. & P. 2/6.

CONDENSERS.

 5,000 mFd. 12 v. wkg. Size 3 x 1/2 in. dia. 2/- each. P. & P. 6d. each.

BRAND NEW PLESSEY 12-v. 4 pin non-async vibrators.

 Type 12 1.48D. **ONLY 8/6.** P. & P. 1/6 each.

3-PUSH BUTTON SWITCH UNIT.

 4 single pole changeover on each push-button. Approx. 3 x 1 1/2 x 1 1/2 in. An absolute Bargain at 4/6 each. P. & P. 1/6 each.

MARCONI QUARTZ CRYSTALS TYPE ZHB.

 Still available as previously advertised.

SPECIAL SPEAKER BARGAINS!

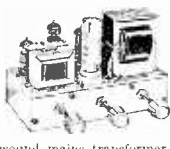
FEW ONLY 6 x 4 in. 3 ohm Speakers. Only 9/-, P. & P. 1/8 per speaker.

8 x 5 in. 3 ohm SPEAKERS by WELL KNOWN MAKER. Unrepeatable at only 10/6 each. P. & P. 1/8 per speaker.

A pair of these are ideal for Stereo.

BOLA CELESTION. Approx. 9 in. x 6 in. 3 ohm. Middle register speaker. 10/6. P. & P. 2/6.

**3-VALVE AUDIO AMPLIFIER
MODEL HA34**



Designed for Hi-Fi reproduction of records A.V. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2 in. w. x 4 in. d. x 4 1/2 in. h. Incorporated E.C.83, EL84, EZ80 valves, heavy duty double-wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 41 watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, P. & P. etc., wired and tested for only **£4.50** 4/-

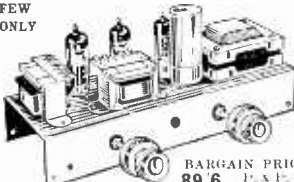
**TWO VALVE GRAM AMPLIFIER
ON PRINTED CIRCUIT BOARD**

(U785, UL84). Can be used with 80 v. tap off motor. O.P. Trans. volume and tone control. Size 4 1/2 in. wide x 3 in. deep x 3 1/2 in. high overall. ONLY 39/6. P. & P. 2/6. Mains dropper res. for filaments if required. 2/6 extra.

STEREO AMPLIFIER

Incorporating 2 ECL82s and 1 EZ80, heavy duty double-wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.

FEW ONLY



**BARGAIN PRICE
89/6** P. & P. 5/-

Also available complete with two 8 x 5 in. speakers for only £8.10/6. P. & P. 6/6.

**6 TRANSISTOR AND DIODE
SUPERHET**

A first-class 2 wave-band transistor superhet. ● Printed circuit panel (size 8 1/2 x 2 1/2 in.). 3 pre-aligned I.F. transformers. ● High-gain Ferrite rod aerial. ● All First-grade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions. ● All parts purchased at one time.

ONLY **£4.50** P. & P. 2/6.

35 OHM SPEAKERS

Suitable for use with above. 2 in. Goodmans. Ideal replacement for most pocket portables. 8/6 3 1/2 in. 12/6 3 in. 17/6 7 x 4 in. 21/-; P. & P. 1/6 per speaker.

Portable CABINET

Size approx. 9 1/2 x 6 1/2 x 3 1/2 in. Suitable for above using 3 1/2 in. speaker. 25/-; P. & P. 2/-.

**COIL AND TRANSFORMER SET
FOR TRANSISTOR SUPERHET**

3 I.F. transformers, one oscillator coil, one driver transformer and wound Ferrite aerial (mod. long and aerial coupling). 32/6 complete, post 1/-; 6 transistor printed circuit board to match. 8/6. Post 9/-; Circuit diagram 1/6 extra.

**SPECIAL
TRANSISTOR BARGAINS**

ALL BRAND NEW

UET 15 (Matched Pair) 15/-
OC71 5/- OC72 6/- U776 6/-
PXA101 6/8 XA103 6/8 V15 10/12/6
Set of Mullard 6 transistors, OC44, 2—OC45,
OC81D matched pair, OC81, 25/-.

EDISWAN MAZDA

R.P.1 Pack: 1—PXA102 Mixer: 2—PXA101 I.F. Amp; (Equip. OC44 and OC45). 10/6
R.P. 2 Pack: 2—PXA101 I.F.—PXA102 Osc.—PXA102 Mixer 12/6
L.P.6 Pack: Consisting of PXA103 Driver, Matched pair PXA171, mounted complete with heatshields (Equip. OC81D and OC81D). 12/6
ALL TRANSISTORS POST FREE

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. Size 7 1/2 in. w. x 2 1/2 in. d. x 3 1/2 in. h. This amplifier (with hi-fi unit) is £29 gu. record player employs E.C.83, EL84, EZ80 valves. Bass, treble and volume controls. Complete with output transformer matched for 3 ohm speaker. Ready built and tested.

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

ALSO AVAILABLE. Mounted on board with output transformer and 3 ohm speaker, ready to fit into cabinet head. PRICE 89/6. P. & P. 4/6.

**QUALITY PORTABLE RECORD PLAYER
CABINET**

Excellent motor board. Will take above amplifier and B.S.R. or GARRARD Auto-hanger or single Record Player Unit. Size 18 x 14 x 3 1/2 in.

PRICE £39.6 Carr. 5/-.

Superior CABINET To take 8 x 5 in. speaker, with motor board will accommodate BSR LA14 or UA16, £38.6. Carr. 5/6. speaker 10/8 extra. P. & P. 1/6 extra.

LARGE CABINET Similar to above with 3 ohm speaker. £38.6. Carr. 5/-.

4-SPEED PLAYER UNIT BARGAINS
All Brand New in Makers' Original Packing

SINGLE PLAYERS
B.S.R. TU 12..... £3.10.0. Carr. 3/6.
B.S.R. GU7 with unit mounted pickup arm £4.18.8. Carr. 4/-.

AUTO CHANGERS

B.S.R. UA14..... £6.2.6
Latest B.S.R. UA16..... £7.2.6
LATEST GARRARD AUTO-SLIM. With heavy duty 4-pole motor. FEW ONLY £7.7.0. (standard Auto-Slim £6.17.6). Carr. 5/- on each.

NEW CARTRIDGE BARGAINS!

B.S.R. TC83 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 67/8. OUR PRICE 24/-; P. & P. 1/-.
COLLARO HI-FI STEREO T/O CARTRIDGE. Type "C". Complete with universal bracket and stylus for Stereo, LP and 78. Original list price 58/8. OUR PRICE 28/-; P. & P. 1/-.

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

FURTHER HUGES PURCHASE enables us to offer these at

67/6 P. & P. 4/6.

Heavy 8 1/2 in. metal variable. Low flutter performance. 2000/50 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.



FOR THE HOME CONSTRUCTOR

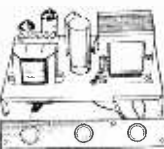
A really excellent all purpose A.C. mains 200/240v.

**AMPLIFIER KIT
TYPE HSL 'FOUR'
3 VALVE, 4 WATT
USING ECC83.**

EC84, EZ80 VALVES

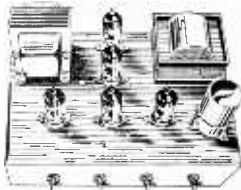
Special features include: ● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss ● Heavy negative feedback loop over 2 stages ensures high output and excellent quality with very low distortion factor ● Suitable for use with guitar microphone or record player ● Provision for remote mounting of controls or direct on chassis ● All this builds onto a chassis size only 7 1/2 in. wide x 4 in. deep. Overall height 4 1/2 in. ● All components and valves are brand new ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success ● Supplied complete with valves, output transformer (3 ohm only), screened lead, wire, nuts, bolts, solder etc. (No extras to buy) **79/6** P. & P. PRICE

Comprehensive circuit diagram, practical layout and parts list 2/6 (Free with kit).



10/14 WATT HI-FI AMPLIFIER KIT

A stylishly finished mounted 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, other controls and announcements to follow each other. Fully shielded section wound output transformer to match 32-15Ω speaker and independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, EC83, EB80 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts). All parts sold separately. ONLY **£6.19.6** P. & P. 6/6.

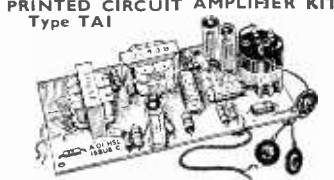


Also available ready built and tested complete with standard input jack sockets. £8.15.0. P. & P. 6/6.

**HIGH GAIN 4-TRANSISTOR
PRINTED CIRCUIT AMPLIFIER KIT
Type TAI**

● Peak output in excess of 14 watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3 in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (4ET114 or 81 Mullard OC81B) and matched pair of OC81 (p.p) ● No slot operation. ● Everything supplied, wire, battery clips, solder, etc. ● Comprehensive, easy to follow instructions and circuit diagram 1/6 (Free with kit). All parts sold separately. **SPECIAL PRICE 45/-** P. & P. 2/6

Also ready built and tested. 52/6. P. & P. 2/6. A pair of TAI's are ideal for Stereo.



● F.M. tuning head by a famous maker. ● Guaranteed non-drift. ● Permeability tuning. ● Frequency coverage 88 to 106 Mc/s. ● OAS1 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3 in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used EC85, two EF80's, and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5 1/2 in. ● All parts sold separately. Set of parts if purchased at one time **55.19.6**, plus 8/6 P.P. and the 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. 6/6.
Mark III Version as Mark I but with output stage (EL82) and tone control. £7.7.0. P. & P. 8/6. Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I, 25/-; P. & P. 2/6. To fit Mark II, 17/8. P. & P. 2/6.

HARVERSON'S F.M. TUNER MK. I

● F.M. tuning head by a famous maker. ● Guaranteed non-drift. ● Permeability tuning. ● Frequency coverage 88 to 106 Mc/s. ● OAS1 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3 in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used EC85, two EF80's, and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5 1/2 in. ● All parts sold separately. Set of parts if purchased at one time **55.19.6**, plus 8/6 P.P. and the 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. 6/6.
Mark III Version as Mark I but with output stage (EL82) and tone control. £7.7.0. P. & P. 8/6. Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I, 25/-; P. & P. 2/6. To fit Mark II, 17/8. P. & P. 2/6.

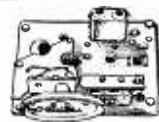


**SPECIAL PURCHASE!
TURRET TUNERS**

By famous maker. Brand new and unused. Complete with PC94 and PCF56 valves, 34.38 Mc/s I.F. Biscuits for Channels 1 to 5 and 8, 9. Circuit diagram supplied. ONLY 25/- each. P.P. 2/6.

F.M. TUNER HEAD

A permeability tuned tuner head by a famous maker, supplied without valve (EC85) and drum and spindle. 18/6, plus 1/9 P. & P. Valve 8/6 extra. Drum and spindle 3/6 extra.



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

SEE LEFT HAND PAGE FOR MORE ITEMS

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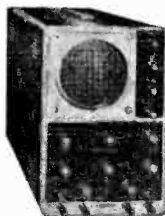


INSTRUMENTS FOR TEST,
SERVICE AND WORKSHOP

**With the clearly-written instruction manuals,
anyone can build any of these models—
have the world's best equipment — and save money**

DEFERRED TERMS ON ORDERS ABOVE £10. ALL MODELS ALSO AVAILABLE ASSEMBLED

TEST INSTRUMENTS



5in. OSCILLOSCOPE. Model 10-12U. Laboratory quality at utility oscilloscope price. Wide-band amplifiers essential for T.V. servicing, F.M. alignment, etc. T/B covers 10 c/s -500 kc/s in 5 ranges.

£41.10.0 Assembled **£32.12.6** Kit

PORTABLE 'SCOPE. Model OS-1. A compact portable oscilloscope, ideal for servicing and general work. Printed circuit board. Case: 7½ x 4½ x 12½in. long. Wt. only 10½ lbs.

£29.8.0 Assembled **£21.18.0** Kit

10-12U
ELECTRONIC SWITCH. Model S-3U. Converts a single beam oscilloscope into double beam operation.

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VALVE VOLTMETER. Model V-7A. The world's best selling VTVM. Measures up to 1,500 volts (d.c. and r.m.s.) and 4,000 pk. to pk. Res. 0.1Ω 1,000 MΩ. Centre zero dB scale, d.c. input. Resistance 11MΩ. 4½in. meter. Complete with test prods, leads and standardising battery.

£19.18.6 Assembled **£13.18.6** Kit

RF PROBE. 309-CU extends range to 100 Mc/s. Indication to 300 Mc/s.

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HV PROBE, HV-336 measures up to 30,000V d.c.

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RF SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental, 200 Mc/s harmonics. Up to 100 mV output on all bands.

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MULTIMETER. Model MM-1U. Ranges: 0-1.5 v. to 1,500 v. a.c. and d.c.; 150µA to 15A d.c.; 0.2Ω to 20MΩ. 4½in. 50µA meter.

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A wide range of other test instruments available including: R/C Bridge C-3U £10.10.0. AF Voltmeter AV-3U £16.10.0. Wattmeter AW-1U, £17.5.0. (Capacitance meter) CM-1U £15.15.0. Power supplies. Decade boxes etc. Many other instruments available under American Mail order scheme. Why not send for full details.

SSU-I SPEAKER SYSTEM



SSU-1

A practical solution to the problem of a moderately priced speaker suitable for Stereo/Mono amplifiers, where the equipment has to be compact. Two speakers, balance control, ducted port reflex cabinet.

Horizontal or vertical (without legs)

Incl. P.T. **£10.17.6** Kit

Horizontal or vertical (with matching legs)

Incl. P.T. **£11.12.0** Kit

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"OXFORD" LUXURY TRANSISTOR DUAL WAVEBAND RECEIVER. The ideal domestic, car or personal portable receiver. 10 Semi-conductors. Solid leather case. Send for full details.



Incl. P.T. **£14.18.0** Kit



UXR-1

6 TRANSISTOR PORTABLE. Model UXR-1. Prealigned I.F. transformers. Printed circuit, 7in. x 4in. high flux speaker. Real hide case. Very easy to build.

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7 TRANSISTOR PORTABLE. Model RSW-1. Two short, trawler and medium wave bands.

Incl. P.T. **£19.17.6** Kit

"MOHICAN" GENERAL COVERAGE RECEIVER. Model GC-1U. Excellent portable or general purpose receiver for "amateur" or short wave listening. See full spec. leaflets.

Assembled **£45.17.6** **£37.17.6** Kit



GC-1U

SEND FOR FREE BRITISH CATALOGUE
OVER 50 MODELS TO CHOOSE FROM

"AMATEUR" EQUIPMENT

AMATEUR BANDS RECEIVER Model RA-1. Covers all amateur bands from 160-10 m. Half lattice crystal filter. 8 valve. "S" meter, tuned R.F. amplifier stage.

£39.6.6 Kit

Assembled **£52.10.0**



RA-1

AMATEUR TRANSMITTER. Model DX-100U. Covers all amateur bands 160-10M. 150 w. d.c. input, self contained with power supply. Modulator, VFO.

Assembled **£104.15.0** **£79.10.0** Kit



DX-40U

AMATEUR TRANSMITTER Model DX-40U. Covers 80-10 m. Power inputs 75 w. C.W., 60 w. peak C.C. phone. Output 40 w. to aerial. Prov. for V.F.O.

£33.19.0 Kit

Assembled **£45.8.0**

Other kits in the amateur range include: SSB Adaptor SB-10U, £39.5.0. Variable freq. Oscillator VF-1U, £10.17.6. Balun Coil Unit, B-1U, £4.15.6. Grid-Dip Meter GD-1U, £10.19.6. Q Multiplier QPM-1, £8.10.0. Wide range of models under American Mail Order Scheme.

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GLOUCESTER,
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A member of the Daystrom Group, manufacturers of the WORLD'S LARGEST-SELLING ELECTRONIC KITS

THE WORLD'S BEST SELLING KIT-SETS

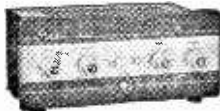


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Millions of Heathkit models are in use throughout the world because:—

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HI-FI AMPLIFIERS



6W STEREO AMPLIFIER. Model S-33. 3 w/chl. Inputs for radio, tape and gram. Stereo/Mono ganged controls. Sensitivity 200MV.

£18.18.0 Assembled **£13.7.6** Kit

6W DE-LUXE STEREO AMPLIFIER. Model S-33H. An inexpensive stereo/mono amplifier with high sensitivity. Suitable for use with Decca Deram cartridge.

£21.7.6 Assembled **£15.17.6** Kit

TAPE RECORD/REPLAY AMPLIFIER KITS. Will operate with most tape decks. Send for details.

TA-1M (Mono), £19.18.0 Kit TA-1S (Stereo), £25.10.0 Kit

18W STEREO AMPLIFIER. Model S-99. Ganged controls. Stereo/Mono gram, radio and tape recorder inputs. P/B selection.

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5W HI-FI MONO AMPLIFIER. Model MA-5. A low priced amplifier based on the S-33. Printed circuit construction makes it easy to build.

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HI-FI SINGLE CHANNEL AMPLIFIER. Model MA-12. Ideal for use with Models USC-I and UMC-I. 0.1 % THD at 10 W. Wide freq. range.

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OTHER MODELS

DE-LUXE LARGE SCALE VVM KIT, Model IM-13U.

a.c. and d.c. volts 0.1-1500v in 7 ranges. Ohms to 1000MΩ in 7 ranges 6" Meter. Modern styling with unique gimbal mount.



£18.18.0 Kit. £26.18.0 Assembled



PUBLIC ADDRESS AMPLIFIER. PA-1.

For vocal and instrumental groups, guitars, etc. 50 Watts r.m.s., output, 4 inputs, 2 loudspeakers in one compact unit. Send for full details.

£74.0.0 Assembled **£54.15.0** Kit

Set of 4 Legs 17/6 extra.

COMMUNICATIONS TYPE RECEIVER RG-1. A high performance low cost receiver for the discriminating listener. Freq.: cov. 600 kc/s-1.5 Mc/s and 1.7 Mc/s to 32 Mc/s. Send for details.

£53.0.0 Assembled **£39.16.0** Kit



SELF SUPPORTING AERIAL TOWER KIT. Model HT1. Ideal for Amateur Radio or TV reception. etc Strong steel construction, height 32 ft. tapered square section 3ft. x 3ft. at base.

Kit **£29.15.0** Oxide Painted. **£35.15.0** Galvanised. Accessories available. Send for details.

COTSWOLD SPEAKER SYSTEMS

STANDARD MODEL

Acoustically designed enclosure "in the white" 26 x 23 x 15 1/4 in. 12in. bass speaker, elliptical middle speaker, 2 in. pressure unit. Covers 30-20,000 c/s. Complete kit with all controls.



MFS SYSTEM

A minimum floor space model for the smaller room. 36in. high x 16 1/2 in. x 14in deep. Similar performance to standard model.



Price either model **£23.4.0** Kit

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Model FM-4U. Tuning range 88-108 Mc/s. Tuning unit (FMT-4U) with 10.7 Mc/s I.F. (£2.15.0 inc. P.T.). I.F. Amp. (FMA-4U) complete with cabinet and valves



Total **£15.18.0** Kit

AM/FM TUNER. Covers FM 88-108 Mc/s. A.M 16-50, 200-550, 900-2,000 m. Tuning heart (£4.13.6 inc. P.T.), and I.F. Amp.

Total **£26.10.0** Kit

EQUIPMENT CABINETS

A large range, in kit form or assembled and finished, available to meet most needs. Illustrated details on request.



Prices from **£6.19.6** to **£29.8.0**

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LEADING STOCKISTS OF MARTIN RECORDAKITS AND AUDIOKITS

MARTIN RECORDAKITS

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TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit, control and input panels, main output transformers, knobs, plans, screws, etc. EFS6, EY383, E290, E246 and 2 EL84, 3 watts output. Magic eye, Radio and Mic. inputs, ext. speaker socket, tone and monitor controls. Can be used as an amplifier £11.11.0
COLLAR STUDIO DECK. Very latest model. 3 speeds, 7in. spools £10.19.6
CASE for above with 8 x 5in. speaker, two-tone grey £5.5.0
COMPLETE KIT with tape and microphone... £26.0.0

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COLLAR STUDIO DECK fitted with Marriot "X" heads £17.17.0
TAPE AMPLIFIER FOR STUDIO DECK as described above but quarter track £12.12.0
CASE with speaker, two-tone grey £5.5.0
COMPLETE KIT with tape and microphone... £35.0.0

Dep. & Mthly. price of

MARTIN AUDIOKITS

The new Martin All Transistor Tea Watt Amplifier Kits represent excellent value for money. Each unit is complete, requiring only to be connected to the next. We show the four most popular units here. Others are available. Leaflets on request.

UNIT 1—FIVE INPUT SELECTOR. Size 31 x 5in. Mag. P.I. Crystal P.I. Radio, Mic. Tape head, 9.15 Volts. Must be used with unit 4. £27.8

UNIT 4—PRE-AMPLIFIER AND CONTROL. 6 x 24in. Volume on/off, bass and treble controls, 9.15 Volts. Must be used with unit 1. £32.6

UNIT 5—MAIN AMPLIFIER 10 WATTS. 6 transistor transformerless push pull output. Mounted on heat sink. 3 Ohms output. 24 Volts. £31.26

UNIT 6—POWER SUPPLY. 24 and 9 Volts. Heavy duty transformer, rectifier and smoothing. £22.18

CONTROL PANEL for unit 1 and 4. £10.6

ALL FOUR ABOVE UNITS FORMULA 1456 WITH PANEL. 3 Ohms output £14.5.0
 1456 with Wharfedale matching transformer 15 Ohms £14.18.6

Dep. & Mthly. price of

BRENELL TAPE EQUIPMENT

DECK Mk. 5 Series 2, half track, 4 speed £32.11.0
 AMPLIFIER for above with power pack £26.0.0

GRAMOPHONE UNITS, MOTORS, PICK-UPS

Decca Deram Arm and Plug-in Shell £5.5.0
 Decca Deram Transcription Cartridge £4.14.6
 Decca Deram Auto Cartridge £3.13.6
 Decca FFS Arm with stereo head £18.18.0
 Garrard SRP10 with Mono cartridge, single player £5.9.11
 B.S.E. UA14 with TCS Mono cartridge, 4-speed changer £18.19.6
 Garrard Autolim, Mono cartridge, 4 speed changer £17.0.0
 Garrard AT6 Antolim de Luxe, GC8 Mono cartridge £11.9.0
 Garrard 4H/F with Mono cartridge £17.0.0
 Garrard Lab Type "A" Transcription auto-changer, with Mono cartridge £19.14.9
 Garrard 301 Strobe £22.0.0
 Philips AG1016. Stereo cartridge, will change 7in records (adaptor 10/- extra) £12.12.0
 Goldring GL58 with arm, less cartridge £17.1.0
 Goldring GL70 with arm, no cartridge £27.3.4
 Goldring "88" Transcription, no arm £18.18.5

MONO AMPLIFIERS

Linear L45, 3 watt, 3 valve £5.19.6
 Linear Diatonic, 12 watt, suitable Mic. or Guitar £12.12.0
 Linear Conchord, 30 watt, ideal Guitar amp., with cover £13.0.0
 Dulco GA5, integrated amp., 5 watt, ECL86 valve £13.2.6
 Dulco DPA15, 15 watt with 2-valve pre-amp. £26.5.0
 Tripletone Hi-Fi Major with pre-amp. Suitable for Guitar or Mic, etc. £15.18.9
 Leak TL12, 10 watt Main amp. only £18.18.0
 Leak Varislope Mono pre-amplifier £15.15.0
 Quad, 15 watt Main amplifier only £22.10.0
 Quad, pre-amplifier, Mono £19.10.0

JASON F.M. and TV SOUND TUNER KITS

FMT1, complete with 4 EF81 valves £7.4.8
 FMT2, less power, complete with 4 EFS0 valves £9.4.6
 FMT2, with power, complete with 4 EF80 and 1 NZ80 £11.4.6
 FMT3, Fringe, complete with valves, less power £10.19.0
 FMT3, with power, complete with all valves £12.19.0
 JTV2, switched F.M. and TV sound, self-powered, all valves £15.12.6
 Mercury II, as JTV2 but less power, all valves £11.0.0
 Instruction book included in all kits. Available separately.
 2/6 switched 3/6.
 JTV/2 ready built, state channels £22.5.0
 Monitor, ready built as Mercury II £18.18.6

ARMSTRONG - NEW TUNER AMPLIFIERS

MONO

AF206 A.M./F.M. Radio chassis, base and treble controls, P.U. inputs, etc. £21.4.0
 227M A.M./F.M. Radio chassis, 10 watts £33.18.0
 223 A.M./F.M. Self-powered (Tuner only) £28.15.0
 224 F.M. only, self-powered Tuner £22.10.0

STEREO

Stereo 55 A.M./F.M. Radio Chassis, with Stereo gram inputs £20.19.0
 227 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel £43.15.0
 228 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel, Filter, Magnetite pick-up, etc. £56.0.0

OTHER TUNERS

Tripletone F.M. Tuner, less power £12.18.6
 Tripletone F.M. Tuner, self-powered £15.14.6

STEREO AMPLIFIERS—VARIOUS

Armstrong 222 Integrated, 10W per channel £27.10.0
 Dulco GA505, integrated £18.18.0
 Rogers Cadet Mk. 2 with pre-amplifier, 4 12.1.5 valves £28.15.8
 Leak Stereo 20 Main amplifier £30.9.6
 Leak Varislope 2 stereo pre-amplifier £25.0.6
 Quad 22 Stereo Control Unit £25.0.0
 For Quad Main Amplifiers see Mono section.

LOUDSPEAKERS

Goodmans Axiote £5.5.7
 Goodmans Axiom 10 £6.5.11
 Goodmans 5K/20/XL £7.7.0
 Goodmans XG 500 cross-over £20.11.1
 Goodmans Axiom 201, 12in. unit £10.17.4
 Goodmans Axiom 301, 12in. unit £15.4.6
 Wharfedale Super S/RS/DD £6.14.2
 W.B. HF1012 10in. £4.7.6
 FANE 12in. Unit, 30 watt £5.5.0
 Wharfedale W12/EG 12in. 15 watt Lead Guitar speaker £10.10.0
 Wharfedale W15/EG 15in. 15 watt Bass Guitar speaker £17.10.0
 Wharfedale Super 10/RS/DD 10in. high quality unit £10.18.0
 Wharfedale RS/12/DD 12in. 15 watt Hi-Fi £11.10.0

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SURBITON PARK RADIO LTD.

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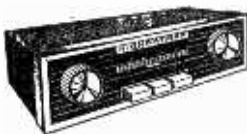
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STERN-GLYNE

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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-pull outputs. ★ Three latest Mullard transistors plus valves types 6BF8 and 6CH83. ★ 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 £1.2.6. (Plus 5/- P. & P.)

Star Features ★ Handsomely Styled. ★ Mullard Valves and Transistors. ★ Push Buttons. ★ 1½ 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, 2/43", 29/6, both plus P. & P. 2/6 if purchased separately.



THE WORLD AT YOUR FINGERTIPS!!

THE HE-30 4-BAND COMMUNICATION RECEIVER

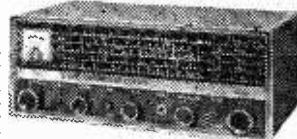


One of the finest general coverage bandspread receivers available at this price. Covering 550Kc/s—1600Kc/s. 4.8Mc/s—14.5Mc/s. 1.6Mc/s—4.8Mc/s. 10.5Mc/s—30Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter, 0-100 logging scale, coverage from 0.65—30Mc/s. 8 valve plus Rectifier super-het circuits. RF stage with an Aerial Trimmer. 2 IF Stages. B.F.O. control Q-multiplier. Controls: Function Switch, Audio Gain, Selectivity (Q-multiplier) Frequency (BFO), Band Selector, IF Gain, Trimmer, AVC-MVC Switch, Ant Switch, Main Tuning, Bandsread Tuning and Head-phone Jack. Selectivity—60dB at 10Kc/s. 0.8Kc/s at 6dB (with Q-multiplier) IF-455Kc/s. External PM Speaker reqd. 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. 50-80 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E.

PRICE **40 Gns.** Carriage Paid

THE HE-40 4-BAND COMMUNICATION RECEIVER

Completely built and ready to go. High sensitivity Superhet receiver covering 550Kc/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 tuner. 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 1/2in. x 8 1/2in. x 5 1/2in. (high) and weighs only 11½ 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

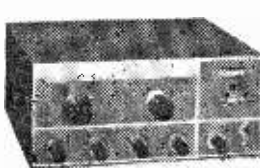


The HE-80 has outstanding sensitivity. 0-100 logging scale for instant re-set, built-in "S" meter special recording jack, remote Control Socket allowing simultaneous control with transmitter. 100Kc crystal oscillator circuit providing accurate harmonic signals of either 4 or 8 ohms impedance. Two headphone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

TECHNICAL SPECIFICATIONS.
 Frequency Coverage: Band 1 540—1005Kc; Band 2 1.6—4.8Kc; Band 3 4.8—14.5Mc; Band 4 10.5—30Mc; Band 5 144—146Mc/s. Band Spread (Ham Band directly read): 80 Metre Band; 40 Metre Band; 20 Metre Band; 15 Metre Band; 10 Metre Band. Sensitivity: 1 micro-volt for 10dB signal to noise ratio. Selectivity: Normal 10Kc at —75dB. 1.25 at —60dB. With Q-multi: variable to 700 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: 60 watts. Audio Output: 1.5 watts, 8 or 500 ohms impedance. Auxiliary Circuit: Electrical Bandsread, Q-Multiplier, ANL, AVC-MVC, BFO, 100Kc crystal calibrator. Valve Line-ups: 4—6AQ6, 6BL6, 3—6BA6, 2—6BE6, 4 or 8, 6AL5, 6AQ5, 6A2, 6CA4. Dimensions: 17in. wide, 6 1/2in. high, 10 1/2in. deep.

PRICE **59 Gns.** Carriage Paid

"STARLITE TRANSMITTER"



Designed to meet the needs of most amateurs the Starlite has single-knob bandswitching. 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-clock 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—crystals or VFO Control; Band coverage: 80-10 metres; Coupling: Pi-network; Valve Line-up: 4146, (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 CFS. 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.

KIT OF PARTS **£6.60** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-).
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 1/2 x 4 1/2".

KIT OF PARTS **£10.00** (Carr. & Ins. 5/-). ASSEMBLED AND TESTED **£13.13.0**
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.) **£10.00**
ASSEMBLED AND TESTED **£13.13.0**
(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 600mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus power available for Tuner

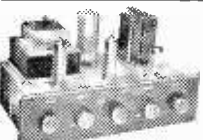
COMPLETE KIT **£12.00**
ASSEMBLED AND TESTED **£16.00** (Carr. & Ins. 7/6).
With PARTRIDGE OUTPUT TRANS. **£1.6.0** extra.
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.



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 73 and



L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. Please state L.S. impedance.
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE "10NO-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** Assembled and Tested **£6.00.0**



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 1,200-2,000 Metres. VHF 87-100Mc/s.

Incorporating internal Ferrite Rod Aerial and the famous Gorler Tuning Heart for VHF.

Pick-up input suitable for most modern Record Players. Power output 4 watts, valve line up E180, E18C80, EF86, ECH71, EL64, 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 1/2 x 6 1/2". P. & P. 5/-.

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

PRICE **16 Gns.**

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 1 1/2, 3 1/2, and 7 1/2" speeds. Complete with microphones 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 TRUVON, BRENNELI, or COLLARO "STUDIO" 1 and 4 track Stereo Decks. Incorporates Ferrux-cube Oscillator. 4-speed Equalisation Signal Lever 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 3/- Post Free.



TAPE PRE-AMPLIFIER MULLARD Type "C"

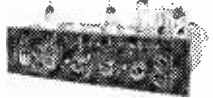
Suitable for most 1 track. Mono Tape Decks. Incorporates Ferrux-cube Push-Pull Oscillator. Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit. KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**
Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.



MULLARD TAPE AMPLIFIER

MODEL HF/TR3/MK II Based on Mullard's Type "A" design and suitable for most 1 track Mono Tape Decks. Incorporates Ferrux-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, Brenneli 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, £44.2.0.		
STP-1 with Brenneli Mk. 5 Series II with Track Switch fitted.....		
STP-1 with Brenneli Mk.5 Series II, 1 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 Brenneli Mk.5 Series II Deck.....	£48.11.0	£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 Brenneli 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 values. 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

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, EBF89, EB91, EM84. ECC83 Multiplex outlet provided. Pre-amplifier—Designed for use with 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 50K 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 r.m.s. for 14 watts output, frequency response $\pm 0.5dB$ 20 c/s. —20Kc/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—6Z4.

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

* 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.

KIT OF PARTS **£10.00** C. & I.
READY BUILT **£13.13.0**

* DOUBLE FEATURE PRE-AMPLIFIER



Inputs for microphone, crystal or magnetic pickups, 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. Tape erase Bias Oscillator circuit incorporating ferro-cube 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 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 are purchased together:

KIT OF PARTS **£23.13.0** READY BUILT **£32.0.0** C. & I. 10/-

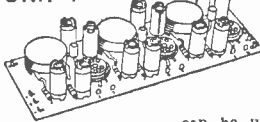
ACOS MONAURAL STETHOSCOPE HEADSETS
Suitable for Tape Recorders, or monitoring tape recorders. 100 ohm impedance magnetic. Complete with lead. **12/6** P. & P. (Originally 21/-). **OUR PRICE 12/6** 1/6

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.

UNIT 4



can be used on A.C. mains with Martin power supply unit.

Following Audiokits available:—
Unit 1.—5-Stage Matching Input Selector Unit. 47/3.
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. 82/6.
Unit 5.—10 watt Main Amp. (3 ohm o/p imp. only at present). £5.12.6.
Unit 6.—Power Supply Unit. £2.12.6.
P. & P. extra on above items. Full range of attractive perspex enclosures available. Send S.A.E. for fully descriptive literature.

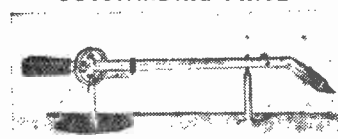
HI-FI STEREO HEADPHONES

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—18 ozs.



PRICE **5 Gns.** P. & P. 2/6.
(Junction box 15/- ex.)

OUTSTANDING PRICE REDUCTION



THE B. & O. ST/L PICKUP COMPLETE WITH SP 11 STEREO DYNE 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: $\pm 2.5dB$ from 30 c.p.s. to 15 K C. Output Voltage: 7mV per channel at 5 cm/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: 7 μ . Recommended Load: 47000 ohms. **9 1/2 Gns.** Plus 3/6 P. & P. PRICE

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.	PADdington 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 7941	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. 3/5 Eden Grove, Holloway, London, N.7.

BELLING & LEE SPARK MASTER

1. Reduces plug burning.
 2. Eases starting from cold.
 3. Minimises pinking.
- 2/6 each. P. & P. 6d.



LEAD ACID ACCUMULATORS (Unspillable)

2 volts at 16 A.H. Brand New. Size 4 x 7 x 2in. 4/11 each. 3 for 12/6. P. & P. 9/- per cell.



9v. BATTERY CHARGER AND A.C. ELIMINATOR MODEL LA. 6P.

A "must" for every transistor set owner. Save those batteries by running your transistor set direct from AC mains this summer. Reactivate all your old P.P.3 batteries. Unit contains neon indicator and standard battery connections with nearly 2 yards of mains leads and plug. Also snap cord for connection to set.

NOW ONLY **19/6** P. & P. 2/6

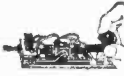
STABILISED POWER UNIT

A valuable unit, containing Mains Transformer with optional input 50 volts, 110 volts, and mains standard input voltage at 50 c/s. Output 6.3 volts at 750 m.a., 380 volts, centre tapped 6X5 full wave valve rectifier. Parrocco 15h smoothing choke, 8 mid smoothing condensers. Plus neon stabiliser valve. The whole assembly being mounted on a compact chassis. An ideal stabilised supply for the constructor for use in transmitters, model control, Hi-Fi equipment, and test equipment.

Price **49/6** P. & P. 3/6.
With polished sturdy wooden cabinet and mains lead. Price **59/6** P. & P. 9/-.

MORSE KEYS

Morse key assembly. Key with base, cover and terminals. Complete with lead.



6/11 P. & P. 2/-
2 Morse Keys for 12/6. Post free.

HIGH IMPEDANCE PERSONAL LISTENING EARPICES

Suitable for all types of crystal sets and transistor sets. Complete with plug. Price **4/11** P. & P. 6d.

HI-FI GTSO RADIO JACK

MAKE A RADIO RECEIVER OUT OF YOUR AMPLIFIER. Full medium wave coverage. Ideal for all tape recorders, amplifiers, etc. No batteries required—just plug in.



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 TCX Metal Encased Block Condensers size 4 1/2 x 2 1/2 x 1 1/2 in. value 8md 350 v. working. Three paxitola 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 RF choke on stand, suitable for transmitting circuits. Three Brand New 87G 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.

DYNAMOTOR

Run all your mains AC/DC equipment from your car battery. 5v. input gives 250v. output, or 12v. input gives 500v. output at 30 watts. Very low battery drain. Size only 3 1/2 in. x 3 1/2 in. A must for the caravaner. **25/-** P. & P. 3/6

NO. 19 SET INSTRUCTION HANDBOOK 3/11 each

1155 INSTRUCTION HANDBOOK 3/11 each P. & P. 3d.

NO. 19 SET 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. (150-87 meters).

For R.T. C.W., or M.C.W. Range on R.T. 15 miles. C.W. 50 miles. Superhet R.X., I.F. 465 Kcs. R.F.O. etc. R.N. valve line-up: 6K7, R.F.: 6K8 mixer, 2 6K7 I.F., 6K8 det. A.P. phone output. T.X.: 6K8 mixer, R.F.O., E-550 buffer, EH34 A.D. and output stage, which has to be de-commissioned to conform with C.P.O. requirements. Transmitter/Receiver 225/241 Mc/s. Local use up to 1 mile. Valve line-up 6X5, 6K7 and 6V6. Intercom set valve 4A2 amplifier for vehicle crew inter-communication. Valve line-up 6K7 and 6V6.

A 2 1/2 in. meter is built in reading L.T. and H.T. voltages, drive etc.

POWER UNIT. 12 volt DC input. Output 275 volts 110 m.a. and 50p volts 50 m.a. Equipment is of American or Canadian manufacture and is supplied in good condition. **£4.10.0**

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

- Accessories
Handbook 3/6 P. & P. 6d.
Connectors 12 pin 12/6 P. & P. 2/6
9 pin 7/6 P. & P. 2/6
Carriage 10/-.
Control Boxes Single, new 6/6 P. & P. 2/6
Whip Aerials 9ft. 6in. 7/6 P. & P. 2/6
5ft. 4/6 P. & P. 2/6
Aerial Bases (Fits all types) 5/11 P. & P. 2/6
Headphones and Mike 12/6 P. & P. 2/6
Headphones less mike insert 5/- P. & P. 2/6

TRANSISTOR SALE

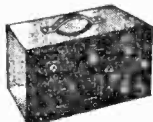
- Mullard OC44 (P. & P. 3d.) 3/11
Mullard OC45 (P. & P. 3d.) 3/11
Mullard OC71 (P. & P. 3d.) 2/11
Mullard OA50 (P. & P. 3d.) 1/11
Ediswan N D202 Germanium diodes (P. & P. 3d.) 1/11
Mullard OA79 (P. & P. 3d.) 1/11
Transistor holder 3-pin (P. & P. 3d.) 11d. each

MICRO ALLOY TRANSISTORS

- Mat 100 7/9
Mat 101 8/8
Mat 120 7/9
VHP Transistor ADT 140 15/-
Above MAT's postage paid.
Ferrite Slab Aerials suitable for transistor sets 3/- P. & P. 6d.

CRYSTAL CALIBRATOR No.7 MK.1

Using 6 valves, a 1 Mc/s crystal osc. is used to synchronise 2 multi-vibrator osc. operating as 10 Kc/s and 100 Kc/s respectively. Harmonics of 10-100 and 1,000 Kc/s are available up to 20 Mc/s. far beyond this on any sensitive set, modulator also incorporated for receiving. In small Bakelite case with carrying handle, power 2 v. L.T. 80-120 v. H.T. Circuit and instructions supplied. Brand new. **£2.15.0** P. & P. 5/6.



SENSITIVE MULTIMETER



20,000 ohm per volt, 1% resistance used throughout. Single control system for all ranges. Compact and lightweight. Highly accurate. **£5.10.0** P. & P. 5/-.

BATTERY CHARGE ADJUSTERS

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

ALTIMETER TRANSMITTER RECEIVER AN PN

Frequency approximately 400 to 700 Mc/s. Transmitter Containing two 9004 acorn valves and moving coil transmitter modulator unit.

A.F. AMPLIFIER Containing two 12BH7 and one 12BL7 valves. The above chassis are housed in a black crackle case which contains three relays Resistors, Potentiometers, and the following valves: 3-12BH7, 1-12BH7, 1-VR150/30 and 2-12H6's making a total of 14 valves in all. A Dynamotor Unit is also incorporated. Ideal for radio control work, etc. Price **55/-** P. & P. 7/6.

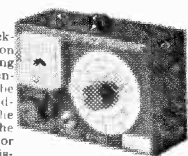
MAINS TRANSFORMERS

Input 200-250v. secondary tapped as follows: 3v, 4v, 5v, 6v, 8v, 9v, 10v, 12v, 15v, 18v, 20v, 24v, 30v, at 4 amps. BRAND NEW not government surplus **35/-** P. & P. 3/6.

FILAMENT TRANSFORMERS

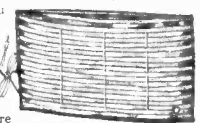
200-250 v. input. 50 c/s. Output 6.3 v. at 2 amp. **6/11** P. & P. 1/6.

RF FIELD INDICATORS



Designed for check the radiation from a transmitting antenna. The sensitivity can be controlled by adjustment of the panel control, the antenna length, or by increasing distance from the radiator. Frequency range 1-25 Mc/s. 200mA. DC. Complete with instruction book. Post free. **69/6**

PILLOW SPEAKER



Listen while you laze with the revolutionary pillow speaker—the very latest novelty. An inflatable cushion with a built in miniature loudspeaker which will plug into transistor portable. Ample dex provided with plugs. P. & P. 2/6. Price **25/-**

TRANS. RADIO TUBULAR SPEAKER



Booster Speaker. Plugs into car-piece socket of most radios and tape recorders. Gives double the volume and a high stereo effect.

that will amaze you, size Approx. 9 x 3 1/2 in. PRICE **25/-** P. & P. 1/9.

TRANSISTOR BATTERIES

Save pounds this summer. PPS type replacement. 6 for 10/- P. & P. 1/9. 12 for 18/6. P. & P. 2/6. Limited stocks.

SPECIAL OFFER

Portable Hawaiian Record Players now half price. **£4.76** while stocks last.

VHF AIRCRAFT TRANS REC. TYPE TR -

Receive aircraft fire/ambulance. New Air Ministry release. An aircraft trans rec. containing 21 valves, carbon pile regulator, FM, IF Strip. Multi-ganged tuning unit. Frequency coverage: 124.5 mcs., 133 mcs., 145 mcs., 156 mcs. All in excellent condition. Working from a 24v. rotary transformer contained in the unit. Only 100 in stock. A bargain at

75/- Post free

OPERATOR'S UNIT

Huge purchase enables us to offer at give away price Operator's Unit, containing standard jack socket, 250 mfd electrolytic condenser, 4-way telephone socket, midgeet selenium rectifier, etc. Price **2/6**. P. & P. 9d.

SYNCHRONOUS VIBRATOR PACKS

Compact unit with 6v. input 250v. D.C. output. Suitable for powering receivers, etc. Price **17/6** P. & P. 4/6.

POWER UNIT AND LF AMPLIFIER

In good condition, employing current type B7G valves and built-in vibrator pack. 12v. operation. Suitable for powering 88 sets, etc. Price **39/6** P. & P. 5/-.

SURPLUS VALVES

807, 6B8G (new), 6K7G, 6K8G, EF50, 6H6, EB34, 1L4 (new), DA90 (new), DF92 (new) Price all 2/6 each. P. & P. 9d. each 2 for 4/6.

FOUR IMPORTANT RADIO BOOKS

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

TELEPHONE ADAPTOR

Fits exterior of telephone by means of suction pad enabling 'phone messages to be fed to any audio amplifier. Price **10/6**

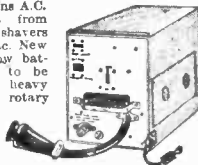
NEW SHOP PREMISES NOW OPEN AT HALFORDS ARCADE, LOWER BRIGGATE, LEEDS. OPEN ALL DAY SATURDAY WE ARE PLEASED TO INFORM READERS THAT WE CAN NOW OFFER A 48 HOUR DESPATCH SERVICE.

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



12 Volts CONVERTOR to 240 Volts

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



12 volts to 240 at 100 ma. BRAND NEW tested in waterproof cartons. **ONLY 35/-**. P. & P. 5/-.

BM3/SONA STREAMLINE MICROPHONE STANDS

TYPE 1 Heavy metal base. Black gloss finish. 7/6. P. & P.

TYPE 2 Chrome finish. Telescopic desk stand extending to 12in. height, heavy black gloss base. 25/- P. & P. 3/-.

TYPE 3 Floor stand, 3 sections. Chrome finish. Heavy base. 55/- P. & P. 3/-.

SPECIAL OFFER

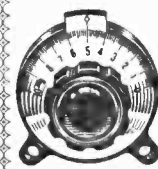
High Impedance lightweight headphones ideal for crystal sets. Only 11/- per pair or two pairs for **£1**. P. & P. 1/6 each.

MORSE PRACTICE OSCILLATOR KIT

A transistorised multivibrator measuring only 2 1/2 x 1 1/2 x 4 1/2in. Fundamental output frequency 1,000 c/s. Battery drain only 3 ma. Simple instructions included. Complete with earpiece. Price **39/6**. P. & P. 1/-.

TSL GORLER SUPER VHF FM TRANSDORISED TUNING HEART

Type 312-0015 or 0029 uses one AF 106 and one AF 125 Super (twin) Transistor plus 2 diodes in ultra high RF plus additive mixer circuit. Tuning range, 87-108.5 Mc/s. Amplification greater than 35 db. Built in A.P.C. and A.G.C. Size 4 x 1 1/2 x 1 1/2 in. **£6.50** including Purchase Tax. Post free.



VERNIER DIALS

Precision vernier dials with approx. 8 to 1 ratio. Surface mounting. Accurately centred metal insert for pin shaft. Reads counter clockwise 0-100 in 180°. Model T:503 3in. dia. **16/-**

LOW IMPEDANCE EARPHONES

Used but working. Price 4/11. P. & P. 2/9.

TEST OSCILLATOR TYPE 4

Frequency range 20 to 100 Mc/s in two bands selected by plugging in the appropriate coop 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. H.F. 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, condenser, valves, transformer, chokes, resistors, etc. A neat compact unit in grey enamelled case 16 1/2 x 7 x 3 1/2 in. with carrying handle. **39/6** P. & P. 5/-.

TRANSISTOR SIGNAL INJECTOR

Produces an audio signal rich in harmonics through the R.F. range. Ideal for fault testing in Radio circuits. Push button controlled by torch. No bigger than a small hand torch. Made by Eagle products. Just the job for the serviceman. **39/6** Post free

UNIVERSAL PLUG

Plug into all sockets with the NEW UNIVERSAL PLUG. Saves money. Saves time. Fits all 13, 15 & 3 amp. 2 pin, 3 pin sockets and adaptors. Easily adjustable. Robust construction. Only 12/6. P. & P. 11/-.



DEEP DOUBLE POUCHES

Deep double pouches in jungle green with shoulder strap. Made of heavy canvas. Dimensions of each pouch 10 x 4 x 1 1/2 in. Fitted with quick release buckle. Useful for carrying tools, maps, small flash cells. No bigger than a small hand torch. Price 2 for 3/- P. & P. 1/6.

DOUBLE THROAT MICROPHONES

Brand new. Can be adapted for use with musical instruments. Price 5/11. P. & P. 1/6.

RESISTORS

Special offers. High quality 1/2 watt resistors. All preferred values (state values required). 10Ω-10 meg. ohm. 3/4d. each, 6 for 1/8, 12 for 1/9, 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.

SONA STREAMLINE BM3 MICROPHONE CRYSTAL INSERTS

Price 7/6. P. & P. 9d.

SNIP LINE

Plug in Discriminator Units. Used as pulse count demodulators for FM. Compact, lightweight unit approx. 4 x 2 1/2 x 1 1/2 in., containing 185 valve. FM demod. coil, tag board with 6 miniature capacitors and 6 miniature resistors. Price **15/-** P. & P. 1/-.

GOVERNMENT SURPLUS MULTI RATIO OUTPUT TRANSFORMERS

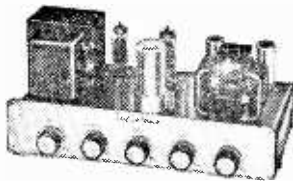
Robust and Compact. Price 4/11. P. & P. 1/6.



TRADE SUPPLIED
ORDERS FROM
ABROAD WELCOMED
Telephone 34708

SONA ELECTRONIC CO. (Dept. PW7), BRIGGATE HSE, 13 ALBION PL., LEEDS

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 dB. Separate Bass, Middle and Treble lift controls. Valve line-up 12AN7, 12AN7, EL84, EL84 and EZ1. Push-pull output with matching to 3 or 15 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: 14 in. x 9 in. x 7 1/2 in. 30/- extra.

New Boxed VALVES 90-day Guaranteed

024	1/2	6K7	5/-	EB91	4/-	PCF82	8/-
1R2	6/-	6K8	5/-	EB41	5/-	PCF82	10/-
1R5	6/-	6L6	6/-	EB81	8/-	PCF84	10/-
1T1	3/-	6N7	5/-	EBF80	9/-	PL14	10/-
2X2	2/-	6Q7	6/-	EL142	9/-	PL13	8/-
354	7/-	6S7	6/-	EL81	8/-	PL33	15/-
3X4	7/-	6X6	6/-	EL80	8/-	PS80	8/-
3Q3	7/-	6N4	5/-	EL22	10/-	PS11	8/-
3Y4	6/-	6A5	6/-	EL75	6/-	PS22	7/-
5Y3	6/-	12AT7	6/-	EPF86	10/-	SR41	3/-
5Z4	9/-	12AT7	6/-	EPF89	8/-	SR61	3/-
6A4	7/-	12AX7	7/-	EL32	5/-	TR2	7/-
6AM6	4/-	12BH7	7/-	EL24	7/-	TR41	8/-
6AT6	6/-	12K7	5/-	EL51	9/-	TR81	9/-
6BA6	7/-	12K8	14/-	EL56	9/-	TR89	9/-
6BE6	5/-	12Q7	7/-	EL24	7/-	TR81	9/-
6BR5	7/-	25Z4	9/-	EL20	7/-	TR82	10/-
6C4	5/-	5Y3	6/-	EL28	7/-	TR82	12/-
6D6	5/-	5Z4	5/-	HVR8010	9/-	TR89	9/-
6G6	4/-	5Y4	2/-	HVR2A	5/-	UL11	9/-
6H6	3/-	12AP6	8/-	KTR30	8/-	UL41	7/-
6I5	5/-	12P6	8/-	KTR7	8/-	US5	7/-
6L6	5/-	12K9	6/-	M14	7/-	UL11	7/-
6L7G	6/-	DL96	8/-	PCV4	8/-	VR150	7/-
6K6	5/-	EA180	8/-	PCF80	8/-	WR1	6/-

I.F. TRANSFORMERS 7/6 pair
45 Kc/s Tuning Miniature Case 2 1/2 x 1 1/2 in.
High Q and good bandwidth. Data sheets.

NEW ELECTROLYTICS

TUBULAR	TUBULAR	CAN TYPES
1350V	2/-	50/350V 5/8 8000V 9/-
2350V	2/3	100 25V 3/- 16/500V 12/-
4350V	3/3	250 25V 3/- 16/600V 12/-
8450V	2/3	300 12V 3/- 16/1500V 7/6
16450V	3/4	1000/12V 3/- 50/450V 6/6
32450V	3/4	3000 6V 1/- 32/32350V 5/-
25/25V	1/8	32/450V 6/6
25/50V	2/-	32/450V 6/6
50/25V	2/-	32/450V 6/6
50/50V	2/-	32/450V 6/6

TELESCOPIC CROWE AERIALS. 13 to 43in. 8/6.
TRIPLEXERS Bands I, II, III, 12/6. COAX PLUG. 1/6.
LEAD SOCKET. 2/-. PANEL SOCKETS. 1/-.
OUTLET BOXES (Surface or flush). 4/- ea.
BALANCED TWIN FEEDER var. 6d. 50 or 300 ohms.
TWIN SCREENED per yd. 1/-. 50 ohm only.
WIRE-BOUND EXT. Speaker Control. 10/3 3/4. 25 Ω 6/6.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Types. All values to 10 ohms to 25 K. 3/- ea. 30 K. 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. 8d.; 100 pF. 150 pF. 1/3; 250 pF. 1/8; 500 pF. 750 pF. 1/8. TV etc. TRIMMER. 1000 pF. with knob. 2/-.
RESISTORS. Preferred values to 10 meg. 1/4 w. 4d.; 1/2 w. 8d.; 1 1/2 w. 8d.; 2 w. 1/7. High Stability. 1/4 w. 1%. 2/-. Preferred values 10 Ω to 10 meg. 10 Ω to 5 Ω 10 Ω to 22 meg. 8d. BRIMSTONS. CZ1. 3/6; CZ2. 2/6; CZ3. 1/6.
5 watt } WIRE-WOUND RESISTORS { 1/3
10 watt } 10 ohms-10,000 ohms { 2/-
15 watt } 10 ohms-10,000 ohms { 2/-
12.5 K to 25 K 10 w. ... { 3/-

Volume Controls
Linear of Log Tracks
Long spindles. Midset
5 K ohms to 2 Meg
L.S. 3/-. 1 1/2
Stereo. 110/6; D.P. 14/6
1m. log + 1m. A. log. 7/6

80 ohm COAX CABLE
Semi-air spaced 1in.
40 vds. 17/6
50 vds. 25/-
6d.yd.
Ideal 625 lines.
Low loss 5dB
100ft. 500 Mc/s 1/6 yd.

MAINS TRANSFORMERS 200/250 v. A.C.
Postage 3/- each transformer.

STANDARD. 250-0-250. 80mA. 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier. 6.3 v. 1 a. 3 v. 2 a. or 4 v. 2 a. 22/6. ditto. 350-0-350 29/6

MINIATURE 200 v. 20 mA. 6.3 v. 1 a. 10/6

MIDGET. 220 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. 60 mA. 6.3 v. 3.5 a. ... 22/6

HEATER TRANS. 6.3 v. 1 1/2 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, 18, 24, 30 v. ... 22/6

AUTO TRANSFORMERS. 150 w. ... 22/6

0, 115, 200, 250, 250 v. 500 w. ... 82/6

MULLARD "510" Mains Transformer ... 33/6

MAINS POWER PACKS. Ready built with Transformers, Rectifiers, Condensers, providing H.T. and L.T. outputs.

200 v. 20 ma. D.C. 6.3 v. 1 a. D.C. ... 25/6

220 v. 50 ma. D.C. 6.3 v. 2 a. A.C. ... 35/6

250 v. 80 ma. D.C. 6.3 v. 3.5 a. A.C. ... 45/6

TRANSISTOR TYPES TO REPLACE P.P.3. 21/- also 2 v. 200 ma. replica batteries P.P.1-4-7-9 same size as P.P.9. 45/-

INTERVAL TRANSFORMERS. 3/1 or 5/1. 9/-
O.F. TRANSFORMERS. Heavy Duty. 5/8. No. ratio. 7/6. Multitap heavy duty push-pull. 10 w. 15/6. Battery. 4/6. Sub. min. 5/8.

10w. O.F. matchbox trans. 3, 7, 15 Ω 12/6

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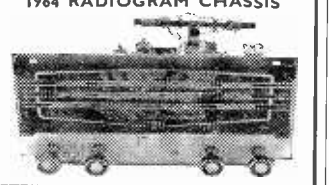
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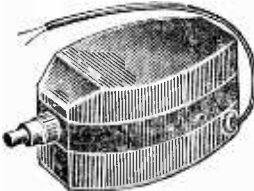
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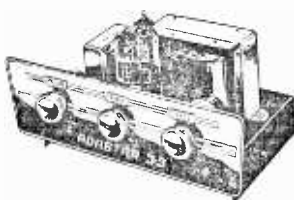
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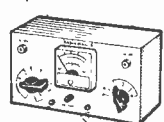
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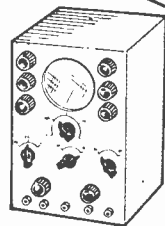
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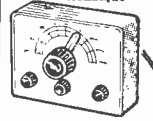
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Practical Wireless

Vol. XL No. 689 JULY, 1964

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The Role of Broadcasting

THE recent events subsequent to the appearance of those electronic buccaneers Radio Caroline and Radio Atlanta have raised many interesting points. At the time of writing, the situation is still unresolved, although the fate of these floating "discophoriums" seems sealed by way of restrictive legislation. However, we do not intend to enter into the rights and wrongs of the affair, but to follow certain trains of thought.

Casting aside, therefore, any legal, moral or cultural considerations, it becomes manifestly clear that there exists a quite considerable public for the type of wares dispensed by Caroline and her sister craft. If there was ever any doubt, confirmation came by way of the extraordinary announcement from the BBC that their Saturday afternoon sports broadcasts on the Light Programme would be replaced by Caroline-type continuous pop music. Coming at the height of the controversy this was not only an admission of the drawing power of such broadcasts but even gave the impression of a panic measure.

Having established the existence of the demand for continuous pop music (though how any devotee can listen to more than one station at once is baffling, for we already have Radio Luxembourg and others) let us go a stage further.

On a recent TV interview, a spokesman for Radio Caroline talked of a great and general requirement for continuous background music with the minimum of interruption. His point (which is shared by others) was that TV is the medium for those wishing to sit and concentrate, whereas radio should be relegated more and more to providing only a non-stop supply of music which can be turned on and off like a tap.

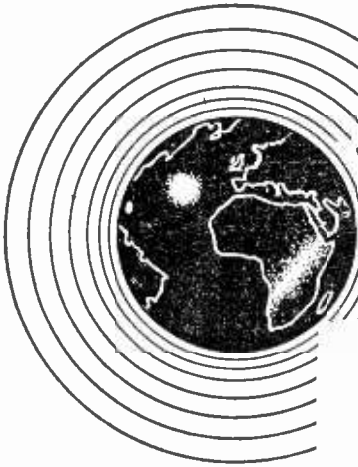
So now we come to the fundamental issue: should this be the ultimate role of broadcasting?

The fact that pop music is cited is irrelevant; it could as well be any kind of music—indeed, so far as some are concerned, even perhaps traffic noises or sound effects! The need, apparently, is to soak continually in sound like blotting paper.

Transistor radios, due to their advantage of portability, have unfortunately contributed something to this morbid craving for background music, or noise. It is common enough to hear them being played loudly while the "audience" virtually ignores its efforts to entertain. We see the same thing in other places where somebody will feed a juke box with coins, only to become completely oblivious (perhaps wisely) to the less-than-hi-fi being pounded out, except in attempting to converse above the level of distorted watts. We also see it in the vogue for piped music at railway stations, in restaurants, clubs, pubs, lifts, etc. We shudder to think where it might be encountered next!

This pathological craving for noise for the sake of noise is a symptom of modern living and as such is the province of the psychiatrist, the neurologist and the sociologist. What we are concerned about is this tendency to regard sound broadcasting as a kind of super piped background music. Surely this is *not* the role of broadcasting?

Our next issue dated August will be published on July 7th



ROUND THE WORLD

of WIRELESS

NEWS AT HOME
AND ABROAD

EUROPE'S FIRST QUARTZ GROWING PLANT

THE first commercial quartz-growing plant in Europe has been established by Standard Telephones and Cables Limited at their recently opened quartz crystal factory at Harlow, Essex.

Using specially designed pressure vessels and control equipment, STC technicians have perfected a process which permits the growth in less than a month, of large pieces of radio quality quartz, suitable for use in the frequency control units used extensively in broadcast transmitters, telephone and communications equipment. Against this the world's deposits of natural quartz took over 3,000,000 years to form.

Whereas natural quartz stones are very irregular in shape and carry unwanted minerals and other inclusions, these man-made quartz crystals are geometrically shaped and virtually free of defects. This new process also presents economical advantages, as natural quartz of suitable grade (which is obtained entirely from Brazil) is expensive and the large pieces necessary for manufacture into frequency control devices are rare.

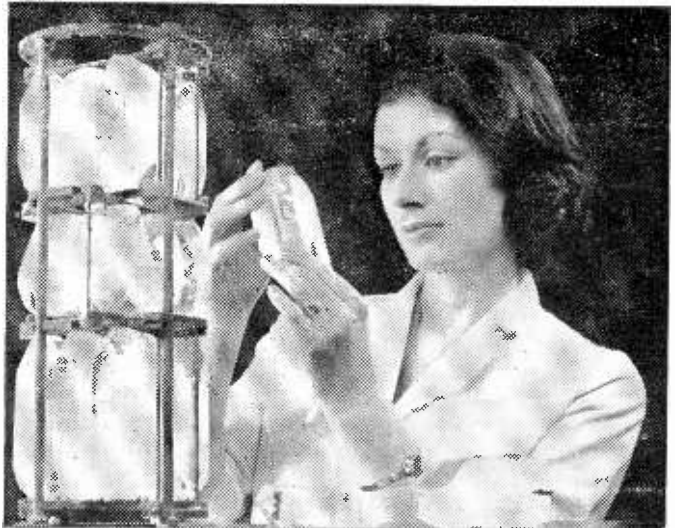
The growing process of the cultured quartz takes place inside 10ft. high, 12in. diameter steel cylinders at pressures of about 24,000lb./sq. in. and at about 400°C. Small, easily obtainable quartz chips are dissolved in caustic soda under these conditions and the quartz re-appears as a steady growth on special "seed" crystals placed in the upper part of the cylinder. Crystals grow to the required size—about 1lb.—in 21 to 24 days.

R.N. Radio Amateurs Donate Receiver

TWO serving members of the Royal Navy Amateur Radio Society recently made a call at the home, in Crewe, of 18-years-old John Hall who was paralysed as a result of an accident while serving in the Royal Navy. The visit was made in response to an appeal for help after another radio amateur had informed the R.N.A.R.S. of John Hall's interest in wireless, and so on

April 18th, G3SJQ and G3JFF (Sub-Lieutenant David Davies and Chief Radio Supervisor Michael Matthews respectively) arrived at his home with a radio receiver which local hams had volunteered to modify for his use.

With this receiver and the help of other radio amateurs in the area, John Hall is now well on the way to achieving his ambition of obtaining an amateur transmitting licence.



The quartz crystals shown in this illustration were grown in three weeks at STC's factory at Harlow.

NEW TELEPHONE CABLE FOR S.E. ASIA

THE first stage of the South-East Asia Commonwealth submarine telephone cable system (SEACOM) is to be laid in the China Sea during the next six months. Three cables will lay some 2,000 nautical miles of cable linking Hong Kong, Jessel-

ton (Sabah) and Singapore—operations which must be completed before the monsoon season starts in November. After extensive testing, the link will be opened for public service about the beginning of February next year.

SEACOM will introduce greatly improved communications both with and throughout the area, and a second stage in its development will complete the system to Australia. This will join Singapore and Hong Kong to COMPAC and CANTAT.

Like COMPAC and CANTAT, this latest submarine cable will have a capacity of 80 telephone channels, with stable circuits for all types of telecommunications.

ADEN GETS NEW WIRELESS RECEIVING STATION

NEARING completion at Salt Pans in Aden is a wireless receiving station being built by Cable and Wireless (Mid East) Ltd. as a sister station to the Company's existing transmitting station there. Between them, the two stations will provide a number of wireless services linking London with cities in various parts of the Middle East, Africa and India. These services will include public telegraph, leased circuits, telex and radio telephony. In addition, the pair will serve as a radio relay station on the London/Singapore, Hong Kong, Australia and Japan routes.

Radio Safety Device for Swimmers

ENGINEERS in the U.S.S.R. have announced a "hydro-acoustic" device which will automatically send out radio distress signals should any mishap occur to a swimmer carrying it.

The device consists of a miniature transmitter—which can be installed in a special pocket in a bathing cap—and a receiver on the shore. Should the swimmer stay under water longer than a minute, the transmitter will automatically send out distress signals, to be picked up on shore by the receiver, which will then give out light and sound alarms.

The transmitter itself consists of a sensor, a time relay, and a piezoceramic generator of ultrasonic waves and works with an accumulator.

New Branch of "Talking Book" Library

ON Friday, 1st May, Lord Fraser of Lonsdale, C.H., C.B.E., Vice-President of the Royal National Institute for the Blind and Chairman of St. Dunstan's, opened at Punch Street, Bolton, Lancashire, the Northern Branch of the Nuffield Talking Book Library for the Blind.

The new premises at Punch Street have been established to provide a localised library for the blind men and women of Scotland and the North of England because, as a result of recent technical advancements which have enabled the Library to accept a greatly increased membership, it has become impossible for the original premises in Middlesex to cope for the whole country.

These technical advancements refer to the Library's tape machines which in 1959 replaced the existing stock of disc recordings of literary works, which was necessarily limited in capacity. The present system, utilising a half-inch tape carrying no fewer than eighteen tracks, provides some twenty-one hours of reading time in one cassette.

The continued existence of the Talking Books Library—an entirely British innovation—is made possible to a large extent by the network of volunteers throughout the country who help to install and service Talking Book machines.

The rapid expansion of the Library membership now increases the need for these servicing volunteers and Mr. D. Finlay-Maxwell, Honorary Organiser of Servicing Volunteers, would be glad to hear from suitably qualified people within the Bolton Branch service area who would be prepared to help in this vital and rewarding work. Potential volunteers should write to him care of J. Gladstone and Co. Ltd., Wellington Mills, Huddersfield, Yorkshire.

Safety Plan to Protect Consumers

ON the eve of the Annual Conference (April 26th—29th) of the Radio and Television Retailer's Association and the Electrical Appliance Association, the President of the two Associations, Mr. A. R. Mitchell, explained a new "Safe Shopping" plan for the public, which was launched at this year's Conference.

The aim of the plan, as outlined by Mr. Mitchell, is to help protect the public from the increasing number of "apparently 'free' offers, switchselling, excessive interest charges, 'vanishing salesmen' and other devices" appearing in the domestic electrical retail market.

Under the plan, members of the public shopping at EAA shops will receive a registration card with their purchases of major electrical appliances and on return of this card to the Association they will be enrolled on a new Consumer Register. The card will then be returned to them with the serial number under which they have been enrolled. They can then write to the Association with any enquiries they may have; for advice or to complain—either about a product bought, or about service received, or about costs or either or both. Subsequently each enquiry will be investigated, the appropriate ones going before special committees which will then deal with them.

TRANSISTOR

25 Watt P.A.

AMPLIFIER

BY A. J. SHORT

THERE are many occasions when an audio amplifier is required at places remote from an a.c. mains supply. To address crowds on sporting and gala occasions, for the modulation of mobile transmitters, and to control and inform the public at outdoor meetings, or for street advertising—these are but a few of the possible applications. A portable amplifier for use with electric guitars, now popular in dance bands, may be a further requirement.

It is, of course, practicable to operate a valve amplifier from a rotary or vibratory convertor. This system has the disadvantage, however, of being electrically inefficient, and large accumulators are necessary to provide the power for a relatively modest signal output. Methods of increasing the electrical efficiency of various systems, introduce—in their turn—further complications.

Advantages of Transistors

A transistor amplifier offers a very attractive answer to the problem. Firstly, a high degree of electrical efficiency can be obtained. Secondly, with no warm-up time involved, the unit need only be switched on for the actual occasions when it is required. Thirdly, the unit is much smaller and lighter than an equivalent valve amplifier. Fourthly, with no fragile valves included, the unit can be made more robust and less liable to damage than a valve amplifier. Fifthly, transistors can be expected to have an appreciably longer life than valves when worked under comparable conditions.

Design Requirements

It was decided that a useful level of power output for a simple, home constructed, transistor p.a. amplifier would be a nominal 25W peak audio. This permits the use of a pair of a wide selection of power transistors now offered by the manufacturers. Costs involved at this level are not excessive, and the remaining materials required can be readily obtained. If higher power levels are required more power transistors will be needed to drive the output stage and the cost of the amplifier increases sharply.

Concerning frequency range, it was decided that

a nominal 200c/s to 7,000c/s, would be required. This has been achieved with reasonable linearity in the design. Some modest falling off of gain occurs at each end of this range, but the quality of reproduction under p.a. conditions is good.

The power supply requirements of an audio amplifier can be considerably reduced if the output stage is operated in Class B, as is now standard practice in transistor technique. A further advantage of using this mode of operation is that it cuts down the heat dissipation of the output transistors and reduces cooling problems.

In the prototype model of this amplifier it was considered unlikely that the amplifier would be actually producing its 25W for more than a few moments at a time, and the cooling was reduced further to accommodate this factor. Should it be thought that the amplifier might be operated at maximum output for appreciable periods, the cooling of the power transistors should be improved accordingly. This can be achieved by mounting the transistors on heavy copper, rather than aluminium, increasing the area of contact between the copper and the casing of the amplifier, and increasing the thickness and size of the amplifier instrument case. As the amplifier case is being used as heat "sink" or radiator, care must be taken to see that it is always used in a well ventilated situation.

The Circuit

The circuit consists of four stages: a.f. amplifier, phase splitter, push-pull driver, and output stage. For simplicity and economy the phase splitter, and push-pull driver stages are directly coupled. The output stage drives the loudspeakers via the auto-transformer.

The a.f. amplifier Tr1 is a high gain stage employing an NKT223 audio transistor in Class "A", working at about 1mA. The circuit is completely orthodox and is fully temperature stable. The stage should be fed in a manner appropriate to the type of signal source employed.

In the circuit diagram shown, the appropriate components to suit the output from a crystal pick-up or crystal microphone are given. It will be found advisable to keep the resistance of the volume control VR1 low to help to keep inuit noises at a low level, particularly when the amplifier is used in a situation having low ambient background noise.

The Second Stage

The second stage transistor Tr2 accepts the large output signal from the a.f. amplifier and, by means of a split load in collector and emitter circuits, produces two phase-opposed signals to be applied to the driver stage.

Of the available 8-9V h.t. rail, two volts appear across each of the two load resistors R10 and R11, and 4V across the transistor. This permits a maximum theoretical peak-to-peak signal of 4V to be applied to the two halves of the following stage. The large bias, of just over 2V, applied to the base of this transistor is in accordance with the high emitter voltage.

As part of the load is in the emitter circuit of this stage, a large signal voltage excursion occurs

on the base of Tr2. The collector current and collector resistor of the first stage are so selected as to make available this large voltage swing ($\pm 2V$).

The Third Stage

The third or driver stage consists of two transistors Tr3, Tr4 working in Class A push-pull to provide drive for the output stage. These two transistors are directly coupled to emitter and collector of the preceding phase-splitter, and the steady voltages on these points provide the bias for the driver stage.

Decoupled emitter resistors adjust the standing current in these transistors to about 25mA each, and the collectors are partially starved of h.t. voltage to keep the collector dissipation below the rated maximum for these components. The collectors of these transistors are connected to separate primaries of the driver transformer T1, wound so that the d.c. flux of the collector currents tends to cancel out. The a.c. fields, however, being in push-pull, are additive and are applied to the transformer secondary. The d.c. flux from the bias currents in the secondary is balanced out in the same way as in the primary.

The transistors in this stage should preferably be a matched pair.

The Output Stage

The output stage consists of a pair of matched power transistors, Tr5, Tr6, in Class B push-pull, and these are coupled to the loudspeakers via an auto-transformer T2. An auto-transformer is used here because of the simplicity of construction of this component. The power transistors are cooled

COMPONENTS LIST

Resistors:

R1 1M Ω	R11 1.5k Ω
R2 33k Ω	R12 470 Ω , $\frac{1}{2}W$
R3 4.7k Ω	R13 10 Ω
R4 4.7k Ω	R14 100 Ω
R5 1k Ω	R15 220 Ω
R6 39k Ω	R16 1.5k Ω
R7 100k Ω	R17 20 Ω , $\frac{1}{2}W$
R8 18k Ω	R18 100 Ω
R9 1M Ω	R19 820 Ω
R10 1.5k Ω	R20 820 Ω

All $\pm 10\%$, $\frac{1}{2}W$ except where otherwise stated. VR1 50k Ω carbon potentiometer.

Capacitors:

C1 22pF silver mica
C2 100 μF electrolytic 12V
C3 100 μF electrolytic 12V
C4 100 μF electrolytic 12V
C5 100 μF electrolytic 12V
C6 100 μF electrolytic 12V
C7 47pF silver mica 2%
C8 1,000 μF electrolytic 12V
C9 100 μF electrolytic 12V
C10 100 μF electrolytic 12V
C11 100 μF electrolytic 12V

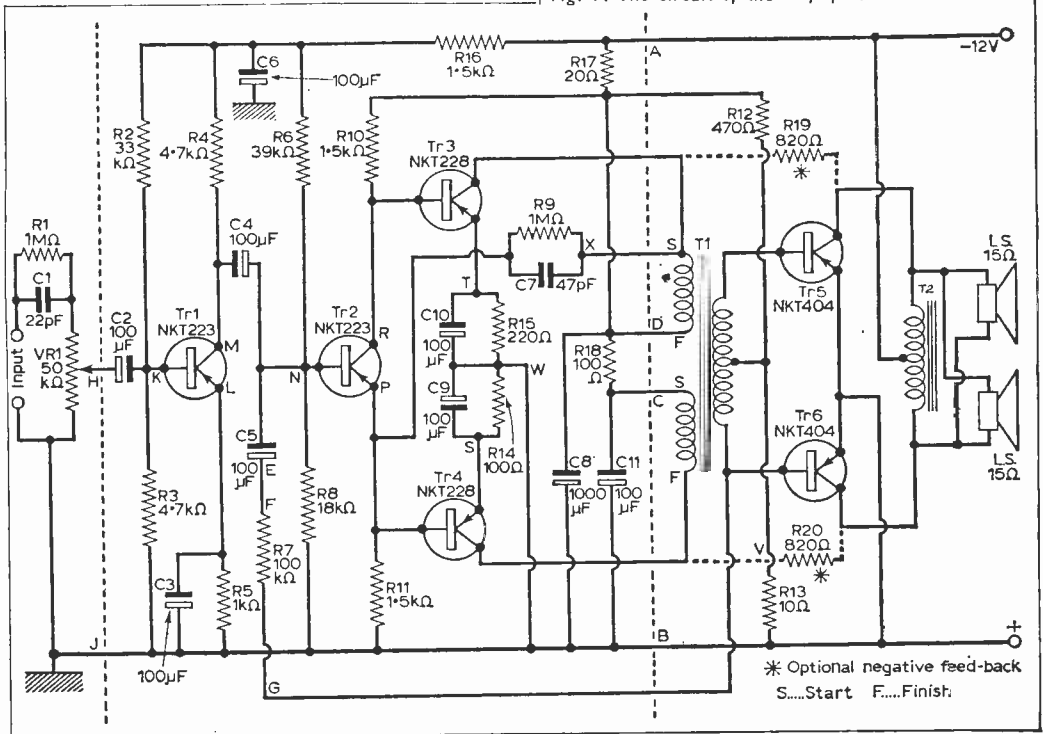
Transformers:

- T1 Driver transformer (see text)
- T2 Output transformer (see text)

Transistors:

- Tr1 NKT223, Tr2 NKT223, Tr3 NKT22B, Tr4 NKT22B, Tr5 NKT404, Tr6 NKT404

Fig. 1: The circuit of the amplifier.



by a thick $\frac{1}{8}$ in. aluminium plate on which they are mounted, which is, in turn, bolted directly to the metal case holding the amplifier. The case then serves to cool the transistors. Mica washers and silicone grease between the cooling plate and the body of the transistor serve to provide electrical insulation while maintaining thermal conductivity. The mica washers and insulating bushes for the transistor mounting bolts are provided by the transistor manufacturers.

In the prototype it was found convenient to mount the output transformer a short distance from the amplifier. When this is done, care must be taken to ensure that the connecting leads are thick and of low resistance, as currents of about 3A flow during peak signals.

When the output transformer is mounted in the same case as the amplifier the cores of the driver and output transformers should be kept at right angles to one another.

Construction

The first three stages are best constructed on a "home-made" printed circuit board, the full size layout of which is given in Fig. 2.

The copper coated laminate may

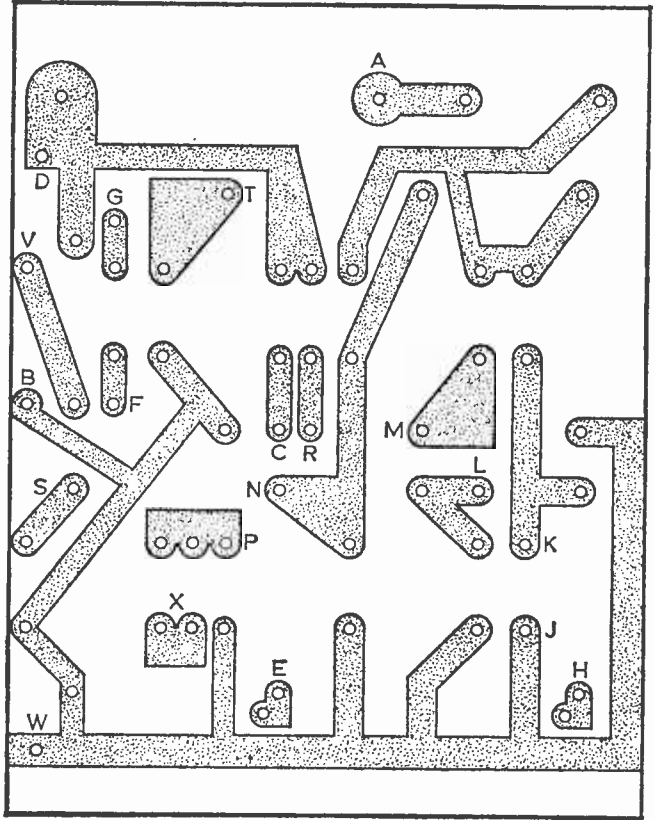
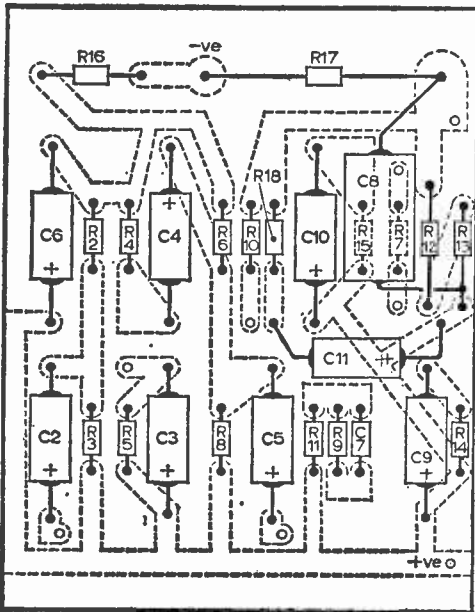


Fig. 2 (above): This illustration of the printed circuit is drawn full-scale and may be used as a template.

Fig. 3 (left): The layout of components.



be obtained from one of a number of advertisers in this magazine, and is cut to size with a fine hacksaw blade. The copper should then be brought to a bright shining finish by scouring with "Vim" or other detergent scourer, and well dried.

A stencil of the printed circuit diagram should be made by cutting out and sticking Fig. 2, or a tracing thereof, to an ordinary postcard and cutting out the black portions with a sharp bladed pen-knife. The extracted pieces should be kept on one side to later locate the drilling holes.

The circuit diagram is then transferred to the copper laminate by drawing with a pencil through the cut-out portions of the stencil onto the copper. Once this has been done and checked, the printed circuit diagram on the copper can be filled in with a dark varnish stain, or dark french polish applied with an artist's brush. The identifying letters may also be marked in varnish if desired.

The varnish will now protect the covered copper from the etching solution to be used. The unprotected portions are to be dissolved away, so care must be taken to avoid greasy finger marks or varnish splashes on these parts.

The Etching Process

The etching solution consists of 4oz. ferric chloride, 1oz hydrochloric acid, 6oz. water, this solution can be made up by the local chemist.

A sufficient quantity of this solution should be poured in to a non-metallic container and the laminate floated, face down, on its surface. The rate of etching varies largely with temperature and may take 15 to 30 minutes or more. As soon as all trace of the unwanted copper has disappeared, the board should be well washed in running water to remove all traces of the etching solution.

When dry the board is drilled at the points indicated on the printed circuit diagram Fig. 2 and the varnish carefully scraped away with a sharp knife from the points to be soldered.

The components should then be inserted in position, as shown in Fig. 3 and soldered to the copper laminate. All loose ends should then be clipped off,

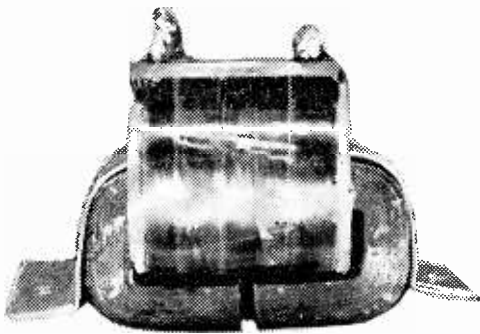
connecting leads inserted and soldered, and the completed printed circuit board mounted in the instrument case by nuts and bolts through the unused ends of the printed circuit board.

Ensure that the underside of the board is well clear of adjacent metal work. The board is now best removed from the case until all assembly and testing has been completed.

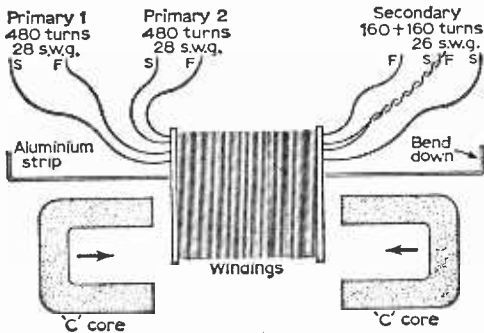
The Driver Transformer

The driver transformer T1 is quite simple and may be constructed in a few hours. It consists of two primaries of 480 turns each of 28 s.w.g. enamelled copper wire, and a centre-tapped secondary of 160 + 160 turns of 26 s.w.g. enamelled copper wire, wound on a type HWR 10/16/5 English Electric "C" core pair, or equivalent, see Fig. 4.

The required dimensions of the core are: cross-sectional area through centre limb, approximately 0.3 square inch. length of flux path approximately 5in., window area approx 1/4 square inch as indicated in Fig. 5. A suitable core may be conveniently recovered from an old a.f. or output transformer. The laminations should be thin for minimum losses.



The driver transformer ready to be clamped into position.



S.....Start of winding
F.....Finish of winding
All turns to be wound in the same direction

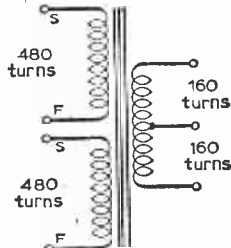


Fig. 4: Winding details for the driver transformer, T1.

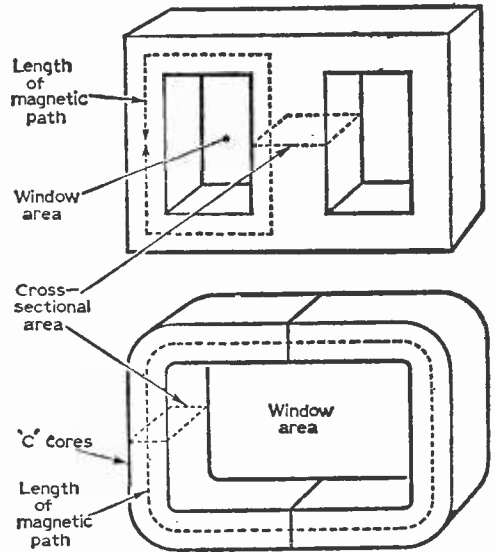


Fig. 5: Critical measurements for the transformer cores.

A cardboard bobbin should be first constructed to fit the core. This should be well dried and shellacked. The two primaries, of 480 turns each, are first wound in even layers, a layer of thin paper between each layer. Two layers of Sellotape should separate the two primaries from one another, and another two layers separate the primary from the secondary.

The secondary of 160 + 160 turns is then wound, bringing out a connection to the centre tap, and the final assembly firmly overtaped with Sellotape. All windings are in the same direction and the ends of the primaries brought out through

the sides of the bobbin on the opposite side to those of the secondary.

The core should now be inserted. If "C" cores are used the two halves must be clamped firmly together. If laminations are used they must be inserted alternately from opposite sides to avoid having an air gap in the core, the final laminations being wedged, if necessary, to avoid buzz and chatter when the transformer is used.

A small tag-board should now be strapped to the transformer to take the connections to the windings, and each winding identified on the tag board.

The Output Transformer

For quality of reproduction, efficiency, and ease of construction, it was decided to design the output auto transformer T2 to generous proportions. The resulting performance, on test, was therefore found to be extremely satisfactory and the amount of wire winding involved was surprisingly small.

The prototype was required, primarily, to drive two 15Ω loudspeakers in parallel, but by means of a little juggling in design a most effective compromise to permit the use of alternatively one or two 15Ω, two or eight 3Ω loudspeakers, has been produced. The transformer consists of a single winding of 272 turns, tapped at 68 turns and 136 turns from one end as shown in Fig. 6. The two halves of the winding are wound with different sizes of wire to take into account the currents flowing.

The core consists of two pairs of English Electric HWR 50/32/5 "C" cores, or equivalent. The approximate dimensions of a suitable core are: Cross sectional area through centre limb, 1.8 square inches, length of flux path, 8in. window area 2½ square inches, all approximate (refer to Fig. 5).

A suitable core of these dimensions, or the actual "C" cores themselves, can often be recovered from an ex-Government transformer, bought for a few shillings.

A suitable bobbin should be made to fit the core and well dried and shellacked. The end of the 18s.w.g. wire is passed through a hole made in the side of the former and 136 turns wound on in even layers, a thin layer of tissue paper between each layer. The end is brought out through another hole in the side of the former where it is connected to the end of the 15s.w.g. wire.

Sixty-eight turns of 15s.w.g. wire are now wound, and at the end of this portion a loop of wire, to provide the second tapping point, is passed through a suitable hole in the side of the former.

The final 68 turns are now wound and the whole assembly firmly taped to prevent buzz and chatter when the transformer is used. All windings should be wound in the same direction.

The core may now be placed in position and firmly clamped together to prevent gaps in the magnetic circuit. The wires from the winding can now have their ends cleaned and soldered firmly to a suitable tag strip.

Alternative Cores

Both transformers have been designed with ample margins of tolerance to accept modest deviations from the size of core specified, without change of number of turns. It should be appreciated, however, that in general, decrease in the size of the core requires an increase in the number of turns of all windings, and that finer gauges of wires will then be needed due to the smaller window areas. This, in turn, leads to increases in winding resistance, an undesirable characteristic.

The cores specified may be obtained from English Electric Co., Transformer Sales Dept, East Lancashire Road, Liverpool 10, Lancs.

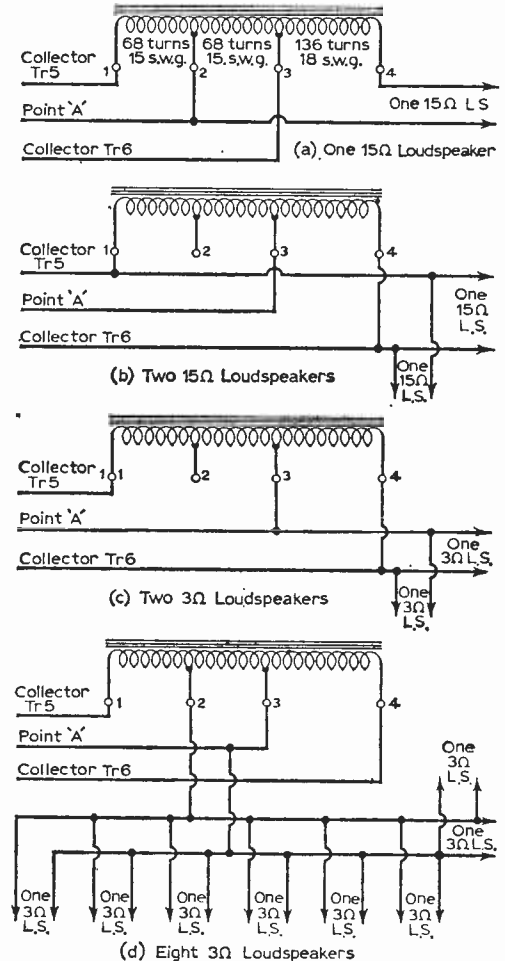


Fig. 6: Alternative output transformer arrangements.

Assembly of the Components

Flexible flying leads are attached to points C, D, G, V, W and X. A red battery lead is attached to point B and a black battery lead to point A, a flexible flying lead is also attached to each of these two points.

Connect the centre conductor of a length of microphone cable to point H and the screening to point J. This cable goes to the volume control.

—continued on page 239

model control receivers

TWO RECEIVER DESIGNS FOR 27Mc/s BAND OPERATION
BY F. G. RAYER

THE two model control receivers described here are for use with any home constructed or ready-made c.w. model control transmitter, working in the 27Mc/s band. The actual transmitter may have one or two valves, the higher power obtained from two valves being needed when maximum range is required.

The first receiver to be described is of very simple type, and is easily adjusted. It is suitable for short range working only—indoors, in a garden, or when sailing a boat on a small pond.

Much greater range is obtainable with the super-

regenerative one-valve receiver, so it is suitable for planes and boats. It will also give good range with a low-power (hand held) transmitter.

Transistor Receiver

The circuit of this simple two transistor receiver is shown in Fig. 1.

When the carrier signal is received, the diode causes the base of transistor Tr1 to become negative. Tr1 conducts, increasing the voltage drop in the collector circuit resistors (R1, VR1) so the base voltage of Tr2 is more positive, releasing the relay RLA so that the relay contacts close.

The receiver parts can be assembled on a small piece of paxolin, or on a tag board (see Fig. 2). The layout is not important, though connections in the tuned circuit should be reasonably short.

The tuning coil can be self-supporting, and can have 12 turns of 18 s.w.g. bare or enamelled wire. It is about 3/4 in. inside diameter, and about 7/8 in. long. The tapping 2 is four turns from end 3, and the coil is supported by soldering it to tags.

For best results, a good quality diode for 27Mc/s or higher frequency is required. Most types, except cheap sub-standard surplus, are satisfactory. Tr1 is a high-gain audio or r.f. transistor, such as OC71, etc. Tr2 is a small output type transistor, such as OC72. The transistors operate as direct current amplifiers, their cut-off frequency is thus of no importance, but they should have high gain.

The relay is the usual model control type, with 1,000 to 5,000Ω windings. A 5mA, 10mA or similar meter, or multi-range meter, is placed in one battery lead for tuning purposes.

Tuning Up

A vertical aerial, some 16in. to 24in. long, is connected to 1 on the coil. The transmitter aerial may be removed. With the transmitter and receiver near together, the 30pF trimmer TC1 is rotated until a dip in current is observed each time the transmitter is keyed. Tuning is quite flat. The transmitter aerial can then be added, and the receiver is moved a few yards away, and the 100kΩ potentiometer and trimmer are set for best results.

Range should be sufficient for the purposes mentioned when used in conjunction with a two-valve transmitter. For maximum possible range, the tapping 2 may be modified a turn at a time, to suit the diode and Tr1. The aerial may also be lengthened, and the turns on the coil can be

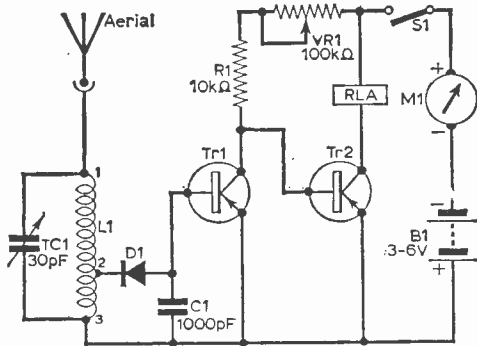


Fig. 1: A simple two-transistor receiver for short range work.

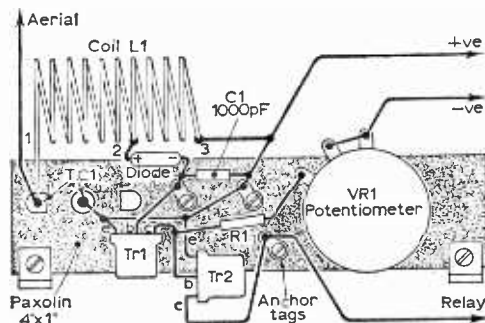


Fig. 2: The method of construction for the transistor receiver recommended by the author.

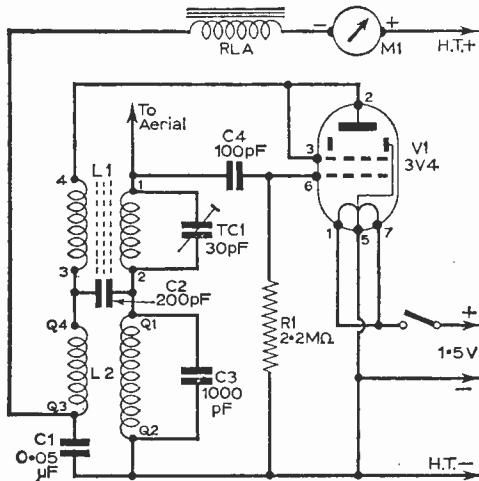


Fig. 3: A super-regenerative circuit for better reception.

adjusted so that resonance is obtained with the 30pF trimmer nearly completely unscrewed.

Super-regenerative Receiver

The circuit of a more sensitive receiver employing a single valve is shown in Fig. 3.

The small coil L1 is tuned to 27Mc/s by

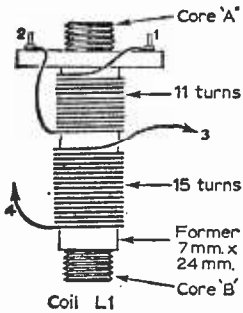
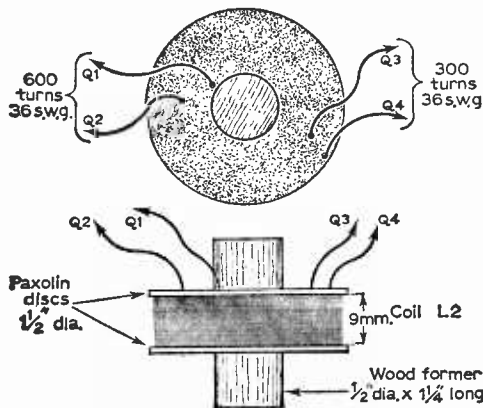


Fig. 4 (left): Winding details of the 27Mc/s coil.

Fig. 5 (below): The construction of the quench coil.

Fig. 6 (right): The layout and wiring of the one-valve receiver.



adjusting its core and the 30pF trimmer TC1. Regeneration is obtained from the feedback winding which is coupled to L1.

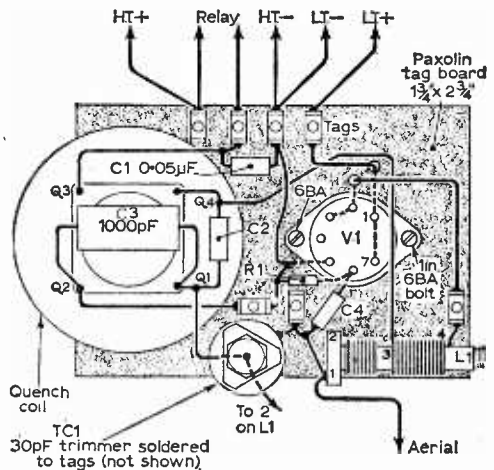
L2 is the quench coil, with its own feedback winding, and it takes the valve in and out of oscillation.

This super-regeneration receiver gives great sensitivity, and a good current change (to operate the relay) even with a weak input signal.

The 27Mc/s coil is wound with 26 s.w.g. enamelled wire, with turns side by side, as in Fig. 4. A space of about 1/8 in. is left between 11 turn and 15 turn windings. Two cores are necessary in the coil, one inserted for each end. Each core is initially screwed in for about two-thirds of its length. Both windings are in the same direction, and touches of adhesive will help hold the ends.

A piece of wood 1/4 in. in diameter and about 1 1/4 in. long is used for the quench coil. Two paxolin discs, about 1 1/2 in. in diameter, and with 1/8 in. holes, are cemented on the wooden former, leaving 9mm winding space, as in Fig. 5. Both windings are of 36 s.w.g. enamelled or silk covered wire, and are in the same direction.

The 600 turn winding begins at Q1, and ends at Q2. A strip of paper is then placed over this winding, and the 300 turn winding is put on, beginning at Q3 and terminating at Q4.



The receiver is built on a tag board or paxolin panel, refer to the layout shown in Fig. 6. Leads to the 27Mc/s coil, 30pF trimmer, valveholder, and 100pF and 200pF capacitors must be very short and direct. The quench coil can be held with a woodscrew.

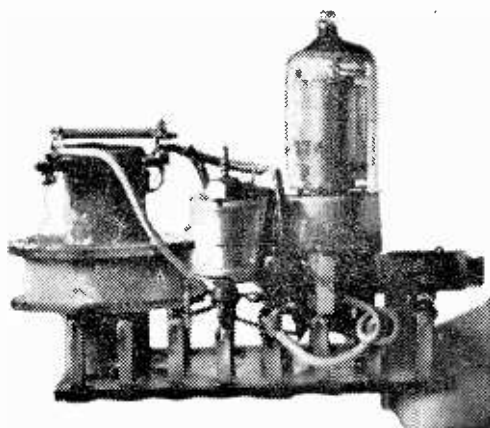
Valveholder tag numbers in Fig. 3 are for a 3V4. Other valves may be experimented with. The best current change is obtained with a valve having a high mutual conductance.

The relay is the ordinary high resistance model control type, and a 10mA or similar meter is added in the h.t. lead. Any 1 1/2V dry battery is satisfactory for the filament. A 67 1/2V miniature battery is necessary for h.t.

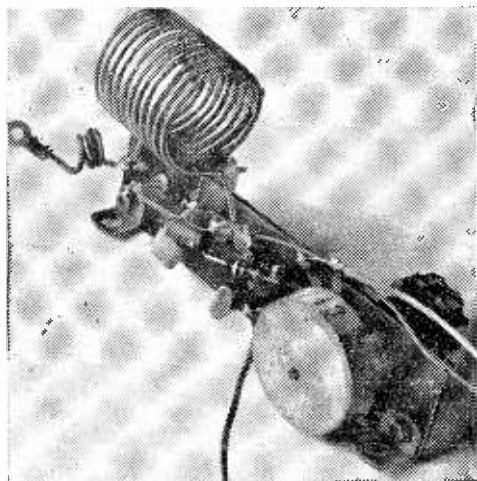
An aerial some 12in. to 18in. or so in length, is connected, and the receiver is placed near the

transmitter, the transmitter aerial being removed. The 30pF trimmer is turned with an insulated tool, until the meter shows a current drop each time the transmitter key is closed. If this drop is extremely small, screw in core A a little, and unscrew the trimmer, to restore tuning. If no current drop can be found, screw in core B a little, and again adjust the trimmer.

If the current drops when the transmitter key is closed, but does not rise immediately the key is released, core B may be too far in. The inductance/capacity ratio of circuit L1, TC1, depends on the positions of core A and the 30pF trimmer, while the degree of regeneration also depends on the extent to which core B is screwed in. Adjustments to obtain a good current drop are very easy



The more sensitive one-valve receiver completed.



The prototype of the two-transistor receiver.

near the transmitter, but become progressively more critical, as the range is increased.

The aerial length also has considerable effect on regeneration, so is best left unchanged, once satisfactory adjustments have been made. Any change to the aerial, or core positions, will make re-tuning necessary. When adjustments have allowed a good current change to be obtained at some yards range, with no aerial on the transmitter, the transmitter aerial can be added, and transmitter tuning checked.

If no possible adjustments give any current drop, connections to one winding of the 27Mc/s coil may have been reversed. If L1 is readily tunable to the transmitter signal, and only a very small current drop can be obtained, then connections to one winding of the quench coil are probably reversed.

The "Junior" Crystal + 2

FURTHER INFORMATION CONCERNING TRANSFORMERS

THE author of the Junior Set + 2 (P.W., May 1964), has asked us to point out that Messrs. Radiospares have changed the size and design of their T/T3 transformer. The new version is more efficient and will of course work perfectly in the receiver, but unfortunately will not fit in the space allocated for it on the board. If a larger sandwich box is used to house the receiver, there will then be no problem.

Should the new T/T3 transformer be used then refer to Fig. 12 and call either of the widely spaced tags red, and the other blue. Of the closely spaced tags take any outside one and call this yellow, and the next tag to it brown. The other two tags are not used. Red and blue may be changed round for best results.

The following alternative transformers are all absolutely suitable, will fit in the space provided, but need changed colour coding:

D189 ARDENTE, T22 (make unknown) (Messrs. Henries Radio Ltd.).

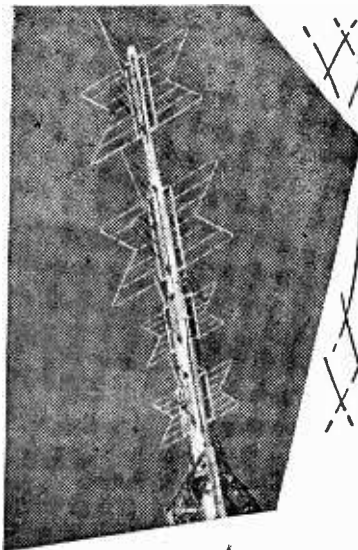
LT/44, Eagle Products (Messrs. Sexton, 162 Grays Inn Road, W.C.1.).

Coding Changes (Fig. 12)	LT/44	Ardente 189	T22
For Blue read	Green	Blue	Outside Red
For Brown read	White	Green	Outside Green
For Red read	Red	Yellow	Outside Red
For Yellow read	Red (lead near White)	Red	Outside Green
Fixing	as text exactly	adhesive	adhesive

The author would recommend LT/44 since this is almost identical in appearance to the T/T3 originally specified.

We apologise for a small draughtsman's error in Fig. 12 where "D" on the coil should go to the junction R1/R2/C4 and not as shown to the battery positive line.

Beginners who wish to have help over any difficulties may of course use our query service, enclosing the usual query coupon.



On Your Wavelength

By THERMION

These apart, there must still remain a host of listeners with (dare I say it) more serious tastes who confine their listening to the Home, Light and Third but who have yet to be converted to f.m. What could suit their requirements better than a preset v.h.f. receiver with a decent audio section and reasonably sized loudspeaker?

All Tastes Catered for

Coming back to these transistor portables, it does seem that with circuit design now very much standardised, the presentation of the package has assumed greater importance than the contents. Styling is paramount. The feminine customer is wooed with delightful confections in exotic colour schemes plus all the trimmings: cherry red with gold grille; flame and white with polished aluminium embellishments; lovat green with silver trim—these are a few examples. The cases are sometimes padded and, perhaps, reach the ultimate in “a moulded case studded with nearly 200 sparkling imitation jewels”. For her mate, the outdoor sporting mood is exploited: less of the metallic trim, a predominance of leathercloth or, in the luxury class, an outer covering of real leather—saddle stitched of course.

I was amused by a technical achievement that some current models feature, namely slow motion tuning. This is certainly a boon for getting those tricky stations right on the nose; I think it might become very popular!

From a Surrey Wood

A reminder of yesteryear from an unexpected quarter. A few weeks ago the newly launched BBC-2 TV programme concluded its transmission one evening, somewhat surprisingly, by playing a recording of a nightingale singing in a wood as made during a live sound broadcast way back.

For the older viewers, this must have brought vividly to mind again those outside broadcasts of 30-odd years ago. Perhaps our younger contemporaries will smile indulgently as I hark back to those warm summer evenings when with hushed expectancy we would listen as the announcer broke into the programme to say that we were about to be taken over to a Surrey wood, to hear the nightingale. Coaxed by a suitable musical accompaniment played by a lady cellist concealed in the wood, the bird would as often as not give a performance. On these occasions the Corporation and the listening nation submitted to the caprice of this little unseen songster.

Very tame compared with a view of tomorrow's dawn at Tokyo brought via satellite—oh yes certainly, but a salutary reminder of the progress made in a mere three decades!

OFTEN I have wondered why no manufacturer considers it worthwhile to produce a three or four station preset receiver for the mass market. I have heard it stated in the past that the public will not buy a receiver that has no tuning scale. Perhaps this was true in the days when one receiver had to satisfy the needs of a household. In those days to invest in a receiver that would limit one's choice to a few stations had little appeal. Nowadays, with two or more sets per household becoming more the rule than the exception I should think there is a real market for a mains receiver that enables one to select at a touch the programme of one's choice so eliminating all the drudgery of turning a gang capacitor.

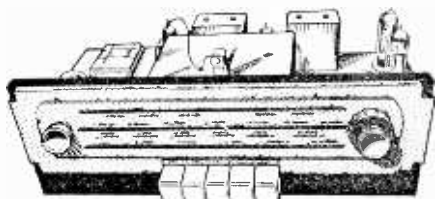
Dormant V.H.F.

This leads me on to another matter that has puzzled me for some time. The BBC has brought into operation a large number of v.h.f. transmitters, and all large areas of population in these islands are covered by this f.m. service. But how many people receive the Home, Light or Third on v.h.f.? What is required is a large scale campaign to encourage listeners to move away from the chronically congested medium wave band, and to share in the benefits of improved quality afforded by the v.h.f. band.

Don't let us hear any talk of sales resistance by the public. If the radio industry applied itself energetically to the promotion of v.h.f. reception, this could quite easily become “with it” as that current status symbol—the personal portable. But in those last two words, methinks; aye, there's the rub.

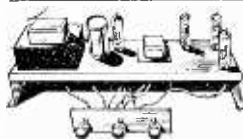
It could be that the industry has a vested interest in preserving the habit of medium wave listening. The enormous market opened up by the transistor portable and the rocketing sales to our prosperous teenagers has mesmerised quite a few firms.

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PUSH-PULL O.P. AMPLIFIER £5.5.0
(6" Carr.)



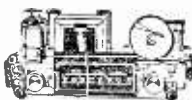
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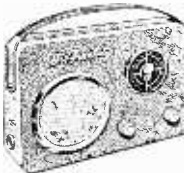
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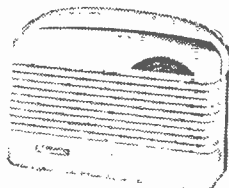
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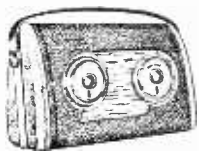
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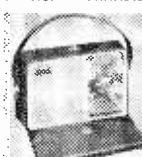
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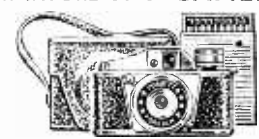
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An Audio Mixer

A SIMPLE TRANSISTORISED UNIT

BY G. R. ADDIS

THE following article describes the development and construction of an audio mixer employing the latest transistor circuit techniques. The circuit is such that it can be arranged to suit most needs, whether amateur or semi-professional.

Since it is likely that the equipment will be used for recording such items as live concerts or lectures, it will be appreciated that light weight, good performance and the utmost in reliability are very important factors governing the design of the unit. In order to keep the weight of the equipment to a minimum, it was decided that transistors rather than valves, should be used, hence dispensing with the need for large and heavy power supplies. Another desirable feature would be the facility to extend the number of channels as and when the

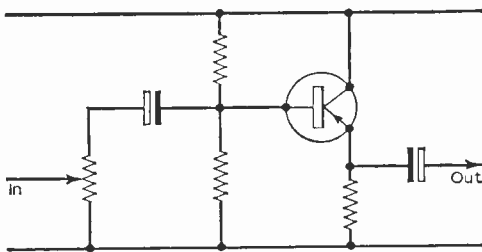


Fig. 1: A transistor in the emitter-follower configuration.

need arose with the minimum expense and trouble. In the final design these requirements have been fulfilled and the mixer meets the requirements admirably.

Preliminary experiments were carried out on a circuit based upon the emitter-follower configuration, Fig. 1. These proved to be unsuccessful, as expected, due to inter-channel modulation.

The first circuit being unsatisfactory, a circuit which is the combination of an earthed emitter stage and an emitter-follower was tried. A circuit

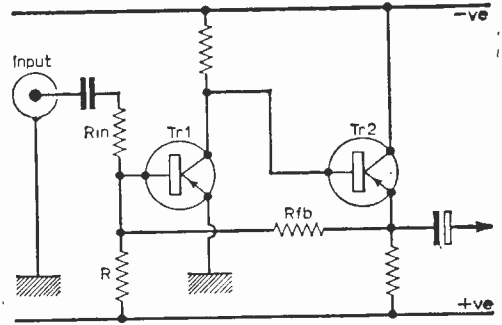


Fig. 2: The basic arrangement for a "Bow's brick" circuit.

such as this is known as a Bow's brick. The basic circuit is shown in Fig. 2

In this configuration, the brick requires both positive and negative power supplies with respect to earth. A more convenient arrangement is shown in Fig. 3, this requiring only a simple power supply such as a battery.

A circuit such as this gives a very stable voltage gain with negligible distortion. The voltage gain can be calculated from the formula:

$$V_{\text{gain}} = \frac{R_{\text{fb}}}{R_{\text{in}}}$$

thus with a feedback resistance of say 22kΩ, and an input resistance of say 2.2kΩ, a voltage gain of 10 would result, i.e. a gain of 20dB. Conversely, if these two resistances were changed around, then there would be a voltage loss of 20dB.

The resistor R is for adjusting the bias conditions, since most of the current flowing through the feedback resistor also flows through resistor R, thus causing the output to be negative with respect to earth and so providing Tr1 with a negative voltage on its emitter.

The transistors chosen for use in the mixer were the type OC45. This was because of their availability, good frequency response and fairly quiet operation. It was decided that the mixer should operate from a 9V power supply. A suitable value of current flowing through Tr1 is in the order of

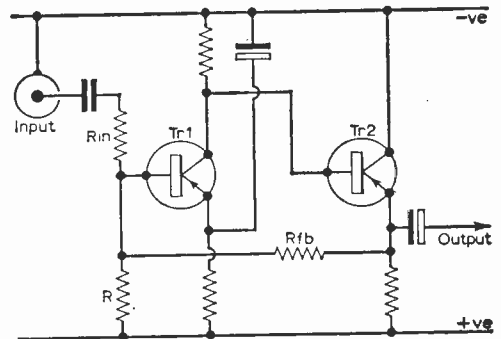


Fig. 3: An improvement on Fig. 2 requiring only a simple power supply.

0.5mA, and that through Tr2 being about 1mA. A suitable voltage on the emitter of Tr2 is 2V positive with respect to earth, thus the voltage drop across R6 will be 7V.

$$\text{Hence } R6 = \frac{7}{1 \times 10^{-3}} \Omega$$

$$R6 \approx 6.8k\Omega.$$

Since the voltage on the emitter of Tr2 is 2V, then the voltage on the collector of Tr1 will be 2V, thus if a current of 0.5mA is flowing:

$$R2 = \frac{2}{0.5 \times 10^{-3}} \Omega$$

$$R2 \approx 3.9k\Omega.$$

Allowing for a potential difference of 3V to be across Tr1, then the voltage on the emitter of this transistor will be 5V with respect to earth, i.e. the voltage drop across R4 will be 4V.

$$\text{hence } R4 = \frac{4}{0.5 \times 10^{-3}} \Omega$$

$$R4 \approx 8.2k\Omega.$$

The value of the feedback resistor, Rfb, was chosen to be 1kΩ, and since the potential difference between the emitter of Tr2 and the base of Tr1 is in the order of 3V, then the current flowing through Rfb will be 3mA. This current flows from the positive rail via R3,

$$\text{hence } R3 = \frac{4}{3 \times 10^{-3}} \Omega$$

$$R3 \approx 1.2k\Omega.$$

Since Rfb is 1kΩ, then for unity gain the value of the input resistance must also be 1kΩ, i.e. Rin=1kΩ.

A capacitor is placed in series with the input resistance in order to prevent d.c. voltage getting on to the base of Tr1 from the input source. A suitable value for this component is 50μF, thus a good low-frequency response is to be expected. Likewise, another capacitor, C3, is placed in the output circuit of Tr2, a suitable value for this component being 10μF. It is also necessary to decouple the emitter of Tr1 and an electrolytic capacitor having a value of 100μF is used for this.

Since the gain of the brick is proportional to the input resistance, Rin, it is necessary to use a variable resistor with anti-logarithmic characteristics in series with the input in order to provide a logarithmic increase in volume as the control is turned in a clockwise direction. If a variable resistance having a value of 1MΩ is used, then the output signal may be decreased by up to 60dB from the original signal level; this being adequate for most purposes.

The final circuit of the mixer is given in Fig. 4. It will be appreciated that if variable resistances having a smaller value than the "fade resistances" were placed in series with each input, then the level of each channel could be adjusted to give the

same voltage output when its individual "fade resistor" was at minimum value. Likewise, another variable resistance could be placed in series with all the inputs so as to provide a master volume control.

Construction

Due to the relative simplicity of the mixer, the complete electronics, apart from the various input resistances, may be built on to a miniature 10-way tagboard. The diagrammatical layout is shown in Fig. 5. Since it is likely that the reader may have

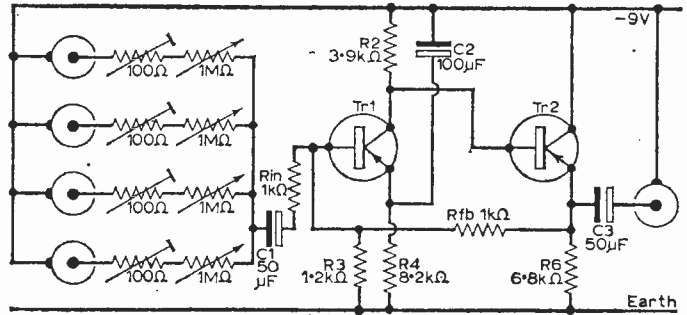


Fig. 4: The circuit finally arrived at for the mixer.

his own ideas on the final arrangement of the input circuits, it is not proposed to give comprehensive details on the mechanical side of the construction.

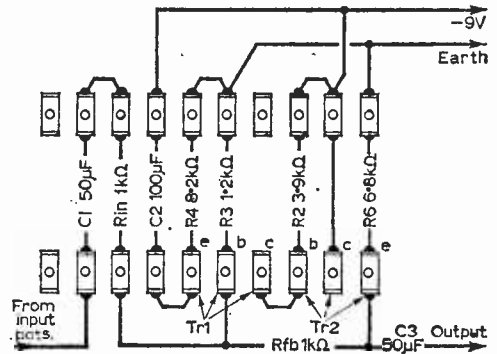


Fig. 5: Illustrating the layout of components when built on a 10-way tag board.

Performance

As stated earlier, the mixer is very reliable in operation, it has a good frequency response and a low signal-to-noise ratio. The measured figures below give a better indication of the performance. Frequency response25c/s to above 200kc/s ± 0.5dB. Harmonic DistortionNot measurable. Noise level90dB below minimum signal output. Power requirements9V at 2—3mA.

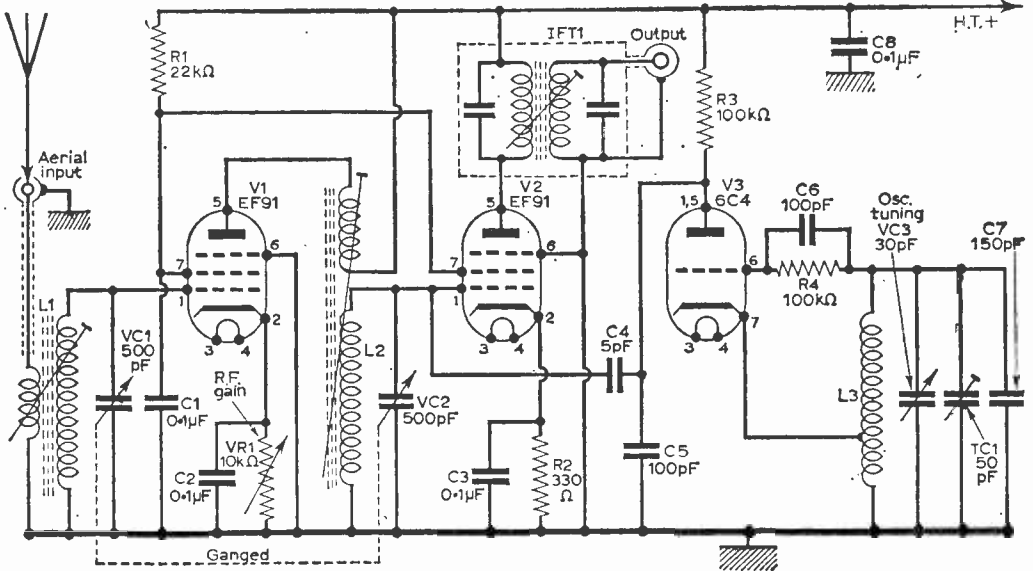


Fig. 1: The circuit of the unit.

A TOP BAND CONVERTER

THIS UNIT WILL ADAPT CERTAIN EX-GOVERNMENT RECEIVERS TO TUNE OVER THE 1.8—2Mc/s AMATEUR BAND

BY J. CALLOW G3RBH

HERE is on the market and in widespread use a large number of ex-government receivers which do not tune the 1.8-2.0Mc/s amateur band, most of them tuning only as low as 2.0Mc/s. It was for this group of receivers that this converter was designed, the prototype being used on a BC 454-B Command Receiver. The output of the converter is on 3.0Mc/s, and so it will be necessary for the receiver to tune this frequency.

Circuit Description

Fig. 1 shows the circuit of the converter. The oscillator is tuned independently of the r.f. stages, thus eliminating troublesome alignment and the need for a three-gang tuning capacitor. VC3 tunes the oscillator over the range of 4.8-5.0Mc/s and thus produces the required beat of 3.0Mc/s throughout the band. The oscillator circuit is a Hartley, which requires no elaborate setting-up procedure. The valve used a 6C4 triode.

The two EF91 valves function as r.f. amplifier and mixer respectively, and the grid circuits are tuned by a twin-gang 500pF capacitor (VC1, 2). Osmor range 4 (trawler band) aerial and h.f. coils are used. These coils have iron cores and so no external trimmers are necessary. The inductance

of the tuned windings is in the region of 35μH. Selectivity in these circuits is of little importance, and it was only expense which prevented band-pass units being used.

The first EF91 is an orthodox r.f. amplifier stage, having a 10kΩ potentiometer VR1 in its cathode to control the r.f. gain. For simplicity the screen of this valve is strapped to that of the mixer, and these screens receive their voltage through a single 22kΩ resistor, R1 decoupled by capacitor C1.

The oscillator signal is applied to the grid of the mixer V2 via a 5pF capacitor C4. The output signal is derived from a 3.0Mc/s i.f. transformer (Fig. 2) which is wound in an old TV i.f. can.

No a.v.c. is applied to the converter, but if desired it can be applied by modifying the circuit

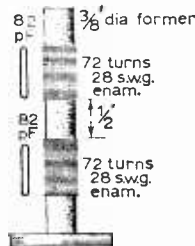


Fig. 2: Winding details of the 3.0Mc/s i.f. transformer.

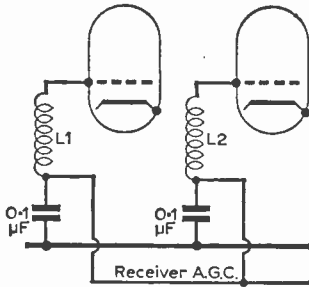


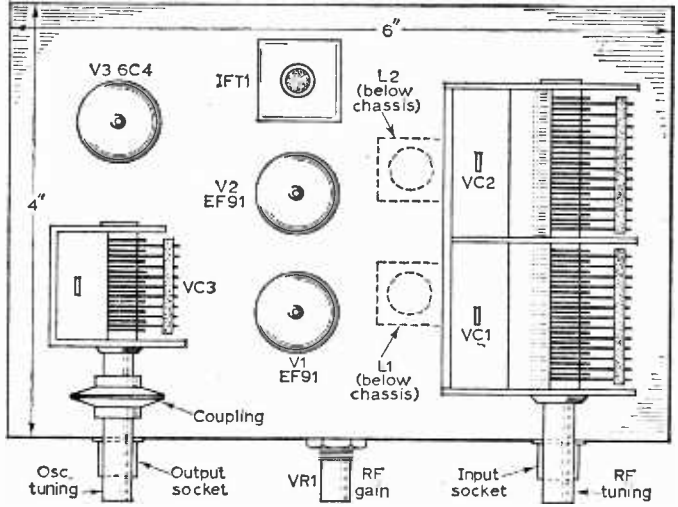
Fig. 3 (above): A modification to incorporate a.v.c.

Fig. 4 (right): The above-chassis layout of components.

as in Fig. 3, but it will be found necessary to connect the converter to the receiver with 4-core cable, the extra conductor being connected to the a.v.c. line of the receiver.

Construction

The prototype was constructed on an opened-end chassis 6in. x 4in. x 2in. Fig. 4 shows the arrangement of components, though this is not critical, and need not be followed exactly as long as



care is taken to avoid any feedback. It must be noted however that the EF91's have a high gain, and so only a little feedback is necessary to cause oscillation.

Owing to the superior selectivity of the converter, it was found necessary to use a slow motion

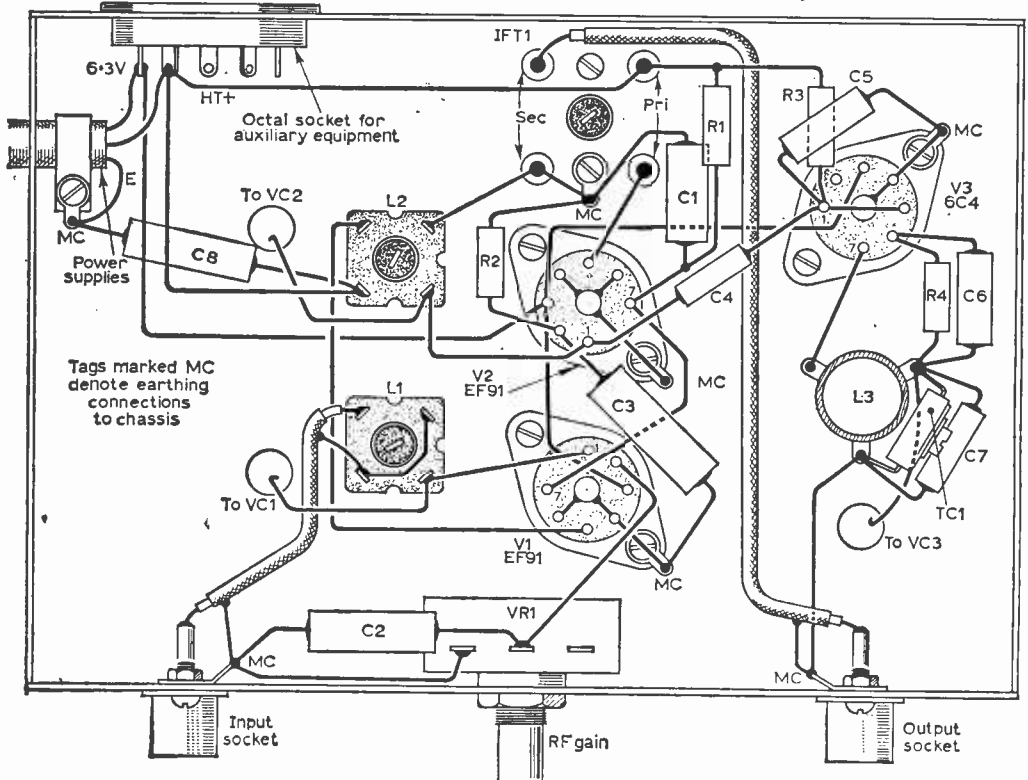


Fig. 5: The complete underchassis wiring diagram.

drive on the oscillator tuning capacitor, and even with this it was found easy to tune past a signal.

Winding the I.F. Transformer

Details of the output i.f. transformer IFT1 are shown in Fig. 2. All components for this were acquired from an old TV i.f. transformer, which was carefully cleaned of wax with methylated spirits. The former was of 3/8 in. diameter with iron cores. The windings consist of 72 turns of 28 s.w.g. enamelled copper wire, and are wound in two layers at each end of the former. Each winding is tuned with a 82pF silver mica capacitor.

COMPONENTS LIST

Resistors:

- R1 22kΩ 1/2W
- R2 330Ω 1/2W
- R3 100Ω 1/2W
- R4 100Ω 1/2W
- VR1 10kΩ potentiometer, wire-wound

Capacitors:

- C1 0.1μF paper
- C2 0.1μF paper
- C3 0.1μF paper
- C4 5pF ceramic
- C5 100pF mica
- C6 100pF mica
- C7 150pF ceramic
- VC1, 2 500+500pF 2-gang variable
- VC3 30pF variable
- TC1 50pF trimmer

Inductors:

- L1 Aerial coil 70-230m (Osmor QA4)
- L2 H.F. coil 70-230m (Osmor QHF4)
- L3 Oscillator coil (see text)
- IFT1 3Mc/s i.f. transformer (see text)

Valves

- V1 EF91
- V2 EF91
- V3 6C4

The tuned circuit in the oscillator consists of a 30pF tuning capacitor VC3 (such as obtained from an RF27 unit) shunted with a fixed capacitor of about 150pF, C7, and an inductance L3. This inductance consists of 17 turns of 24s.w.g. enamelled copper wire close wound on a 3/8 in. diameter former, tapped 5 turns from the earthy end. The inductance value is about 6μH.

Setting Up

The converter requires 6.3V at 0.9A and 200-300V h.t. at about 30mA. Such requirements can be furnished by the power pack on most receivers.

When the converter has been allowed to warm up for about 15 minutes, set the oscillator tuning capacitor VC3 to the half meshed position, tune the station receiver to 4.9Mc/s, and "zero" the oscillator in on this frequency by means of the oscillator padder TC1.

Then tune the receiver to 3.0Mc/s, connect an aerial to the converter, and couple the output of the converter to the receiver. The twin-gang tuning capacitor should be adjusted so that it is a little more than half meshed. The cores of the i.f. transformer are then peaked up. Next peak up the twin-gang tuning capacitor, and finally the cores in the aerial and h.f. coils. When all the cores have been properly adjusted they should be sealed with a drop of wax.

The 30pF oscillator capacitor VC2 is the main tuning control of the converter, the twin-gang capacitor being used to peak up the signals. With a little practice and experience the converter will function well, and the selectivity of the combined equipment will be found far superior to that of any single conversion set.

—continued from page 228

TRANSISTOR "25WATT P.A. AMPLIFIER"

The transistors are fitted to the printed circuit board and heat sink as shown in the following table:

No.	Type	Base	Emitter	Collector
Tr1	NKT223	To K	To L	To M
Tr2	NKT223	To N	To P	To R
Tr3	NKT228	To R	To T	To Driver Transformer
Tr4	NKT228	To P	To S	To Driver Transformer
Tr5	NKT404	Fitted to Cooling Fin		
Tr6	NKT404

The printed circuit board and driver transformer can now be mounted in the case, earthing the case, if desired, to point W.

Connect the collectors of Tr3 and Tr4 to the start of one primary winding of the driver transformer and the finish of the other primary winding. The other end of the winding to which the collector of Tr3 is connected goes to the flying lead from point D. The other end of the

winding to which the collector of Tr4 is connected goes to the flying lead from point C.

The centre tap of the driver transformer secondary should now be connected to the flying lead from point V, and the remaining two connections taken to the bases of the output transistors.

The flying lead from point B should be taken to the emitters of both output transistors, and the collectors of the output transistors connected to the output transformer, together with the flying lead from point A, in accordance with the diagram Fig. 6. Connect the flying lead from X to the collector of Tr3. The flying lead from point G should not be connected at this stage.

Check all wiring carefully and when satisfied that all is correct connect to a 12V accumulator (observing polarity) via a 1A fuse.

The amplifier should now work, and if satisfactory the fuse can be exchanged for one of 5A rating and the feedback loop connection from point G connected. To establish the correct point of connection test the flying lead from point G on the base of each of the output transistors in turn. The correct connection will produce a reduction in amplifier sensitivity while the incorrect connection produces a vigorous howl. It will be observed that a small internal feedback loop containing a 1MΩ resistor and a 47nF capacitor connected to the base of Tr4 already exists. This is to balance out the internal collector to base feedback of Tr4 and ensure stability of the Tr2, Tr3, Tr4 network.

on the Short Waves

A MONTHLY COMMENTARY BY J. GUTTRIDGE

AS mentioned last month, several stations broadcast special programmes giving details of reception conditions and frequency changes. Here are details of some of them. All times are in GMT.

Radio Australia carries a programme called "Australian DX-ers Calling". This deals exclusively with broadcast band stations and lasts ten minutes. It is beamed to Great Britain at 0715 on Sundays over 9.570kc/s and 11.710kc/s. This programme is especially useful for keeping up to date with Asian and Far Eastern developments.

Ham band enthusiasts are catered for by Radio Sofia, Bulgaria, on Friday evenings at about 1945 and 2145. Best reception at both times is on 6.070kc/s. A similar type of programme is broadcast by Radio Prague, Czechoslovakia, on the first Monday of each month at 1915 and 2215. The 1915 transmission comes in well on 7.345kc/s, whilst the 2215 transmission is on 1.286kc/s medium wave.

One of the best programmes on the broadcast bands is that transmitted by Radio Denmark. Information is usually supplied by O. Lund Johansen, the World Radio/TV Handbook editor. Transmission times are Tuesday at 1920 on 15.165kc/s and 2035 on 9.520kc/s, Wednesday 0220 on 9.520kc/s and Thursday on 15.165kc/s at 0950 and 1520. Reception, unfortunately, is often difficult as none of the transmissions are beamed to the British Isles or Europe.

Both ham and broadcast band listeners are catered for by Radio Nederland's programme "DX Juke Box". This is transmitted in all its English transmissions on Thursdays. Details of these transmissions are given in this month's schedule change news.

"Sweden Calling DX-ers" is one of the most comprehensive DX programmes. It is transmitted by Radio Sweden during the last 15 minutes of its English transmissions on Tuesdays. These are beamed to Europe from 2200—2230 on 6.065kc/s and 2330—2400 on 1.178kc/s medium wave. Some of the other beams can also be picked up in the U.K.

The second half of the Swiss Broadcasting Corporation's English transmission on Saturdays is given over to a programme called "Swiss Short Wave Merry-go-Round". On the first and third Saturdays each month there is a report on stations in the broadcast bands, whilst on the others amateur band topics are dealt with. The U.K. transmission is from 1845—1945 on 7.110/9.665kc/s.

The programmes mentioned so far are those which will probably be of most use to the average listener. There are also programmes from the Canadian Broadcasting Corporation, Radio Finland, Deutsche Welle, BBC, Radio Budapest,

N.H.K. (Japan), Radio Warsaw, Radio New York Worldwide and the Voice of America.

Jamming

Good news for all broadcast band listeners comes in an announcement from the BBC on the subject of jamming. It says that all its East European transmissions, except those in Bulgarian, are now free of jamming. Let's hope this spreads and other stations' transmissions go unblocked. The trouble with jamming is that it is non-selective and often blocks out stations other than the one it is aimed at.

Ham Band News

According to Radio Sofia the 21mc/s ham band is now good for working to the Far East. If you want to hear a station in Franz-Josef Land, Sofia suggests trying 14.040kc/s or 14.060kc/s, where UA1KUD is working in CW. This station will QSL through the Russian bureau, P.O.B.88, Moscow. A blot in the ham world is a report that the Lebanon has suspended all licences.

VR4CN in the Solomon Islands will be working from 1200 on single sideband around 14.320kc/s for about the next eight months according to the Swiss Broadcasting Corporation. They also report 20m as the best DX band at present.

B.C. Band News

In the broadcast bands more summer schedules have come to hand. Radio Nederland (P.O.B.222, Hilversum, Holland) is completely rearranging its schedule with the commencement of transmissions from its relay station in the Netherlands Antilles. New frequencies being used are 17.720/15.440/15.435/11, 960/9.705/7, 210/7, 165/7, 110kc/s. European English transmissions are from 2000—2050 on 6.020kc/s repeated from 2100—2150 in the 19 and 25m bands. "Happy Station" programmes on Sundays have also been extended. A full schedule is available free of charge from this station.

Bernard Attrell, of Winchester, reports that the Windward Islands Broadcasting Service is back again to the U.K. on 15.085kc/s from 2130—2230. The signal is a very good one, especially when you remember the station is using only 5kW. When reporting to this station there is no need to send reply postage. Its address is St. George's, Grenada, W.I.

The Canadian Broadcasting Corporation, P.O.B. 6000, Montreal, is now using 5.970kc/s and 9.625kc/s for the whole of its English transmission to Australasia. This is on the air from 0715—0850.

—continued on page 274

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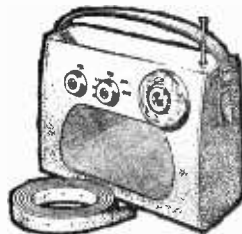
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SUPER SEVEN

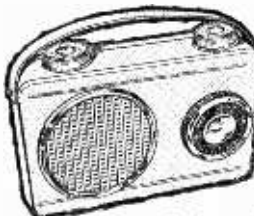
● 9 stages—7 transistors and 2 diodes

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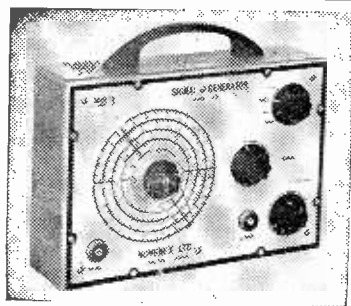


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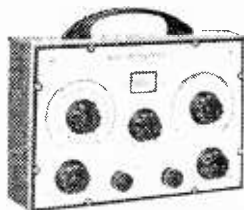
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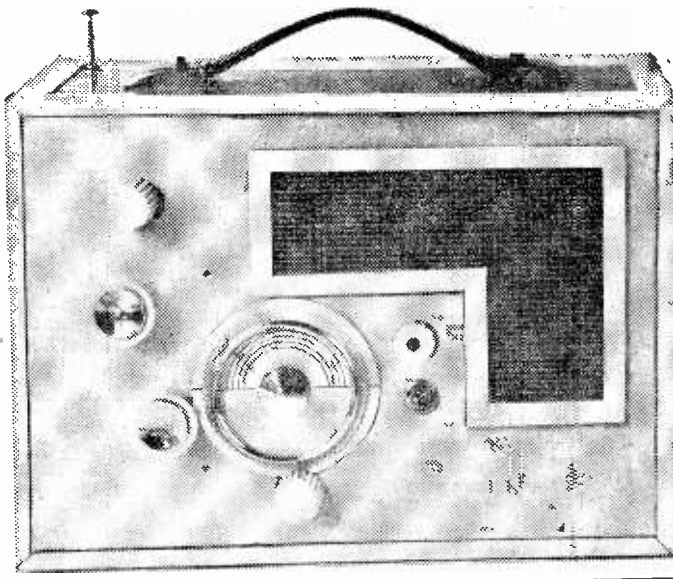
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By L. R. Repage



The CHELMER 4

TO many readers this article may seem to be going back a few years, and in a way this is true, for the first preliminary layout experiments of components was made by the author quite two years ago.

The small miniature components were purchased with the intention of constructing a portable of modest size which would be capable of good reception on the three main BBC transmissions, using a frame aerial, and also to be capable of picking up short-wave transmissions by the inclusion of the appropriate short-wave coils and a tubular-type aerial.

These aims have been achieved and under good reception conditions quite a good selection of short-wave stations can be received on the two short-wave bands, whilst with a good aerial, wire twisted round the aerial tube, long-distance American transmissions have been received at, of course, the appropriate times.

The author must admit that the chassis presents a somewhat "dreadnought" appearance but the whole is the outcome of a series of additions which have taken place during the two years' work on the set. It is, in fact, a prototype of an amateur constructor. The mechanical construction could no doubt be simplified in many respects but not with regard to the general layout of component parts, which has received much thought, particularly in the designing for short and direct wiring, a necessity for the short wave bands.

So the author gives herewith drawings and constructive notes of this quite useful portable

in that it may tempt some readers to give these grand little valves a go again.

CONSTRUCTIONAL DETAILS

As the author anticipated quite a lot of experimental work in connection with coils and frame aerials it was decided to make the design such that the main tuning components were easily dismantled and replaced after the various modifications. For this reason a separate coil unit, complete with switching, was designed.

The several capacitors and resistors forming the automatic volume control circuit were made in a unit form, as also the padding capacitors, these being neatly arranged in a "bank" immediately adjoining the coil unit.

Again, for ease of removal the chassis was fitted with bottom flanges to engage into recesses in the frame aerial unit. With this arrangement and with but four soldered connections necessary, and with the two batteries in position, the set is completely self-contained and workable. It can be slipped into the cabinet in a few seconds, however, by removing the tuning dial and the three control knobs. By the way, an extension spindle with coupling is necessary for the main tuning capacitor.

THE CIRCUIT

The theoretical circuit diagram is shown in Fig. 1 and is a conventional superhet arrangement of four valves: frequency changer, intermediate

COMPONENTS LIST

Resistors:

- R1 33kΩ
- R2 5kΩ
- R3 100kΩ
- R4 1MΩ
- R5 1MΩ
- R6 2MΩ
- R7 4.7kΩ
- R8 33kΩ
- R9 500Ω

All ±10%, 1/4W carbon

VR1 1MΩ carbon potentiometer, miniature button type

Capacitors:

- C1 180pF silver mica
- C2 0.01μF paper
- C3 0.1 μF sub-miniature type
- C4 0.01μF miniature type
- C5 150pF silver mica
- C6 150pF silver mica
- C7 0.01μF miniature type
- C8 0.01μF miniature type
- C9 100μF electrolytic 25V
- C10 8μF electrolytic 150V
- VC1 500pF } midget twin gang, with centre
- VC2 500pF } screen and long shaft
- VC3 25pF }
- VC4 25pF } twin gang
- TC1-4 500pF compression type trimmers

Transformers:

- T1 L.F. transformer (Radiospares Midget 3-1)
- T2 Output transformer (Elstone Type MO/T)
- IFT1, 2 Miniature 465 kc/s i.f. transformer (Repanco)

Inductors:

- L1 Long wave frame aerial
- L2 Medium wave frame aerial } see text
- L3 Short wave 1 aerial coil (Osmor QA2)
- L4 Short wave 2 aerial coil (Osmor QA1)
- L5 Long wave oscillator coils (Osmor QO9)
- L6 Medium wave oscillator coils (Osmor QO8)
- L7 Short wave 1 oscillator coils (Osmor QO2)
- L8 Short wave 2 oscillator coils (Osmor QO1)

Switches:

- S1 Single pole, 4-way wafer switch
- S2 Three pole, 4-way wafer switch with long shaft
- S3 Double pole on/off toggle switch

Valves:

- V1 DK92
- V2 DF91
- V3 DAF91
- V4 N17

Miscellaneous:

Four BG7 valve holders with screening cans. Aluminium for chassis, etc. Perspex, 1/8 in. thick for coil unit. Tagboards. Dial 2 3/4 in. dia. (push-on type). Three knobs. Wire for coils (see text). Paxolin tubing 1/2 in. dia. Plastic covered connecting wire. Loudspeaker 2 in. dia.

frequency amplifier, detector and audio frequency amplifier and pentode output stage.

The input from the long or medium wave frame aerials goes to the control grid (G3) of V1, the frequency changer, whilst for the two short wave bands two coils are switched in and work in conjunction with a tubular aerial rod.

Four oscillator coils are used, the oscillator grid and oscillator anode windings of these being switched by S2b and S2c.

The intermediate frequency is the normal 465kc/s and is fed to V2 via the miniature i.f. transformer IFT1. Here the 465kc/s signal is amplified and the output at IFT2 is then

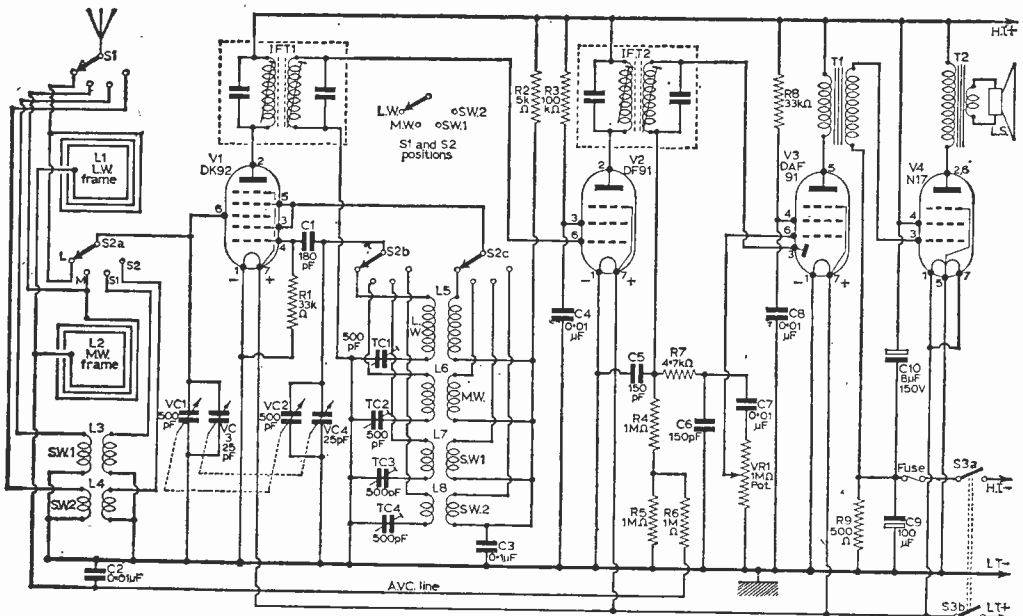


Fig. 1: The circuit diagram of the Chelmer.

passed to the diode of V3 via the volume control VR1.

A miniature audio transformer T1, ratio 1:3, couples V3 to the power output pentode V4.

Automatic bias voltage is developed across R9. It will be noted that h.t.— and l.t.+ are both switched off and on by the two-pole switch S3, thus preventing battery drain when the set is off.

It will be seen from the diagram that switch S1 is separate from S2.

S1 is used primarily for connecting the tubular aerial to the two short wave aerial coils, L3, L4, as it was found that the frame aerials were adequate for the medium and long bands without any aerial. However, there is a slight gain, particularly on some of the Continental stations, by using the tubular aerial and, if desired, two wires

can go from switch S1 to the grid ends of the frames, thus making a four-point change for the aerial.

It was not found desirable to use a.v.c. for the short wave coils, but if the reader wishes to include this the bottom end of the grid coils in the coil unit will have to be joined to the a.v.c. line instead of being earthed.

Above the main tuning (ganged) capacitor VC1, VC2, will be seen two smaller (ganged) vernier capacitors, VC3, VC4, for each of the two sections. This vernier will be found most useful for the short wave bands.

The author tried resistance coupling from V3 to V4, but transformer coupling was found much more satisfactory with the 90V h.t. only available. A good-quality component is desirable both for T1

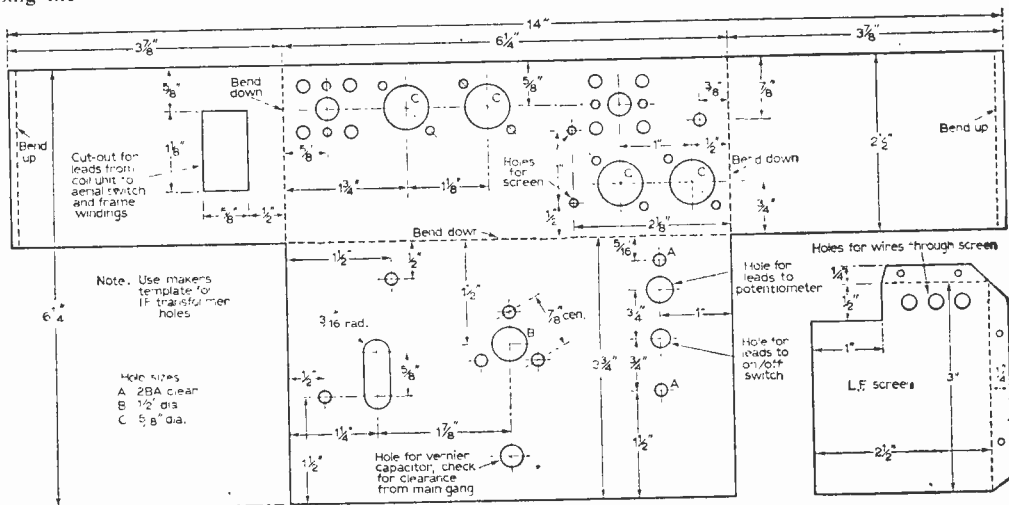
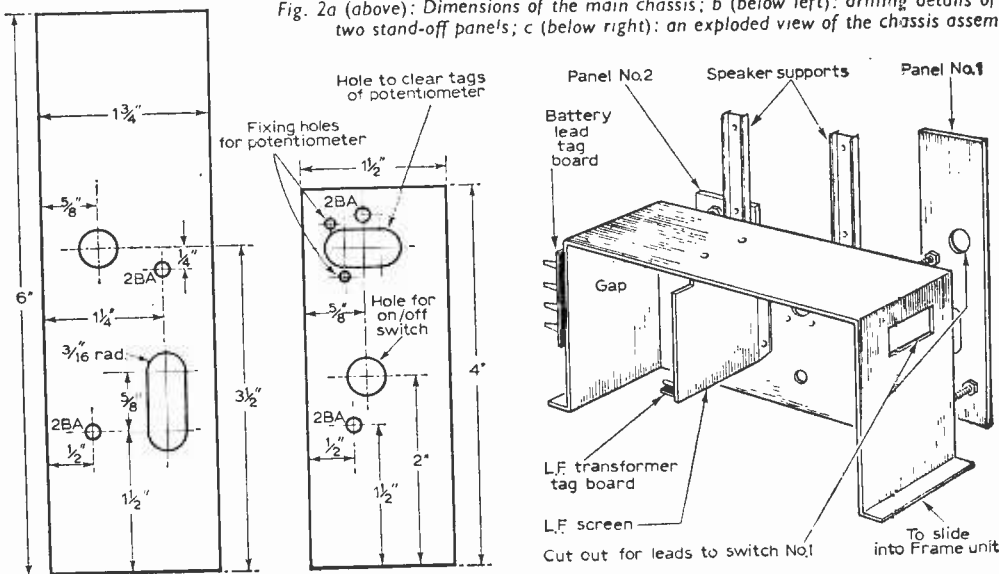


Fig. 2a (above): Dimensions of the main chassis; b (below left): drilling details of the two stand-off panels; c (below right): an exploded view of the chassis assembly.



and for the matching transformer T2.

Note particularly the filament connections to V4. The pentodes in this series of valves have a tapped filament for either 1.4V or 2.8V working. The circuit shows as connected for 1.4V use.

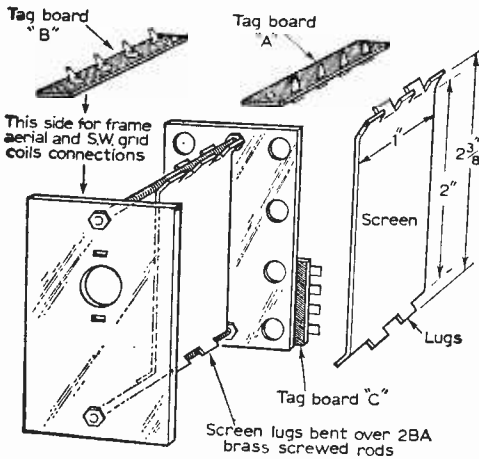
MAKING THE CHASSIS

The original chassis was formed on a standard aluminium box type chassis measuring 6in. x 2½in. x 2½in. and to this stand-off legs and panels were added during the various stages of modification.

Many constructors will no doubt prefer to make up the chassis from a single sheet of aluminium and so full details are given in Fig. 2. The aluminium should be about 1/16in. thick.

It will be seen that in addition to the main chassis piece there are two stand-off panels (Nos. 1 and 2 in Fig. 2b) and an i.f. screen.

The stand-off panels might possibly be dispensed with but the trouble of cramping below the chassis deck would have to be reckoned with if the on/off switch and potentiometer were fitted inside.



The diagrams are fully dimensioned, although generally sizes have been given for centres. Diameters of holes should be checked with the actual components to be used. Sometimes makers provide templates and these should be used for marking—this applies particularly to i.f. transformers.

An "exploded" view of the chassis assembly is given in Fig. 2c.

The loudspeaker part is mounted on two lengths of aluminium curtain runner section bolted to the chassis, the speaker unit being secured to them by four lengths of 2B.A. screwed rods. The speaker can thus be adjusted to the required projection from the chassis. It will be seen that the twin vernier capacitor is mounted immediately below the main ganged capacitor, allowing very short connections and ease of operation. Both gangs require short extension spindles.

The aerial switch is just above the coil unit switch. It would be possible to combine the aerial and coil-change switches, using a four-pole, four-way switch in the coil unit, but such a switch will be found rather complicated, having tags on either

side of the wafer, whilst a ganged-type wafer switch takes up too much room for the coil unit.

The miniature loudspeaker is in the centre, mounted on its supports.

THE COIL UNIT

Many readers may feel that this rather awe-inspiring unit is quite beyond their scope. However, when once the framework of this unit is made up, with the wafer wavechange switch fitted, the wiring is progressive and, if a definite procedure is adhered to, it is not beyond the average

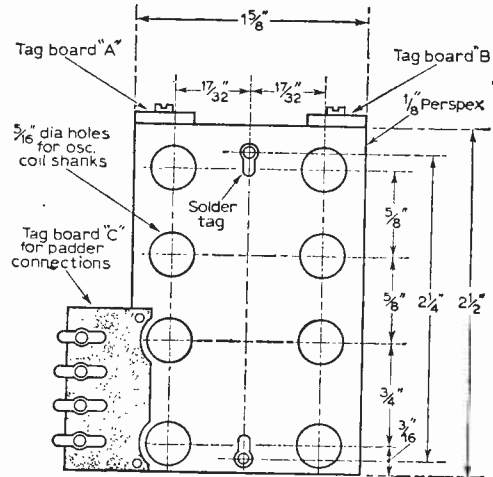
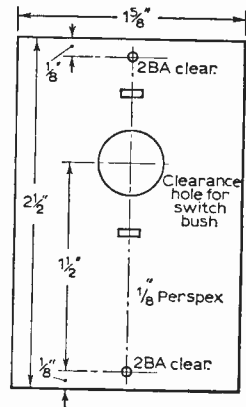


Fig. 3a (left): A general assembly view of the coil unit; b (above): details of the end piece of the unit carrying tag board "c"; c (right): details of other end piece.



radio amateur. This procedure will be given later.

Full dimensions are given in Fig. 3 for the framework of the coil unit, including the screen.

Perspex sheet is a nice material to work with, although there is no reason why aluminium sheet could not be substituted, apart from the problem of fixing the tag boards A and B.

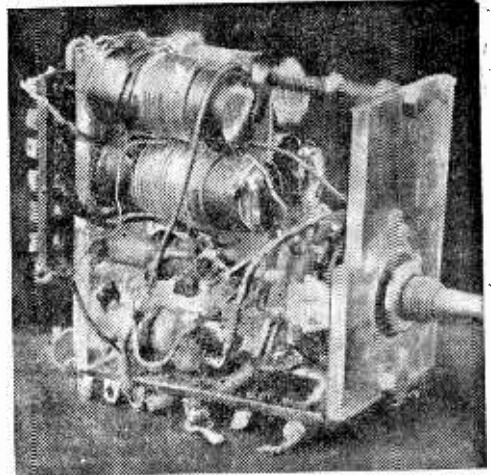
The general assembly is shown in Fig. 3a. Two lengths of 2B.A. brass screwed rod act as tie bars to the front and back plates and also form support for the aluminium screen, the lug pieces of the latter being pressed tightly over the screwed rods with pliers. This screen is, of course, situated at the back end, leaving a space at the front end for the switch and the wiring from it and from the coils.

When the two tag boards A and B have been

fitted the wiring-up of the coil unit can be commenced and it is wise to mark on the tag boards the connecting labels first. Thus "grid" (control), "OSC A", "OSC grid" and "h.t.". Also the tag board B should be labelled: "Aerial," "Long", "Med.," "Short 1", "Short 2". The "Long" and "Med." are, of course, frame aerial connections in this instance.

First, by trial with a small battery and flash-lamp, find the correct set of four contacts on the switch for each pole if this cannot be ascertained by visual means. Each set of tags should be colour spotted with four different colours, with the same colour for the pole tag itself. Thus we will have, say, red spots for OSC/anode connections, green for OSC/grid and white for control grid. This is a great help when wiring the coils, but care should still be exercised to get each coil correctly connected to the right tags for long, medium, short 1 and short 2 changeover.

Commence with wires from each of the main Supports for speaker unit



A view of the completed coil unit.

kindly. Once securely soldered, however, the material is quite strong and a good insulator.

THE MAIN ASSEMBLY

The back view given in Fig. 4 shows clearly the neat arrangement of components and these, being in the form of separate units, simplifies the below-chassis wiring. The units are also quickly removed, necessitating only a few minutes with the soldering iron.

A main h.t. positive bar has been fitted from the tag board on the left and is soldered to the appropriate h.t. leg of the first i.f. transformer. This bar, which has short lengths of sleeving threaded on, allows various h.t. positive points available for connections. If red sleeving is used it will not be confused with the nearby chassis wire (earth), also a useful arrangement.

This latter bar, together with its duplicate at the bottom of chassis, should, of course, be very thick gauge tinned copper wire. Certain wires, however, will be more conveniently connected direct to chassis. Holes will be drilled for these and soldering tags bolted to the chassis. Such points are shown for V3 and V4 in the wiring view. Others could be so connected, if preferred, to common earth points.

On the right is seen the coil unit and from the small tag board on it go wires to the appropriate padder capacitors, the other ends of which are to chassis.

CONTINUED NEXT MONTH

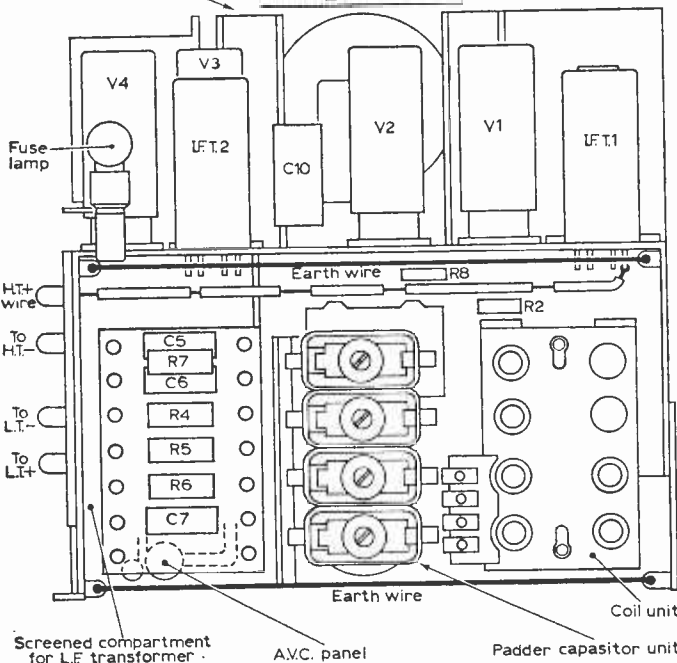
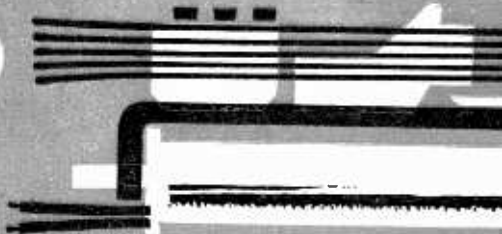


Fig. 4: A rear view of the assembled chassis showing positions of major components.

poles of the switch to control grid, "OSC anode" and "OSC grid" tags on tag board A, using fairly large gauge flex or stranded wire. A plastic insulated flex is less bulky than electric wiring type flex. Then continue by fixing the long wave coil oscillator, followed by the medium wave oscillator coil.

A good hot electric soldering iron of the pencil pattern is useful and it is advisable to wrap a small piece of wet or damp fabric round the coil tags as the plastic material used does not take heat

IMPROVED RELAY CIRCUITS



THE greatest enemies of the amateur radio and electronics enthusiast are (1) financial limitations, (2) lack of availability of components on the commercial market and (3) limitations in the operating characteristics of many of the components that are available.

Relays are typical components that can be considered as falling into all three of the above categories in that while some of the not very sensitive types may be purchased for only a few shillings, the price of those that will work from only a volt or two and have a resistance of thousands of ohms is quite prohibitive to many readers.

Situations often arise in which the experimenter requires a relay that can be operated from a current of only a few micro-amperes, but such components are just not available although they are, in fact, manufactured for the industry. Moving coil types are available on the surplus market, but these generally require a current of between one and two hundred micro-amperes to make them operate—which is too heavy a current to satisfy the above requirement.

Critical On/Off Ratio

One of the most severe limitations in the characteristics of relays is the wide difference in

where a photo-transistor or cadmium sulphide photocell is used to turn on a light when the daylight falls below a certain intensity and is intended to turn the lamp off again when the daylight rises back to that intensity, it is often found that due to the large difference in the relay on/off voltages the lamp often stays on almost permanently.

In this article it is intended to show simple circuits which are designed to overcome to a large degree these three enemies of the enthusiast when applied to relays.

Increasing the Sensitivity

Transistors may be used to increase the effective sensitivity of both moving coil instruments and ordinary relays. Fig. 1 shows three circuits that may be used to this end. It can be seen that no biasing networks are included in the circuits and these have been found to be quite unnecessary in this particular application.

In the circuits used as prototypes a relay with a coil resistance of 670Ω was used which required a current of 14mA to "drop in", and sensitivity figures quoted will refer to this relay. It must, however, be pointed out that any relay that has characteristics falling within the practical voltage and

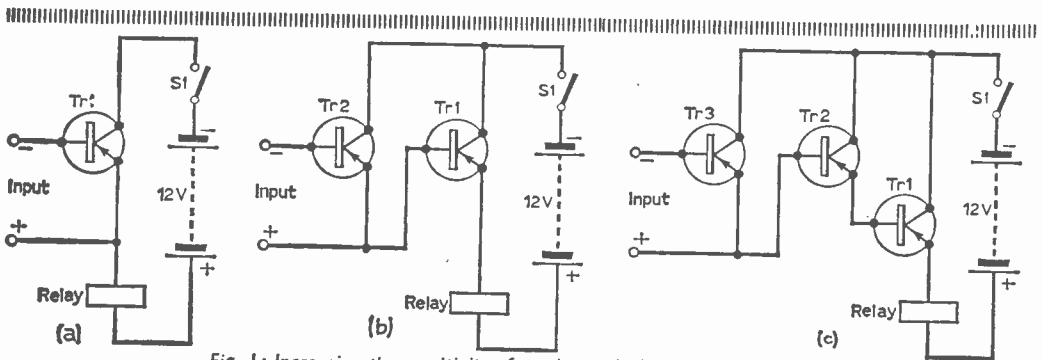


Fig. 1: Increasing the sensitivity of a relay with the aid of transistors.

the pull-on and the drop-out voltages. For example, it is found that a typical relay may pull on at $8\frac{1}{2}\text{V}$ and drop out again only when the voltage is reduced to $1\frac{1}{2}\text{V}$, an on/off ratio of nearly 6:1.

In many cases this on/off ratio, which generally lies between 3:1 and 4:1, may prove to be too high to give satisfactory operation of a piece of equipment. In a light-operated unit, for example,

current ranges of the transistor with which it is used will be found to work satisfactorily using the circuits shown. Red Spots (a very cheap and excellent general purpose transistor) were used, but many other transistors are suitable.

The relay is shown connected in the emitter circuit of the transistors, but it can equally well be used in the collector circuit with no noticeable change in performance.

for the Constructor

R.M. MARSTON

Referring to Fig. 1a, the circuit must be connected up as shown and the triggering voltage applied between the base and emitter. It is important to notice this point as if the trigger voltage is connected between the base and the positive supply line a very much greater voltage will be needed to cause the relay to operate.

In the test circuit it was found that the relay operated with a trigger voltage of 310mV and a current of 2.6mA. The drop-out voltage was 250mV which represents a very low on/off ratio.

The circuit in Fig. 1b, using two transistors, was found to operate from a voltage of 150mV at 20 μ A with the trigger voltage applied between the

prevent relay chatter, the component values being selected to suit the frequency of operation.

The second point to note is that if a number of relay circuits of this kind are to be used in an instrument, then each one must have its own separate power supply—and in any case no relay unit must have a supply common with the rest of the instrument circuitry.

If a large number of such units are to be used in one instrument it would be as well to build a rectifier and smoothing network into each unit and drive each one from its own secondary of a transformer or inverter unit.

The third point is that all transistors used must

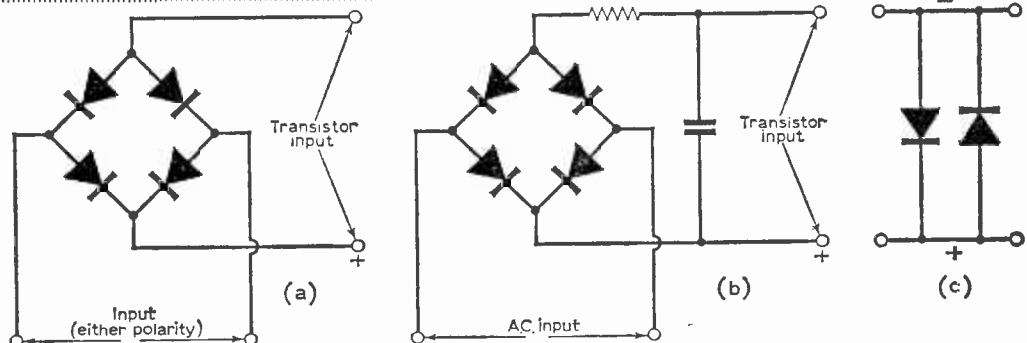


Fig. 2 (a): An arrangement to suit either positive or negative input signals; (b): to suit a.c. inputs. (c): Diodes arranged as trigger voltage limiters.

emitter and base of Tr2, while the circuit using three transistors shown in Fig. 1c operates from a mere 50mV at 10 μ A.

All voltage readings were taken using a 20,000 Ω per volt meter on its 2.5V range. It can be seen that at these low operating voltages and current the input to the transistors presents quite a high impedance.

Triggering Polarity

Three points must be noted in particular about these circuits. First, they will only operate from one polarity of trigger signal, the base forming the negative connection and the emitter the positive.

If it is required that the circuit operates from either positive or negative signals, a bridge rectifier must be connected across the input, as shown in Fig. 2a. Alternatively if the circuit is required to operate from a.c., a bridge rectifier and smoothing circuit must be used across the inputs as shown in Fig. 2b. The smoothing circuit is necessary to

have very high resistance between emitter and collector, otherwise a small current in one transistor may be sufficient to cause a sufficiently high current to flow through succeeding transistors to prevent the relay from dropping out once it has been operated. If a "leaky" transistor must be used then it should be used in the Tr1 position, and then only if the leakage current is well below the relay drop-out current.

Checking the Transistors

It would be as well to check all transistors before connecting them in circuit in the usual way.

This can be performed by using an ohmmeter or a battery, a limiting resistor and a sensitive current meter in series. Check that (1) a high resistance exists between the emitter and collector with the check leads in both polarities; (2) that with one lead connected to the base a high resistance exists between it and both the emitter and the collector; (3) that when the other lead is connected to the

base giving a reversal of polarity a low resistance exists between it and both the emitter and the collector.

The voltage ratings of the transistor must not, of course, be exceeded during these tests. A not very "with it" friend of mine once tested half-a-dozen transistors in this way with a 250V Megger and was quite disgusted when none of them passed the test.

Safety Diodes

A simple precaution to prevent trigger voltages of excessive amplitude from causing excessive current to flow in the transistors, with subsequent damage, is shown in Fig. 2c.

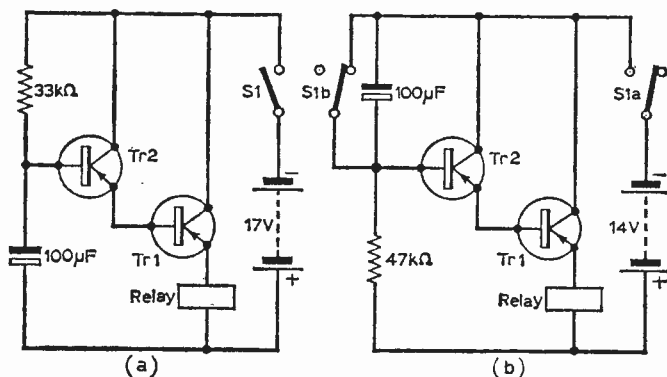
Here two germanium diodes are connected in parallel, anode to cathode and shunted across the input. When only a few millivolts are applied to the diodes they act as a very high resistance and have almost no shunting effect, but as the voltage is increased their resistance falls, with a subsequent increase in shunting effect until when about half a volt is applied they act almost as a short circuit.

If the trigger voltage is to be applied with one polarity only, with no danger of a reversal of polarity, only one diode need be connected across the input as a precautionary measure.

It is often required that a time delay be incorporated so that either the relays will not click in until a certain time has elapsed from the moment of the trigger voltage being applied, or alternatively, they will click in as soon as the voltage is applied but drop out again after a certain time has elapsed.

With the more sensitive relays it is simply a matter of connecting a resistor and a capacitor of the

Fig. 3: Raising the input impedance still further by the use of two transistors; (a): a "delay-before-operate" circuit; (b): an "on-delay-off" arrangement.



correct value and in the correct configuration directly to the relay in order to achieve this, but such relays are generally rather expensive and it is with methods of saving the amateur money that this article is primarily concerned.

Very cheap relays that require a comparatively high operating current may be used in conjunction with a couple of Red Spot or similar transistors to achieve the same or even better results at a fraction of the cost. In the circuits to be described the same type of relay as used in the earlier circuits was employed, that is, a 670Ω 14mA operating type.

Time Constant Circuit.

The normal method for obtaining the time delay with a transistorised circuit is to wire the relay in series with either the emitter or collector of the

transistor and connect a time constant circuit, which consists simply of a resistor and capacitor in series, between the positive and negative supply lines with the junction of the two components wired to the transistor base.

If the capacitor is wired to the negative line, then the relay will come on as soon as the operating voltage is applied to it but will drop out again after the required time delay; whereas if it is the resistor that is connected to the negative line then the delay will occur before the relay operates.

In practice the input or base to emitter impedance is fairly low, in the order of a few hundred ohms, when sufficient voltage is applied to it to cause a current of several milliamps to flow in the collector circuit. This low impedance acts as a shunt across the time constant circuit, with unfortunate results.

An approximation of the time constant given by a series resistor and capacitor is given by the formula $T=RC$, where T =time in seconds, R =resistance in ohms and C =the capacitance in Farads. Thus a resistance of 100,000Ω must be used with a capacitor of 100μF in order to obtain a delay of ten seconds.

If the transistor input impedance shunts the resistor down to a value of only 100Ω then a capacitor of 100,000μF will be needed to give the ten second delay, an impractical value.

Another way of looking at the problem is to say that a certain voltage must be applied to the base in order to cause a sufficient voltage to appear across the relay to make it operate, but the time constant circuit forms a voltage divider chain to

the base. With the resistor shunted to a value of a 100Ω or so in the "delay before make" type circuit and using the specified 100μF capacitor it would probably be necessary to apply over a hundred volts across the chain in order to reach the required base voltage.

The way round this difficulty is to connect the relay in the emitter line, in which case the base voltage is applied between the base and the positive line and not base and emitter, with the result that the input impedance is raised in much the same way as happens with the valve type cathode follower circuit. Roughly speaking the input impedance then becomes the product of the transistor current gain and the resistance in the emitter line, in this case the relay coil resistance.

Raising the Input Impedance

The input impedance gained in this way may still be low enough to cause severe difficulties, but it can be raised still further using two transistors, as shown in Fig. 3.

Here it can be seen that the emitter of a second transistor, Tr2, is connected to the base of the first and that the collectors of both Tr1 and Tr2 are connected to the negative line. The operation is as follows:

Assuming the rough calculation of input impedance above to be correct and the gain of the transistors to be 30, then if a relay with a coil resistance of $1,000\Omega$ is used it is found that the input resistance at the base of Tr1 = $30,000\Omega$. The base resistance of Tr1 also forms the emitter load of Tr2, so that its input impedance becomes $30 \times 30,000 = 900,000\Omega$ or so. In practice impedances of several hundreds of $k\Omega$ can be expected. This is sufficiently high to cause negligible shunting to most time constant circuits.

It is found in practice that the time delay required is best found by experiment as it depends not only on the theoretical resistor and capacitor values, but also on the characteristics of the relay, the transistors and on the voltage of the supply.

In the circuit shown in Fig. 3a, which is of the "delay before operate" type, it was found that with the relay already stipulated a delay of six seconds occurred using a resistance of $33,000\Omega$ and a capacitance of $100\mu F$ and a battery voltage of 17V. The relay is started by switching the supply on to the unit via S1. When the supply is turned off again the unit resets almost at once, a delay of a small fraction of a second occurring while the capacitor discharges itself. The reason for the fairly large battery voltage is that the transistor used would only pass a little over the required 14mA to operate the relay from a 12V supply even when the base of Tr2 was connected to the 12V negative line directly. 17V is, of course, well above the recommended maximum rating for Red Spot transistors and although the writer has used such voltages many times in the past without a single failure it is possible that break-down may occur in some cases.

It is therefore recommended that in cases where it is decided to use a transistorised delay circuit on a relay which requires an operating current of greater than 14mA within the voltage ratings of the transistors, Tr1 be replaced either by an OC72 or OC81, or preferably, with a view to keeping the cost down, by two or more Red Spots in parallel, that is, wired emitter to emitter, collector to collector and base to base.

On-Delay-Off Circuit

The circuit shown in Fig. 3b is the arrangement for the on-delay-off type of unit. In the prototype circuit a delay of five seconds was obtained using a capacitor of $100\mu F$ and a resistor of $47,000\Omega$ with a battery voltage of 14V.

It should be noticed that with this circuit once the relay has dropped out the circuit does not automatically reset itself, as the capacitor retains its charge even if the battery supply line is broken. It is therefore necessary to use a two pole, two way

switch for operating the circuit, with one switch bank in series with the supply and the other wired across the capacitor so that when the power is turned off the capacitor is automatically short circuited and discharged. Resetting then becomes automatic. There may be occasions when time delays or increased sensitivity are not required at all, and the only problem presented by the relay under consideration is its wide on/off voltage ratio. As already mentioned, this ratio generally lies between about 3:1 and 4:1 which is large enough to present many problems in what can be described as servo-operated equipment where the relay is intended to come on only when a sound, light, heat or other quantity reaches a certain value and to drop out again when the quantity falls below that value again.

Reducing the On/Off Ratio

A simple solution to this problem is to wire a Zener diode in series with the relay, as shown in Fig. 4. The reduction in the on/off ratio is a function of the ratio of the Zener voltage/relay voltage ratio.

The action of the Zener is to more or less raise the on/off

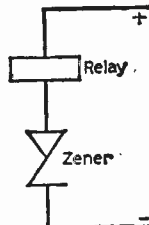


Fig. 4: Using a Zener diode to reduce the on/off ratio.

voltages of the relay by the value of its own voltage. For example, in a test circuit it was found that a relay came on at $8\frac{1}{2}V$ and dropped out at $1\frac{1}{2}V$, giving a ratio of about 5.7:1, a little wider than average. When an 8V Zener was connected in series with the relay it was found that the on voltage became 15 and the off voltage 8, giving a ratio of between 1.7:1 and 1.8:1, a great improvement.

In a second test a $1,000\Omega$ relay with an on voltage of $10\frac{1}{2}V$ and an off voltage of 3 was used, giving an on/off ratio of 3.5. When the 8V Zener was connected in series the voltages became 16 $\frac{1}{2}$ and 10 respectively, giving a ratio of 1.65.

A third test used a $10,000\Omega$ relay with on/off voltages of 10 and 3 with a ratio of 3.3:1. When the 8V Zener was used these became 18 and 10.5 giving a ratio of about 1.8:1.

The higher the Zener voltage used the smaller becomes the on/off ratio, so that the ratio can be made to be determined only by the maximum available supply voltage and the sensitivity of available relays.

If for example, a relay with on/off voltages of 10 and $2\frac{1}{2}$ is available, giving a ratio of 4:1, and is to be used in a valve circuit where an operating voltage of say 200 may be used, then a number of Zener diodes may be wired in series to give a Zener voltage of 190. It will then be found that when the relay is put in series with them the on/off voltages will become about 200 and 197 so that the on/off ratio is then reduced to virtually 1:1.

It must be realised, of course, that it is only the on/off voltage ratio that is altered in this way, the on/off current ratios remaining the same. ■

A tape auto stop

BY K. A. CARR-GLYNN

MANY less expensive tape recorders are not fitted with automatic tape stops to halt the drive mechanism when the tape has run to the end of the spool, but the device to be described enables practically all such tape recorders to be modified for "auto stop".

Most tapes have stop foils at the ends, before the last leader, and this foil is used to actuate the tape stop. The circuit as shown in Fig. 1 is a very simple one, though very effective.

MR1 is a meter rectifier of the bridge variety, though, as it is only the heater voltage that is being rectified and in normal conditions there is no drain on it, there is nothing against the use of germanium diodes here.

When running the tape normally, the negative potential from MR1 is applied to both grids of V1, which is consequently cut off. The reason a double triode is used is the need to provide a large current increase to operate the relay RL1. When the valve is cut off the relay is de-energised and supplies are made to the tape amplifier and drive motor. This state is indicated in Fig. 1.

However, when the metal leaders on the tape

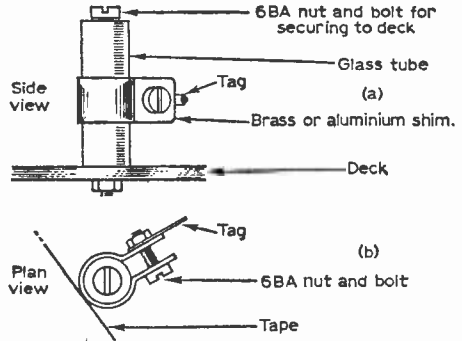


Fig 2: A brass shim fitted to a tape pressure guide.

short out the two contacts "x" and "y" the grids are earthed, and a large current flows through the valve and the relay becomes energised. Thus the motor supply is broken, and also, in order not to increase the current drain on the h.t. rectifier, the amplifier supply is broken also.

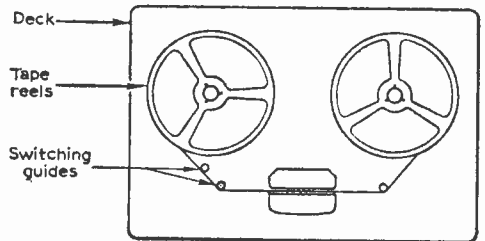


Fig 3: A suitable arrangement for the 'switching guides'.

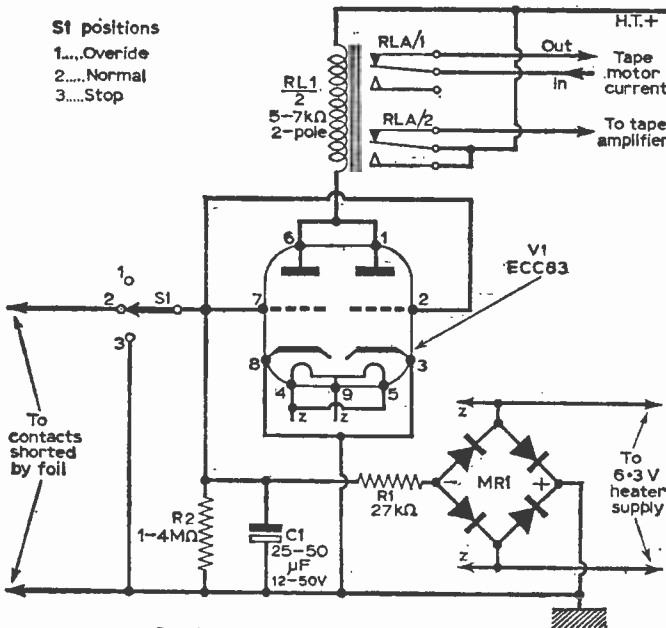


Fig. 1: The simple circuit of the device.

It can be seen from this, however, that the *beginning* of the tape will also stop the tape, and to prevent this action a three-way switch can be inserted, shown as S1 on the diagram.

When S1 is placed in the "over-ride" position the foil does not actuate the stop device, and when placed in the "stop" position the grids are earthed and the motor and amplifier supplies broken.

In order to operate this device two contacts are needed which will be shorted together by the metal foil. In the Philips recorder which the author possesses, one of the tape guides was a glass shim and one of the tape pressure guides was used as the other contact as indicated in Fig. 2.

Two of these contacts or "switching guides" could be fixed on to the deck at any convenient point (Fig. 3).

It is essential to ensure that brass shims are perfectly flat on the glass. The shims should be well polished with grinding paste, then with "Brasso" to ensure a perfectly smooth surface.

a voice-operated Baby ALARM

This piece of equipment will operate on a baby's cry and will relay the output through the audio stages of a television receiver.

By G. G. Scott

THIS alarm device consists of a voice operated switch and it was designed to work in conjunction with the output stage of a television receiver.

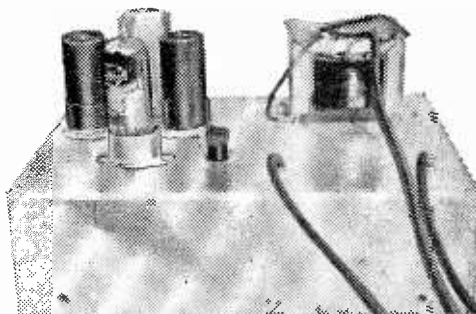
The television receiver audio circuit is broken between the volume control and the grid of the a.f. amplifier. Connection is taken from the centre slider on the volume control to a relay which is mounted on the baby alarm unit.

In the de-energised condition of the relay, the television sound is switched back to its own amplifier. When the relay is energised due to a signal in the alarm, the audio output from the television receiver is switched off and the audio output from the baby alarm is switched to the television set.

This system was designed as the normal baby alarm with its own output stage and speaker and was found to have certain disadvantages.

(1) Difficulty was found in detecting whether the sound was coming from the alarm or the TV set.

(2) If it was a good programme on TV, one waited a minute or so before seeing to baby, while



The finished equipment.

so that the grid only goes slightly positive and is held at a more or less constant potential, thus squaring the positive peaks. On the negative half cycles, when the signal goes beyond grid base, the valve is cut off thus squaring the negative peaks.

A bleeder network, R8, R9, from h.t. is used so that the cathode potential is less dependent of valve current. It was also found that the screen produced a better square wave than the anode, so the screen is coupled through a 1500 pF capacitor C3 to a double diode, V3.

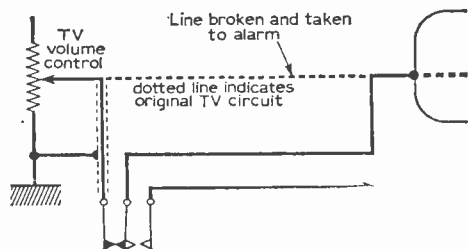


Fig. 1: The necessary connections from the television receiver.

if a baby appeared on TV one was always running to see to baby!

The Circuit

The microphone pre-amplifier is of the simple double triode (ECC83) type, designed more for simplicity rather than quality.

Two outputs are taken from the second stage, V1B, one via the relay contacts to the television receiver, and the other to a square wave limiter.

A 1MΩ grid stopper (R10) is used in the limiter stage V2. When the signal on the grid of V2 is more positive than the cathode, grid current flows

Operation of Diodes

On the positive half cycle the right hand plate of C3 follows the square wave output. This makes the anode of diode V3B positive, and it conducts, so charging up the 0.05 capacitor C4 in its cathode (to approximately 50V) as well as the 1,500 pF capacitor C3 (see Fig. 3).

On the negative half cycle the square wave voltage drops by about 200V thus the right hand plate of C3 drops to approximately 150V negative. As diode V3A cathode is now at 150V negative with respect to its anode, it conducts thus discharging C3 to its original state. As diode V3B anode is also negative this diode is cut off and C4 discharges through the 1MΩ resistor R14.

On the next positive half cycle the whole operation starts over again.

The 1MΩ resistor R15 and the 0.1μF capacitor

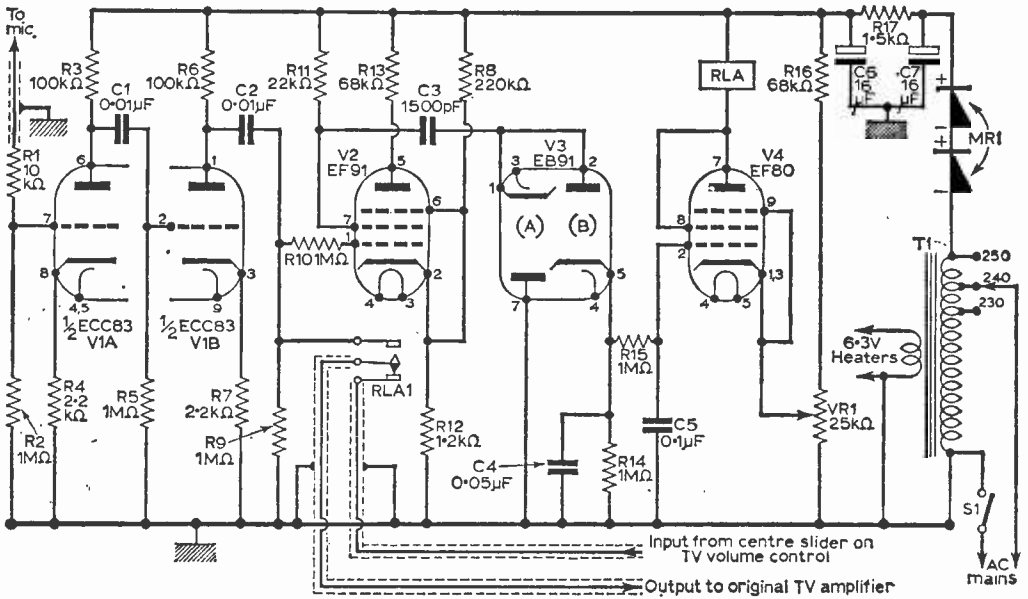


Fig. 2: The circuit of the unit.

COMPONENTS LIST

Resistors:

R1 10kΩ	R10 1MΩ
R2 1MΩ	R11 22kΩ
R3 100kΩ	R12 1.2kΩ
R4 2.2kΩ	R13 68kΩ
R5 1MΩ	R14 1MΩ
R6 100kΩ	R15 1MΩ
R7 2.2kΩ	R16 68kΩ
R8 220kΩ	R17 1.5kΩ 1W
R9 1MΩ	

All ±10% ½W carbon except where otherwise stated.

VR1 25kΩ wire wound potentiometer

Capacitors:

- C1 0.01μF paper
- C2 0.01μF paper
- C3 1,500pF paper
- C4 0.05μF paper
- C5 0.1μF paper
- C6 16μF electrolytic 350V
- C7 16μF electrolytic 350V

Miscellaneous:

- MR1, 2 Half wave metal rectifier 125V 60mA
- T1 Mains transformer. 200—250V tapped primary 6V 1.5A
- S1 Single pole on/off switch
- V1 ECC83
- V2 EF91
- V3 EB91
- V4 EF80

C5 form a filter so that a d.c. proportional to the frequency is applied to the grid of the relay amplifier V4.

The cathode of the amplifier valve is connected to a bleeder network from h.t. The 25kΩ variable VR1 (wire wound) biases the valve to cut-off when no signal is applied. The correct bias is found by talking fairly quietly into the microphone and adjusting VR1 until the relay just energises.

As the d.c. voltage on the grid of the relay amplifier is proportional to frequency, then the bias on the cathode can be arranged to suit the frequency required.

The power supplies are derived from a 6V heater transformer and two RM1 half wave metal rectifiers connected in series.

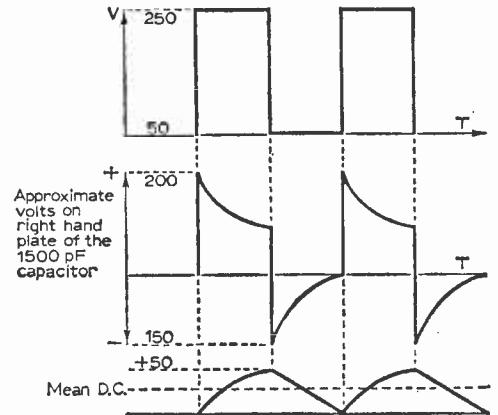


Fig. 3: This illustrates the operation of the diodes (see text)

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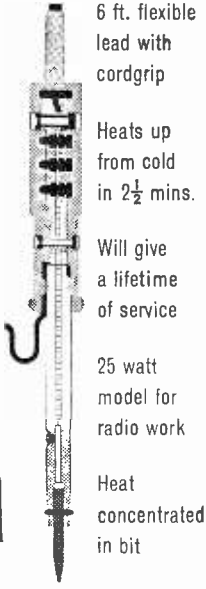
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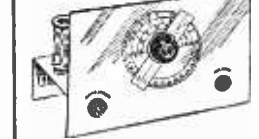
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An amazing little set, with built-in ferrite rod aerial bringing in medium wave at wonderful volume. Sturdy case. Size only 2 1/4 x 3 1/4 x 1/4 in. Fits into the palm of the hand. Drilled chassis colour coded for easy assembly. Total Building Costs (including earpiece) **30/-** P. & P. 2/-.

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Export Trade enquiries invited

BOOKS REVIEWED

RADIO, TELEVISION AND ELECTRICAL REPAIRS

Edited by Roy C. Norris; published by Odhams Books Ltd. 576 pages, 6in. x 9in. Price 50s.

THIS is the fourth edition of a well-known publication, but is by no means a rehash. A team of eight specialist contributors, under the guidance of Roy C. Norris, Technical Editor of "Electrical and Radio Trading", has completely rewritten the work.

The subjects range from water heaters, domestic appliances and electrical installations, through radio and TV adjustments and repairs to the latest u.h.f. innovations that pave the way to colour — and there is even a section specially prepared to explain the various colour TV systems. Also included is a comprehensive section on the servicing of gramophone and tape recorder mechanisms.

Whether the handyman wants information on electrical wiring, bench work, power supplies or refrigeration, or the practising engineer requires to brush up his knowledge of current techniques of radio and television repairing, an authoritative reference will be found in this comprehensive volume.

There are thirty chapters, each a dozen pages long, an initial table of abbreviations and symbols and an index that runs into five pages of small print. In the 576 page work there are no less than 470 illustrations.

It is perhaps on this last point that the reviewer might find cause to carp. There is a curiously old-fashioned flavour about the drawings and their presentation. No photographs have been used. The very annoying habit of omitting component values from circuit diagrams has been retained, except in the fault-tracing section.

But this is a minor defect in an ambitious publication that should not be absent from the bookshelf of anyone, amateur or professional, who is concerned with radio, television or electrical repairs.—*B.R.G.*

SHORT WAVE AMATEUR RADIO

By J. Schapp, PA0HH. 160 pages, 5½ x 8½ in. 7 fold-out diagrams. Price 21s.

Published by Philips Technical Library. U.K. Distributors: Cleaver-Hume Press Ltd.

THIS book is not a handbook which could be described as essential for experienced amateurs, nor is it a basic book for the novice, but tends to steer a middle course. Unfortunately, in a small volume such as this it does, of necessity, only offer a very brief discussion on the various technical aspects of amateur radio.

It omits any great discussion of single sideband, a mode which is becoming increasingly popular, and also makes no attempt at v.h.f., this being described as outside the scope of the book. It is felt that this book has a limited appeal on the British market although had values been included

with all the circuits shown it might well have proved more useful. The preface warns that this is not an extensive practical manual and the brevity with which it deals with some topics may be judged by the fact that transmission lines are dealt with in two pages.

At the back are pull-out circuit diagrams of two transmitters and two receivers. The wire for the coils is not specified in s.w.g., but in actual diameter in millimeters. Although there are no layout diagrams and few constructional details there are photographs of the equipment, which would prove handy to the would-be constructor.

There are a number of useful appendices contained in the last twenty-eight pages. Included amongst these are bandspread calculations, coil calculations, amateur abbreviations, and an abridged version of the list of countries prefixes.—*D.G.*

DIODE CIRCUITS HANDBOOK

By Rufus P. Turner. 128 pages, 8¼ x 5½ in. Price 18s.

INTRODUCTION TO ELECTRONIC SERVICING

By J. A. Stanley. 160 pages, 8¼ x 5½ in. Price 24s.

Both books originally published by Howard W. Sams & Co. Inc., Indiana, U.S.A. Published and distributed in the U.K. by W. Foulsham & Co. Ltd.

THE diode is perhaps one of the simplest components to be found in the world of wireless and electronics. So simple, in fact, that many people tend to regard it as merely a glorified cat's whisker. It's the "small thing with two wires", and asked to name some uses of a diode, the average reader might reply; "rectification, detection and . . . ?"

For these who, like the writer, have sadly underestimated the humble diode a book has been written and in it Mr. Turner describes not two, but nearly a hundred uses for a diode. Not only describes them but furnishes with each a practical circuit diagram complete with values. Still not convinced? Then, let's flick through a few pages entirely at random, and see just how versatile and useful these "things with two wires" are:—

Page 35 shows two circuits, one of a c.w. transmitter and the other a 'phone transmitter. The valve line up—one diode. A diode capacitor memory cell is depicted; again only one diode is necessary. One could jump about the book and name circuits to suit all tastes. The photo diode, tape or punched card reader, a "grid" dip oscillator (yes only one diode for this too) an a.f. milliammeter, a diode matrix to name just a few.

In case some readers are still thinking in terms of "cat's whiskers", Mr. Turner includes many circuits which use the newer Zener diodes, tunnel diodes, and a newcomer called the Varactor, a device whose capacitance is dependent upon the voltage applied to it. A snag which might arise is the availability in this country of the particular

continued on the following page

A SIMPLE R.F. AMPLIFIER

BY J. ROBERTS

THIS unit is primarily intended for use with those domestic receivers which cannot be provided with an efficient outdoor aerial. It consists of an untuned radio frequency amplifier which can appreciably improve the medium and long wave performance of the usual four stage type of superhet receiver. The amplifier will also prove to be useful for most crystal sets and t.r.f. receivers.

The circuit is exceptionally simple and construction should therefore present no difficulty to less experienced constructors. Of course the usual care must be taken when soldering the transistor and when connecting the battery since errors will almost certainly destroy the transistor.

Economical Power Consumption

The circuit is very modest with respect to power supplies and works efficiently when taking a current of about 1mA from a 4½V torch battery. With long and therefore more efficient aeriels the amplifier may tend to overload the receiver when it is tuned to powerful stations. It is thus necessary to be able to adjust the gain of the amplifier and this is achieved by reducing the current flowing through the transistor by means of VR1.

Connecting to the Receiver

With most receivers there will no difficulty in connecting up the amplifier. However very great care must be taken when dealing with receivers of the a.c.-d.c. (all mains) type. In such cases ensure that the neutral wire of the mains is connected to the chassis and also that the earth and aerial sockets of the receiver are isolated from the chassis via suitable capacitors. It is also advisable to dis-

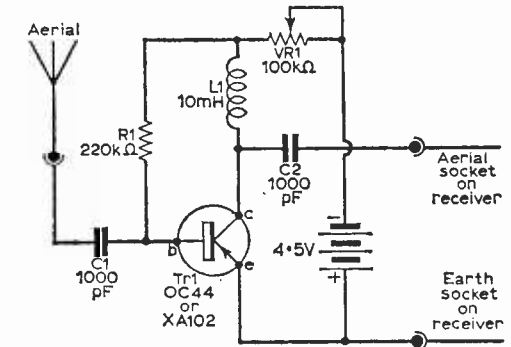


Fig. 1: The simple transistor circuit.

connect such receivers from the mains supply when connecting the amplifier.

Performance

It is difficult to give an exact idea of the improvement likely to be noticed, as so much will depend on the particular receiver and aerial in use with the amplifier.

The amplifier has been tested with receivers other than the domestic type and this example of a test on a communications receiver may be of interest:

National 9 Valve superhet, 8ft. indoor aerial, time 11 p.m., medium wave band; 26 stations readable without amplifier; 51 stations readable when the amplifier was added. The results of this test were checked carefully and there is no error. ■

BOOKS REVIEWED

—continued from previous page

diodes indicated since this book is of American origin. Any reputable stockist would perhaps advise as to British equivalents, and of course, it is possible to send to the U.S.A. for the diodes with the happy knowledge that postage would be reasonably cheap.

Other than bearing this one point in mind the book would appear to be a useful addition to any Library. Since the majority of the circuits contain only one or perhaps two diodes the book should appeal to experimenters with a limited budget. Indeed, there is a separate chapter entitled "Experimenter's Circuits", which would be ideal for readers whose interests lie in this field.

WRITING a book strictly for a novice is no light task, especially when the subject is on a highly technical topic such as a branch of electronics. It is one thing for an author to be knowledgeable and highly skilled, but to write clearly and concisely so that a raw beginner will fully understand is a very different kettle of fish.

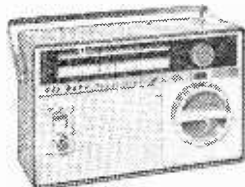
In "Introduction to Electronic Servicing for the Beginner", Mr. Stanley has proved beyond any shadow of doubt that he is able to write with great clarity and simplicity and in such a way that any novice will find it a very difficult task *not* to understand.

This book is thoroughly recommended and is excellent in every way. It takes the novice gently by the hand and guides a good reliable solid path through both theory and construction. It is profusely illustrated, and gives both circuit diagrams and actual drawings. When a new section or extra components are added, the existing wiring is shown "ghosted" and the new additions are shown clearly in black. It teaches how to read a circuit diagram, and by the excellent methods mentioned gives full details for the construction of a power unit, signal tracer, multimeter, and superhet tuner, together with full details of how to use, how to test, and how to repair. Although the price is 24s., there can be little doubt that it is a bargain.

The book is of American origin, but no risks are taken due to differences in electronic practice, and a two and a half page introduction is especially written for the benefit of British readers.

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THE SKYROVER and SKYROVER DE LUXE

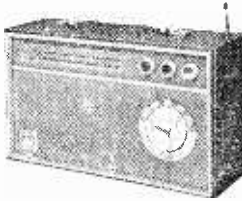
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7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE covers the full Medium Waveband and Short Waveband 31-94 M, and also 4 separate switched band-spread ranges. 13M fm, 19M and 25M, with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions.

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The "Sixteen" Multirange METER KIT

This outstanding meter was featured by *Practical Wireless* in the Jan. '64 issue. Lasky's are now able to offer the complete kit of parts as specified by the designer.

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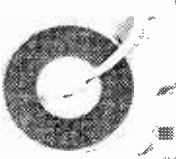
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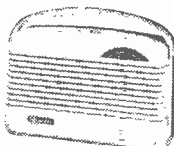
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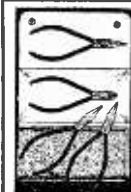
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WHITELEY: HF1016 10in., £7.7.0; HF1017 10in., 24.12.0; HF16 8in., 24.6.0; T816 8in., 25.19.8; T10 Tweeter, 24.12.0; T359 Tweeter £1.12.3; CX3000 Crossover unit, £1.1.3; CX1560 Crossover unit, £2.2.0. H.P. Terms available on all speakers.

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TEST GEAR accessories

Part 6

BY C. MACKAY

CONTINUED FROM PAGE 136 OF THE JUNE ISSUE

MOST experimenters will have in their workshop at least a good multimeter. A signal generator or grid-dip meter, possibly a bridge and an audio oscillator may also be available, and nowadays many of these individuals even own an oscilloscope.

However, there must be few experimenters who, at one time or another, have not wanted to take voltage or current readings at two different points in an experimental set-up and thus found that one multimeter is just not enough.

Although they have spent a large amount of money on, say, an oscilloscope, they are usually most unwilling to fork out an extra £2 for a low sensitivity though highly accurate second multimeter.

This kind of meter can be of the 1,000Ω per volt type (1mA f.s.d.) and, in conjunction with pre-

cision shunts and droppers, can give a result of as high an accuracy as one's good (say 20,000Ω per volt) multimeter—provided that care is taken to use this second meter in such a way that it does not noticeably affect the circuit conditions.

The circuit of a suitable multimeter built by the author is given in Fig. 22a. The meter used was of the 1mA f.s.d. type with an internal resistance of 100Ω.

If a meter with any other value of internal resistance is employed R7

$$\text{becomes } \frac{R_i}{99} \text{ and } R_8 \text{ becomes } \frac{R_i}{9}.$$

Seven ranges are available: 0—1mA d.c., 0—10mA d.c., 0—100mA d.c., 0—1V d.c. 0—10V d.c., 0—100V d.c., 0—1,000V d.c.

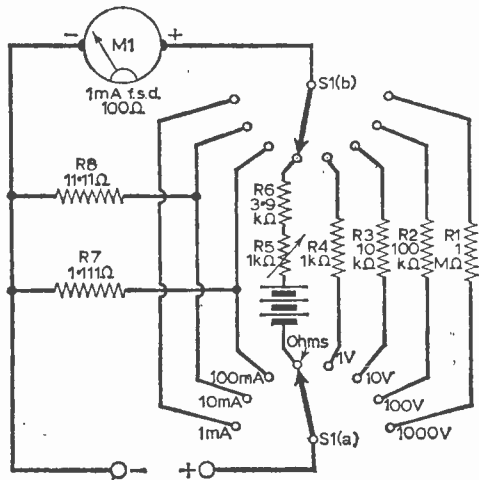
CONTINUITY/INSULATION TEST

No facilities are included for the measurement of a.c. voltages and currents as the "good" multimeter is generally adequate.

As shown above, a range for testing insulation and continuity is provided, though no separate calibration scale was given for this range. However, if required it could be calibrated as in Fig. 22b.

Good quality 1% tolerance components must be used for R1-R4, R7 and R8.

In order that the overall accuracy of the completed instrument should be maintained as high as possible the author advises that the shunts (R7 and R8) should be bought and not made up. These can be purchased at a reasonable price from the Planet Instrument Company, which advertises



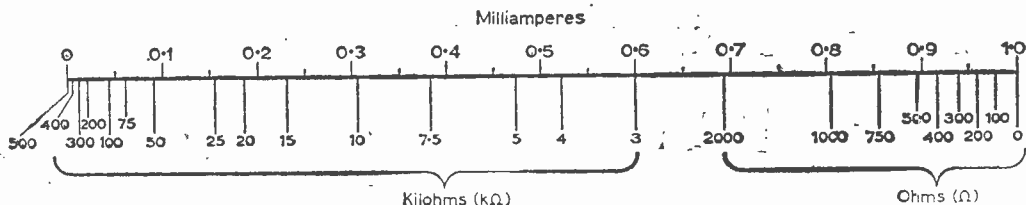
- COMPONENTS LIST FOR FIG. 22a**
- R1 1MΩ 1%, 1W
 - R2 100kΩ 1%
 - R3 10kΩ 1%
 - R4 1kΩ 1%
 - R5 1kΩ wirewound
 - R6 3,900Ω 10%
 - R7 1·111Ω 1% wirewound
 - R8 11·11Ω 1% wirewound
 - M1 Moving coil meter, 1mA f.s.d. Internal resistance 100Ω

- S1 1 pole, 8 way, 2 bank wafer switch
- B1 4·5V flat battery

Miscellaneous:
Two terminals, one red, one black.

Fig. 22a (left) : A multimeter circuit as used by the author;

b (below): calibrations for an ohms scale.



regularly in this magazine. R6 is for adjusting the meter to read full scale on the resistance range with the input terminals shorted out.

MOUNTING THE METER IN ITS CASE

The case used by the author was a rejuvenated wooden box used for protecting a large mains transformer in transit. Virtually any case, wooden, plastic or metal, can be used. If it is metal the terminals, which can be spade terminals or wander plug sockets, should be well insulated from the box. The matter of the cabinet will therefore be left to the ingenuity of the experimenter.

A few suggestions worth some consideration are using biscuit or sweet tins, lunch boxes (metal or plastic), Oxo cube boxes or baking tins with a separate aluminium baseplate.

This unit can be easily and completely constructed for under £2.

USING THE "SECOND" METER

If this meter is placed across a circuit wherein the current flowing is of the same order as that which will be taken by the meter itself, the extra load imposed upon the circuit by the meter will completely change the circuit conditions and all readings taken by the meter will be inaccurate if

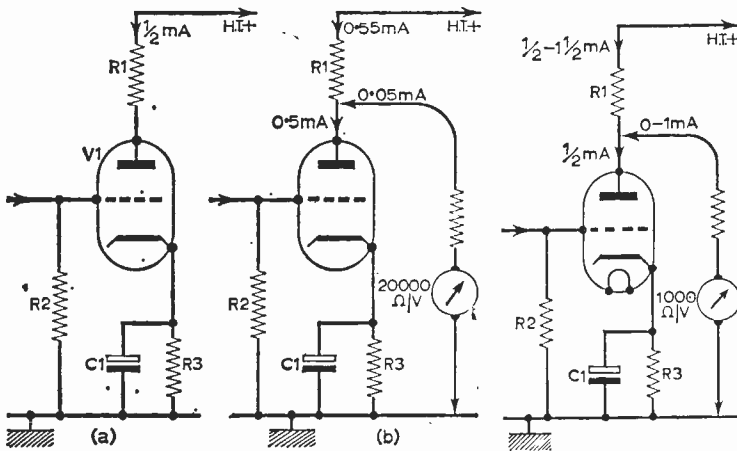


Fig. 23 (a): An audio amplifier; (b) measuring with a 20kΩ/V meter; (c) with a 1kΩ/V meter.

not completely false.

A meter which draws only say, 50µA, therefore, will not have nearly so drastic an effect as will one which draws 1mA.

This can be seen more clearly in Fig. 23a. Here, a valve, V1 is drawing 0.5mA from the h.t. + supply. In Fig. 23b a 20,000Ω per volt meter is connected across point A and chassis in order to measure the anode voltage. This meter will draw only 0.05mA from the circuit and the error of the reading will be only because the current has increased from 0.5mA to 0.55mA.

In Fig. 23c, a 1,000Ω per volt meter is connected between A and chassis. As this meter takes its maximum current of 1mA, the anode voltage will

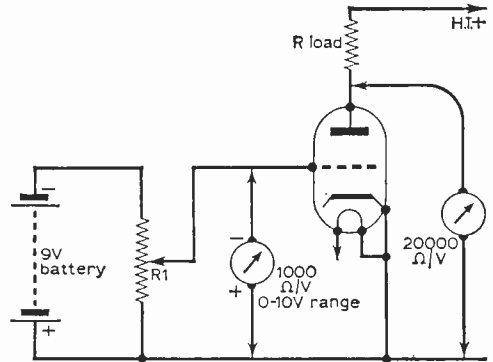


Fig. 24: "Cause and effect measurements" where a pair of meters is indispensable.

be greatly reduced (owing to the increased current through R1) and the error will be so great as to make the reading quite useless.

The reader by now, will probably be wondering why a meter of this sort has ever been used at all. The reason is that these meters can be used for voltage measurements where the current taken by the meter does not affect the performance. They

may also be used for current measurement so long as the current to be measured is high enough to give a readable reading (usually 5% of f.s.d. is enough).

TWO METERS INDISPENSABLE

An example of a circuit test where two meters are indispensable is given in Fig. 24. Here, it is desired to measure the amplification of a triode valve with a given anode load. The "good" meter, which draws a low current, is used to measure the anode voltage, while the low sensitivity meter is used to measure the input voltage, which is adjusted by means of R1,

a potentiometer attenuator.

The low sensitivity meter is also highly satisfactory for the measurement of current. For example, this meter could have been used to measure the anode current accurately in Fig. 23. As the anode load resistance would only be increased by perhaps one part in two or three thousand, the results obtained with the meter in that position would be most accurate. At the same time the "good" meter could be used for voltage measurement on the anode as in Fig. 23b.

This relatively simple meter will be found to be invaluable to the experimenter if it is used with only a little forethought. The instrument is of a well-tried and thoroughly reliable design and will give many years of reliable service.

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2 1/2	7000	35	8/8	4	7000	25	11/8	5	6000	3	8/-	5	9500	3	10/8
2 1/2	7000	50	8/8	4	6000	35	10/8	5	6000	5	8/-	5	9500	5	10/8
2 1/2	7000	80	8/-	4	7000	35	11/-	5	7000	3	8/8	5 1/2	7000	3	11/-
3 1/2	7000	35	8/8					5	7000	5	8/8	6 1/2	5500	3	11/8
								5	7000	3	9/-				

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	6000	3	7/8	5 x 3	9000	25	11/-	8 x 2 1/2	4500	3	9/8
5 x 3	7000	3	8/-	5 x 4	6000	3	8/8	8 x 2 1/2	9500	3	10/8
5 x 3	9000	3	8/8	6 x 4	7000	3	9/-	8 x 2 1/2	6000	3	8/8
5 x 3	6000	25	9/8	6 x 4	8500	3	8/8	8 x 2 1/2	6000	5	9/8
6 x 3	7000	25	10/-	6 x 4	9500	3	10/-	8 x 2 1/2	7000	5	9/-

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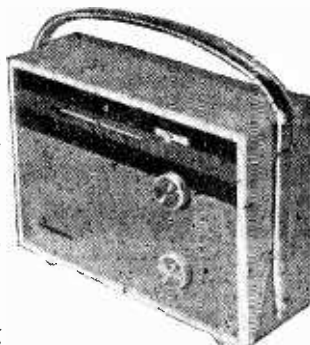
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Please send STAMPED and ADDRESSED envelope with any enquiry. We regret no catalogues—our stocks move too quickly! Kindly make provision for additional postage and packing charges to avoid delay. Terms: Cash With Order or C.O.D. on orders over 10/-.

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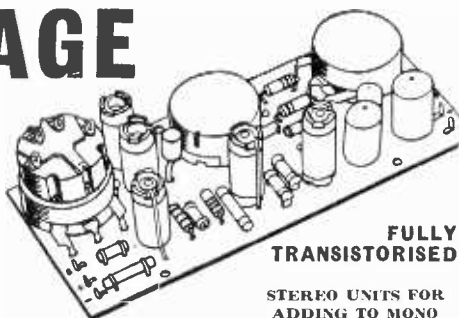
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CLUB

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London, W.3.

The Club next meets on 9th June when members will review the experiences and results of their participation in National Field Day.

AMATEUR RADIO CLUB OF NOTTINGHAM
Hon. Sec.: R. W. Attenborough, G3RDJ, Beech House, Chapel Lane, Epperstone, Nottingham.

The meetings of this Society are held every Tuesday evening at the Sherwood Community Centre, Woodthorpe House, Mansfield Road, Sherwood.

BRADFORD RADIO SOCIETY
Hon. Sec.: E. G. Barker, G3OTO, 63 Woodcot Avenue, Baildon, Shipley, Yorkshire.

Members enjoyed a full programme of events for May, beginning with a discussion on N.F.D. arrangements on the 12th. In the same month a party from the club were the guests of the Spen Valley Radio Society, and on the 26th, J. Spivey (G2HHV) gave a lecture called "V.H.F. Operating."

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, "Field House," 19 Kingsley Road, Gt. Boughton, Chester, Cheshire.

Members attended the meeting for May 5th to hear a lecture. A week later, members were invited to bring any valves with them for testing on the valve-tester which G3EWZ had brought along for a demonstration. National Field Day arrangements were under discussion on May 26th.

IPSWICH RADIO CLUB
Hon. Sec.: R. J. Wells, 43 Clench Road, Holbrook, Ipswich, Suffolk.

This society's activities cover all aspects of radio and therefore any potential members are welcomed to the meetings which are held at Ipswich Civic College on the last Wednesday in each month, commencing at 7.30 p.m.

LICHFIELD AMATEUR RADIO SOCIETY
Hon. Sec.: V. Hickman, G3LXR, 143 Main Street, Stonnall, Walsall, Staffordshire.

The membership of this Society continues to grow with more and more licensed amateurs among its numbers. One honorary member, T. Painter (G3NEU), has recently presented the club with an inscribed silver cup which will become the trophy for forthcoming d.f. events.

MELTON MOWBRAY AMATEUR RADIO SOCIETY
Hon. Sec.: D. W. Lilley, G3DFD, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicestershire.

The only club event for May was on the 21st when J. L. Warrington (G2FNW) gave a lecture entitled "70 cms."

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax.

Society events for May began with a junk sale on the 13th. A fortnight later Mr. L. L. Cobb (G3UJ) gave a talk on "Transistors."

PRESTON AMATEUR RADIO SOCIETY
Hon. Sec.: W. K. Beazley, G3RTX, 9 Thorngate, Penwortham, Preston, Lancashire.

On May 12th, a group of members enjoyed an interesting visit to the Ribble Generating Station. Later in the month, on the 26th, the final arrangements for N.F.D. were discussed.

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven," 9 Holybrook Road, Reading, Berkshire.

Members G2FZI and G3EJA have both donated cups and T. Bingham a shield for Club trophies to be awarded to the winners of contests held during this year. The meeting for May 30th was devoted to a sale of surplus equipment.

SALOP AMATEUR RADIO SOCIETY
Hon. Sec.: Dr. K. E. Jones, G3RRN, Greystones, Shrewsbury Road, Church Stretton, Shropshire.

This Society reports an increasing membership with very good attendances at the meetings.

SCARBOROUGH AMATEUR RADIO SOCIETY
Hon. Sec.: P. B. Briscoe, G8KU, "Roseacre," Irton, Scarborough, Yorkshire.

A sale of members' surplus gear was held on May 7th. A talk on the SX111 receiver on May 14th was followed on the 21st by a



display and demonstration of home constructed equipment. On May 28th, members attended a talk given on "Oscilloscopes."

SOUTH SHIELDS AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: D. I. Forster, G3KZZ, 41 Marlborough Street, South Shields, Co. Durham.

Members from this Society were among the visitors to the mobile rally held at Harewood House, Yorkshire, on 24th May. The Club is organising its own mobile rally on 5th July to be held at Bents Park Recreation Ground, Coast Road, South Shields.

SPEN VALLEY AMATEUR RADIO SOCIETY

Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Leeds.

"Missilemen 1964" was the title of the lecture given to members of this Society at their meeting on May 14th by Mr. M. A. Browne. On May 21st, members paid a visit to Research Electronics at Cleckheaton and on the 27th, David Pratt (G3KEP) gave a talk entitled "RTTY." Another visit was organised for the first event in June, when a group of members went to the Met. Office at Church Fenton.

WESSEX AMATEUR RADIO GROUP
Hon. Sec.: P. Cutler, 43 Langside Avenue, Wallisdown, Poole, Dorset.

This Society has recently decided to increase its meetings to two a month and also increase its amateur radio activities. To put into effect this latter decision, the Group elected to purchase a 20m s.s.b. transceiver and put a 2m station on the air.

WIRRAL AMATEUR RADIO SOCIETY
Hon. Sec.: A. Seed, 31 Withert Avenue, Bebington, Wirral, Cheshire.

A mobile week-end in Wales was organised by member G2MYV and was held successfully during May.

WORCESTER AND DISTRICT AMATEUR RADIO CLUB
Hon. Sec.: G. W. Tibbetts, 35 Perdiswell Park, Droitwich Road, Worcester.

Activities for May consisted of a junk sale and a practice run for National Field Day. The sale was held on the 16th and the practice run on the 24th.

SEVENTH LONGLEAT MOBILE RALLY
Rally Organiser: E. C. Halliday, G3JMY, 4 Parkside Avenue, Winterbourne, Bristol.

This year's mobile rally at Longleat, near Warminster, Wiltshire, is to be held on June 21st and talk-in-stations will be G3JMY/A on top band and G3JL/A on 2m. The entrance to Longleat House park and estate lies on the Frome-Warminster Road (A362). There will be the usual attractions: displays, competitions, demonstrations, etc. and once again this event promises to be a memorable occasion.

... AND FOR YOUR FURTHER ENJOYMENT
why not get the June issue of *Practical Television*, on sale now?

Featured in this issue is a C.R.T. Tester and Rejuvenator.

Also details for converting receivers for reception of Continental programmes, and many more interesting articles and regular features.

T rade N ews

New Portable from Roberts Radio

A NEW transistor portable, Model R.300 has recently been announced by *Roberts Radio Company Limited, Molesey Avenue, West Molesey, Surrey*. This set covers medium and long waves and incorporates six transistors and three diodes.

A coaxial socket for a car aerial is included in the design and a carrying cover made of strong grey waterproof material is available as an extra.

The size of the R.300 is 9½in. x 5½in. x 4¼in., and its price is 15 gns. Power is provided by an Ever-Ready PP9 battery, and current consumption with no signal is 12mA.



The R.300 portable receiver, new from Roberts Radio

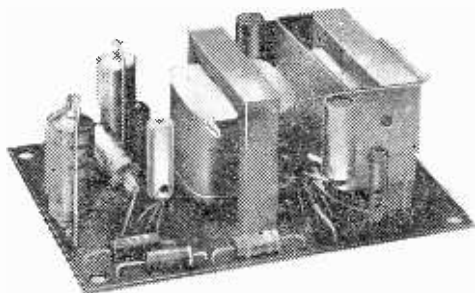
The "Audio Heart"

MARKETED by *Technical Suppliers Ltd., 63 Goldhawk Road, London, W.12*, is a miniature high quality transistor amplifier designed to be used at the centre of any good audio assembly. The "Audio Heart" gives 1W undistorted output for an input voltage of 5 to 10mV. Input impedance is 1.5 to 2kΩ, and output impedance 3 to 5Ω. The operating voltage is 6V, and the signal-to-noise ratio is said to be below measurable level.

Among its numerous applications, the "Audio Heart" can be used with a radio tuner for use in a car, as a burglar or baby alarm, etc., and two of

the units can be used for stereo applications.

The size of the "Audio Heart" is 3in. x 2.2in. x 1.2in. high, and it is available ready built and tested at a price of 59s. 6d., or in kit form with full building and operating instructions for 52s. 6d.



This is the "Audio Heart" marketed by Technical Suppliers Ltd.

Two New Receivers

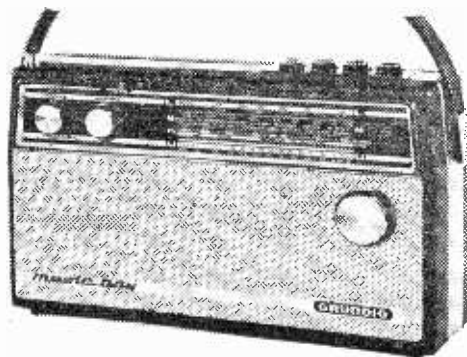
GRUNDIG (Great Britain) Ltd., announce the introduction of two new portables to their range of receivers. They are the "Music Boy 204", and the "City Boy 204". The Music Boy has a bandwidth 49m band and is claimed to give crystal clear reception over a wide range of European short wave stations. Other bands covered are medium, long and v.h.f./f.m.

The circuit includes nine transistors, three diodes and one rectifier. Power output is 1W and power is provided by two 4.5V flat torch batteries or a 9V power pack. The speaker is an elliptical 4in. x 6in. model fitted with a ceramic magnet.

The Music Boy weighs approximately 4lbs. without batteries and measures 11in. x 6½in. x 2½in. Price is 39 gns.

The "City Boy" embodies nine transistors, three diodes and one rectifier, and covers medium, long and v.h.f. bands. Output is 1W and this is fed into a 6in. x 4in. elliptical speaker. Weight is approximately 3½ lbs. without batteries and the dimensions are 10¼in. x 6½in. x 2½in. Price is fixed at 34 gns.

Grundig (Great Britain) Ltd., Newlands Park, Sydenham, London, S.E.26.



The Grundig "Music Boy 204".

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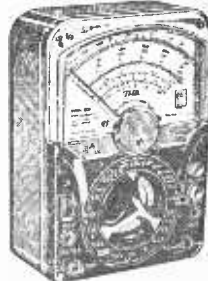
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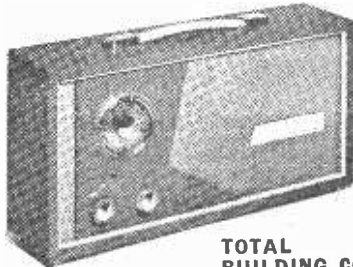
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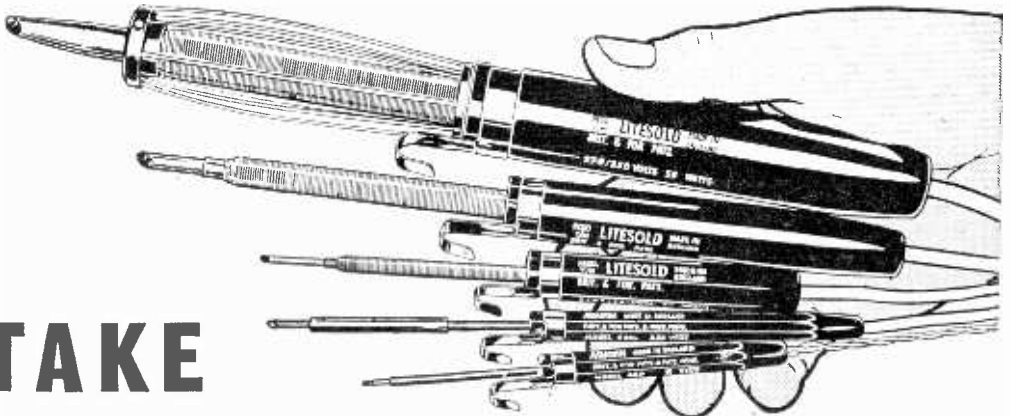
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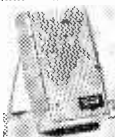
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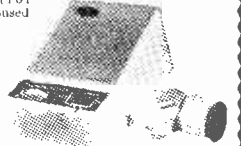
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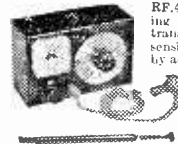
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Adding extra ranges to simple meter movements is one means of making

BY GEORGE WAREHAM | PART 2

inexpensive multimeters

CONTINUED FROM PAGE 149 OF THE JUNE ISSUE

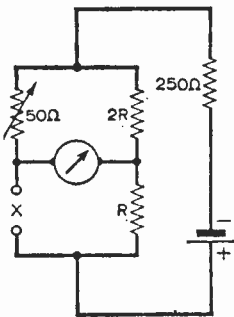
LAST month some general hints were given on choosing a milliammeter and converting it to a multi-range instrument. In this month's article the conversion of a piece of surplus equipment containing a suitable meter is described.

The instrument described here was made from a piece of "surplus" equipment which rejoices in the name "Gear, Electric Firing Mark Two: Instrument, Testing, Mark 2 or 2A". It consists of a centre-zero milliammeter in a wooden case with an ebonite front panel.

The case contains one or two other components and in fact it turns out to be a Wheatstone bridge reading 0—25Ω, obviously intended for checking the continuity of detonating circuits of some kind. The circuit is shown in slightly simplified form in Fig. 4.

If anybody requires a single-range bridge for measuring low resistances the instrument may be used unmodified. (The average multimeter tends to be inaccurate below about 10Ω. One often wants to measure the resistance of transformer windings, such as the secondaries of output transformers, which may only be a few tenths of an ohm. For such measurements the unmodified unit would be a useful addition to the laboratory.)

Fig. 4: The basic circuit (less the press-switch contacts) of the surplus unit referred to in the text.



However, the writer wanted a cheap multi-range meter. This surplus unit cost about 15s. and the finished article cost about 25s. The ranges in the writer's version are:

Current	0—3,	0—30,	0—300mA
Voltage	0—3V,	0—30V,	0—300V
Resistance	0—25,	0—250,	0—2,500Ω

Basic Information

Several of the units in the surplus dealer's shop had bent meter pointers. Evidently the sappers who had used them had disregarded the warning label telling one not to switch the meter into

circuit with the firing dynamo going.

The dealer had affixed a label giving the sensitivity of the meter as "600—0—600μA". Examination of the meter itself revealed a rated f.s.d. of 660μA. Subsequent measurement revealed that the sensitivity was, in my particular specimen, 647μA. (The sensitivity was slightly different in the two directions of deflection: 547μA is the average.)

The meter scale reads 30—0—30 and has 30 small divisions each way. This means that, unless

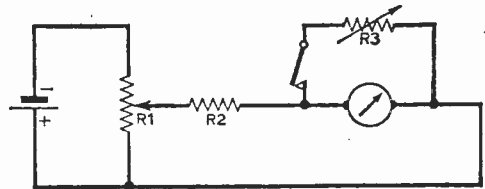


Fig. 5: Circuit arrangement for finding the coil resistance of a meter.

one rewrites the scale, the smallest f.s.d. current which fits the scale is 3mA. The damping of the basic movement was rather poor but good enough to permit an f.s.d. of 1.5mA, which is possible without rewriting the scale, at the expense of some simple mental arithmetic.

Meter Coil Resistance

A test with a 10Ω ± 1% resistor showed that the original Wheatstone bridge was quite accurate. This suggested the possibility of using the instrument to measure its own resistance, which was shown by a rough check (as described last month) to be within the range of measurement of the bridge.

The method of measuring the coil resistance is of quite general application. What one does is to adjust a variable resistor to the same resistance as the meter and then measure the variable resistance. The technique is illustrated in Fig. 5. Here R1 is any low-resistance potentiometer (say, less than 1,000Ω) and R2 is selected to permit f.s.d. with the available voltage.

With the switch open, adjust R1 for f.s.d. Leave R1 alone, close the switch, and set R3 so that the meter reading is exactly halved; R3 is now equal to the meter resistance and can be taken away and measured.

In the present case one takes the meter out of its original circuit and then, once R3 is set, one puts the meter back again so that the bridge can be used to measure the resistance. In the case of the writer's instrument the meter coil resistance turned out to be 23-3Ω.

General Design

All the necessary information for designing voltage multipliers and current shunts had now been obtained. The next step was to decide how to use them to obtain a multirange meter. There are two basic ways of doing this.

One is to connect all the multipliers and shunts permanently, as in Fig. 6, and select the ones needed by plugging the meter leads into the appropriate sockets. The other is to use only one pair of terminals and to switch the appropriate shunts and multipliers into circuit. (Combinations of the two systems are possible.)

Current Ranges

It was decided to use switches and only one pair of terminals. The first problem was to choose between the alternative ways of obtaining different current ranges shown in Fig. 7.

The simplest method is shown in Fig. 7a.

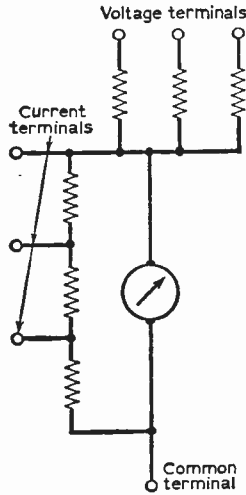


Fig. 6: A multi-range instrument using multiple terminals but no switches.

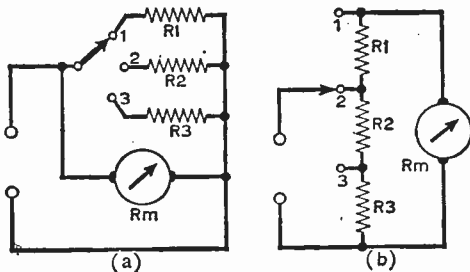


Fig. 7: Two arrangements for incorporating the current shunts.

It is simplest in that each current range is completely defined by one resistor. Thus R1 might set the 3mA range, R2 the 30mA range, and so on.

The use of this system is often deprecated for the following reasons. First, and most important, the contact resistance of the switch affects the accuracy. The effect may be very serious on high-current ranges. For example, the shunt resistance for, say, a 3A range may be only a few hundredths of an ohm. Even if the switch contact resistance is only a hundredth of an ohm it has an

appreciable effect. Secondly, safety considerations impose limitations on the type of switch. It must have make-before-break contacts. Otherwise, when changing from one range to another, the full current goes through the meter coil.

The arrangement of Fig. 7b avoids both these difficulties. Variations in contact resistance have no effect on the way the current divides between shunts and meter, and during changeover the current is simply switched off. Disadvantages are a higher voltage drop on the higher current ranges and the fact that since all resistors are in circuit all the time, an error in one of them affects all the ranges (though not necessarily very much).

In the writer's opinion there is not much to choose between the two arrangements when only moderate currents are to be measured. Make-before-break switches are easily obtained and contact resistance is quite low with modern precious-metal-plated contacts.

The second system was adopted as a matter of convenience. The meter case of the "surplus" unit is rather shallow and only a single-wafer one-pole ten-way range switch could be accommodated: the second arrangement proved to be easier to use with such a switch.

Calculating the Shunts

For a Fig. 7a type of circuit calculating the shunts is easy. The voltage drop across any shunt is the same as the voltage drop across the meter. Knowing the resistance of the meter and the f.s.d. current, the voltage drop at f.s.d. is calculable. Thus a 30Ω meter with f.s.d. 1mA has a voltage drop of 1mA x 30Ω = 30mV. To make the meter read 10mA f.s.d. we have to arrange that 9mA flows through the shunt when this voltage appears across the meter circuit. Thus the shunt resistance must be 30mV/9mA = 3.33Ω. For a 100mA range 99mA must go through the shunt, so its resistance R100 (say) = 30mV/99mA = 0.33Ω. In general if the f.s.d. has to be multiplied N times by the shunt, then,

$$\text{Shunt resistance} = \frac{\text{Meter resistance}}{(N-1)}$$

The Fig. 7b type of circuit is more difficult because the voltage drop across the circuit varies from range to range. With the switch in position 1 the drop across the meter is the same as across the three shunts in series. This enables us to calculate the total shunt resistance from the formula above:

$$R1 + R2 + R3 = \frac{\text{Meter resistance (Rm)}}{(N-1)}$$

But what happens in position 2? If we make the voltage drop across the circuit the same as the f.s.d. drop the meter will read less than f.s.d., since R1 is now in series with Rm. And in position 3 R1 and R2 are both in series with Rm. Thus the circuit drop at f.s.d. increases as higher current ranges are switched in.

Fortunately the various values can be arrived at by a process of elimination as follows:

Step 1. Total shunt resistance

$$R1 + R2 + R3 = \frac{Rm}{N1 - 1}$$

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1D5	6/6	6C12	6/	7D3	16/	25Z6	5/3	AC/CPEN 3/6	EB93	8/6	E191	2/6	MH4	3/6	RP48	19/6	U801	11/3	GET111/12/		
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1F2	2/3	6CDE	5/	7D8	15/	28D7	5/6	AC/TP 17/	EB96	3/6	E197	20/6	MH3	5/6	SP42	12/6	U303	8/6	GET157-10/		
1F3	2/3	6W4	24/	7E7	5/6	30G7	5/6	AC/CPEN 12/	E131	5/6	E198	10/6	MB48	10/6	SP61	6/6	U40	6/6	GET160	7/6	
1F91	3/9	6D11	1/6	7E8	13/6	30K 15	5/6	AC/CPEN 20/3	EB97	5/6	E199	20/6	MH14	12/	SC25	27/6	U801	18/3	GET174	9/6	
1F99	3/6	6D3	9/6	7E8	14/6	30P18	10/6	ATP4 2/8	EB98	7/3	E4	17/6	MU12/14/6	SG61	5/9	U4020	6/6	GEX36	3/6		
1G6	6/	6D4	3/	7F4	6/	30P5	5/6	AZI 5/5	EB99	6/3	E434	17/6	MX4	4/6	741	9/6	VP40G11/9	GEX36	10/6		
1H5GT	7/9	6D8	15/	7E9	2/6	30P11	9/3	AZ31 1/6	E121	6/	E435	12/	N37	23/6	TDD2	12/6	VMB4B 12/6	GEX46	11/6		
1L	2/3	6E5	9/6	8W6	9/6	30P112	11/3	AZ41 6/8	E436	4/6	E437	13/6	N7	23/6	TDD4	8/6	VMB4 8/6	GEX46	11/6		
1L46	16/10	6E1	9/6	8P2	4/6	30R4	5/6	AZ5 4/6	E438	12/6	E441	6/6	N48	26/6	T448	6/6	VP13	7/6	GEX46	11/6	
1L45	4/	6E5	5/3	917	7/6	30L15	9/3	E163	10/6	E44	6/	E441	7/6	N39	15/6	TH210	10/6	VP4	14/6	MAT100	7/6
1L45	4/6	6E6G	3/9	10C1	9/3	30P4	12/3	(1) 12/6	E442	7/6	E44	1/6	P1	2/6	TH20	14/6	VP4A	14/6	MAT101	8/6	
1N8GT	7/6	6P6GT	7/6	10C2	12/3	30P12	7/6	(C) 12/6	E443	12/6	E441	27/6	E44	8/6	PABCO8 10/6	TH23	6/6	VP4B	20/6	MAT120	7/6
1P1	5/9	6E8	5/	10D1	7/	30P16	1/	(C) 13/6	E444	2/3	E447	7/6	PC76	10/6	TP22	5/6	VP3C	7/6	MAT121	8/6	
1P10	4/6	6E11	17/6	10E2	12/3	30G6	6/6	(C) 50/6	E445	6/6	E441	10/6	PC28	3/6	TP23	8/6	VP3	5/6	VP23	6/6	
1P11	5/6	6E12	3/9	10F1	10/	30P11	8/6	(L) 19/6	E446	7/3	E441	5/6	PC95	11/6	TP220	17/6	VP41	5/6	OA10	2/6	
1P15	4/	6E13	4/9	10F9	9/6	30P113	8/6	(C) 18/6	E447	3/6	E441	5/6	PC97	7/6	TY86F	11/6	VP133	9/6	OA70	3/6	
1R4	5/	6E14	23/3	10F10	10/	30P114	12/6	(C) 2/6	E448	3/6	E441	21/6	PC84	5/6	UACB80 5/6	UACB80 5/6	VR75	21/6	OA73	3/6	
1R5	3/6	6E15	6/	10L13	6/3	32A5	20/9	(C) 6/6	E449	3/6	E448	9/6	PC85	6/6	UAF42 7/6	VR105	21/6	OA79	3/6		
1P4	2/9	6E16	6/9	10L14	9/6	32A6	18/6	(C) 5/6	E450	14/6	E448	9/6	PC86	10/6	7C41	10/6	VR10	4/9	OA80	3/6	
1P4	3/6	6E17	3/9	10L15	12/3	32A7	18/6	(C) 5/6	E451	12/6	E448	9/6	PC87	9/6	UACB41 6/3	VT61A	8/6	OA85	3/6		
1P4	5/6	6E18	13/6	10P14	11/6	32Z3	16/4	(C) 16/4	E452	4/6	E448	9/6	PC89	10/6	UACB81 6/3	VT61B	3/6	OA86	4/6		
1C5	5/6	6E19	4/9	10D3	17/6	32Z4T	4/6	(C) 5/6	E453	4/6	E448	9/6	PC90	5/6	UACB80 5/9	VC111	5/6	OA90	3/6		
2A7	12/6	6E20	3/3	11B1	17/6	32Z6T	4/6	(C) 5/6	E454	5/6	E448	9/6	PC92	6/3	UACB89 6/9	VC120 10/6	OA91	3/6			
2C26	2/9	6E21	9/6	11B2	15/	32	2/6	(C) 1/3	E455	6/6	E448	9/6	PC94	8/6	UACB81 6/9	VC120A/10/6	OA92	3/6			
2D18C	7/6	6E22	5/	11E3	12/6	30R4	5/6	(C) 12/6	E456	12/6	E448	9/6	PC96	6/6	UACB82 6/9	VC13	7/6	OA93	6/6		
2D21	5/6	6E23	3/	12A6	2/3	41HT	15/	D42 10/6	E457	3/6	E448	9/6	PC97	6/6	UACB83 6/9	W21	5/6	OA21	11/6		
2P	23/3	6E23	3/6	12A8	16/8	42	5/6	1663	6/6	E458	11/6	E448	9/6	PC98	5/6	UACB85 6/3	W24	20/6	OA16W 35/3		
2X2	3/6	6E24	3/6	12A9	8/6	48	10/	177	2/3	E459	10/6	E448	9/6	PC99	5/6	W01M 24/6	W24	22/6	OA22	23/6	
3A4	8/9	6E25	3/6	12A10	9/6	45Z6	12/	DAC32 7/9	E460	8/6	E448	9/6	PC101	7/6	UACB21 6/6	W3	10/6	W25	5/6		
3A2	6/9	6E26	3/9	12A11	6/6	50C2	21/6	DAC91 3/6	E461	9/6	E448	9/6	PC102	7/6	W76	3/6	W26	12/6	OA23	27/6	
3B7	5/6	6E27	4/3	12A17	5/6	50C6	1/6	DAC96 6/6	E462	6/3	E448	9/6	PC103	7/6	W77	2/6	W27	2/6	OA26	25/6	
3D6	3/9	6E28	3/6	12A18	8/9	50C5	6/6	DAC90 6/9	E463	11/6	E448	9/6	PC104	12/6	W81M 5/6	W28	5/6	W28	24/6		
3Q4	5/3	6E29	4/6	12A19	4/6	50P140/40/6		DD4 12/6	E464	10/6	E448	9/6	PC105	6/6	W01M 26/6	W29	10/6	W29	17/6		
3Q5GT	7/6	6E30	7/6	12A17	3/6	50C14T 6/3		DD11 10/6	E465	13/3	E448	9/6	PC106	25/6	UACB1 6/9	W30	10/6	W30	18/6		
3E	4/6	6E31	12/6	12A18	6/6	52K4	14/6	DD14 9/6	E466	5/6	E448	9/6	PC107	3/6	E448	9/6	W31	17/6	OC36	21/6	
3V4	5/3	6E32	5/6	12A17	4/6	53A1T 14/6		DD15 7/6	E467	8/6	E448	9/6	PC108	3/6	E448	9/6	W32	14/6	OC37	9/6	
4D1	3/9	6E33	1/3	12A16	6/	52	6/6	DD23 8/6	E468	8/6	E448	9/6	PC109	7/6	UACB5 6/6	W34	6/6	OC42	5/6		
6R40Y 8/	6E34	7/6	12A17	4/6	50P140/40/6			DD4 12/6	E469	10/6	E448	9/6	PC110	17/6	UACB6 1/6	X24	18/6	OC43	12/6		
5T4	7/6	6E35	3/3	12A17	9/6	5/6	4/6	DD7 7/6	E470	5/6	E448	9/6	PC111	10/6	UACB7 6/6	X24	15/6	OC44	8/6		
5U3	4/6	6E36	7/9	12A18	5/6	50	2/6	DD9 2/6	E471	2/6	E448	9/6	PC112	7/6	UACB8 6/6	X41	6/6	OC45	11/6		
5V4C 7/6	6E37	24/	12A16	4/6	53	22/6		DD9 2/6	E472	3/6	E448	9/6	PC113	7/6	UACB9 6/6	X43	5/6	OC45	8/6		
5Y8T 4/6	6E38	10/6	12A17	6/9	53	8/6		DD9 2/6	E473	10/6	E448	9/6	PC114	10/6	UACB10 10/6	U46	3/6	OC46	5/6		
5Y4 9/6	6E39	10/6	12A11	10/6	53A2	6/3		DD9 2/6	E474	10/6	E448	9/6	PC115	10/6	UACB11 10/6	U46	3/6	OC46	22/6		
5Z3	7/6	6E40	9/6	12HGT 7/6	90A7	6/6		DD9 2/6	E475	6/6	E448	9/6	PC116	10/6	UACB12 10/6	U46	3/6	OC46	22/6		
6E2	7/6	6E41	12/6	12A16	6/6	52K4	14/6	DD14 9/6	E476	3/6	E448	9/6	PC117	10/6	UACB13 10/6	U46	3/6	OC46	22/6		
630L2 8/3	6E42	11/3	12A16	6/6	50C4	4/6		DD17 3/6	E477	3/6	E448	9/6	PC118	10/6	UACB14 10/6	U46	3/6	OC46	22/6		
6A7	8/9	6E43	10/	12K5	10/6	50C6	4/6	DD18 23/3	E478	20/6	E448	9/6	PC119	10/6	UACB15 10/6	U46	3/6	OC46	22/6		
6A8G 5/9	6E44	9/9	12K7GT 3/6	90C7	18/	DD101 25/3		DD19 2/6	E479	20/6	E448	9/6	PC120	10/6	UACB16 10/6	U46	3/6	OC46	22/6		
6A97 4/6	6E45	9/6	12K8GT 3/6	150B2	16/6	DD107 16/11		DD20 2/6	E480	3/3	E448	9/6	PC121	10/6	UACB17 10/6	U46	3/6	OC46	22/6		
6A98 3/6	6E46	9/6	12K9GT 3/6	150B3	16/6	DD108 16/11		DD21 2/6	E481	3/3	E448	9/6	PC122	10/6	UACB18 10/6	U46	3/6	OC46	22/6		
6A95 2/6	6E47	9/6	12K10GT 3/6	150B4	16/6	DD109 16/11		DD22 2/6	E482	3/3	E448	9/6	PC123	10/6	UACB19 10/6	U46	3/6	OC46	22/6		
6A97 5/9	6E48	9/6	12K11GT 3/6	150B5	16/6	DD110 16/11		DD23 2/6	E483	3/3	E448	9/6	PC124	10/6	UACB20 10/6	U46	3/6	OC46	22/6		
6A95 8/9	6																				

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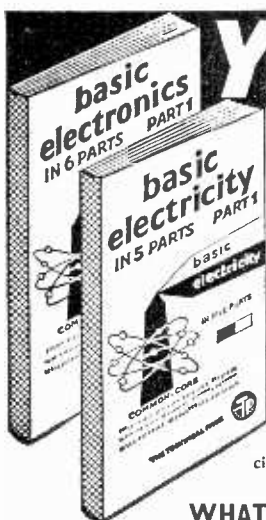
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where N1 is the current multiplication required on the lowest current range. In the writer's case the lowest range was 3mA and the f.s.d. 660μA, giving N1=3.000/647, and Rm was 23.3Ω. So, in this particular case,

$$R1 + R2 + R3 = 23.3 / \left(\frac{3.000}{647} - 1 \right) = 6.4\Omega$$

Step 2. $R2 + R3 = \frac{N2}{N1}$

For example, to turn the writer's meter into a 30mA meter,

$$R2 + R3 = \frac{23.3 + 6.4}{30 / (0.647)} = 0.66\Omega$$

It follows that $R1 = 6.4 - 0.66 = 5.74\Omega$.

Step 3. $R3 = \frac{N3}{23.3 + 6.4} = \frac{300 / (0.647)}{23.3 + 6.4} = 0.066\Omega$

for 300mA in the case in point. Thus $R2 = 0.66 - 0.066 = 0.594\Omega$. Clearly the method can be extended to any number of current ranges. Thus a 3A range would require an extra resistance R4 of 0.0066Ω and so on.

Making the Shunts

The largest shunt resistance (5.74Ω) lies in the range of resistance which can be measured reasonably accurately by the original unit. However, the writer decided to try his luck without actually measuring the resistance but instead to cut suitable lengths of wire of known resistance. In fact the only wire available was ordinary copper wire, but this proved to be quite satisfactory. (Resistance values are given in standard wire tables.)

It is necessary to use a reasonably long piece of wire, because one can never say within a quarter of an inch or so what the final length is, because a certain amount of wire is in effect lost in the connections. (It is reasonable to allow an extra half-inch.) If the length is short, say, a couple of inches, this uncertainty accounts for rather too high a proportion of the total. On the other hand, it is tedious to wind huge lengths of wire. A search in the wire box revealed some 43s.w.g. (2.359Ω/yd) which would serve for the 5.74Ω resistor (87.5in.) and some 36s.w.g. (0.594Ω/yd) which would do for the 0.66Ω resistor (38.4in.). These resistors were made up and connected in series across the meter. If correct the meter must read very nearly 3mA, since the third resistor (0.066Ω) has little effect on the 3mA range.

A current of 3mA was obtained from a 3V dry battery and a 1kΩ resistor (later to serve as the 3V "multiplier") and the meter registered very nearly f.s.d., showing that the shunts were correct. No suitable single wire was available for the third shunt so a piece of 7/0.0076 (i.e. seven strands of 36s.w.g.) connecting wire was tried. The length, calculated on the assumption that the resistance was one-seventh of the resistance of 36s.w.g., was 31.2in. It turned out that the meter read 25% high in the 300mA range. This seemed odd until it was realised that to use stranded wire one has to allow for the twist!

The length was adjusted, using a 30mA standard current (3V, 100Ω) so that the meter read f.s.d. on the 30mA range and one-tenth f.s.d. on the 300mA range.

Voltage Ranges

By leaving the 3mA shunt permanently in circuit a range of 3V was obtained using 1kΩ, 30V with 10kΩ, and 300V with 100kΩ. Close tolerance resistors should be used (± 1%) and the power rating should be adequate. Thus at f.s.d. the 100kΩ resistor must dissipate 3mA x 300V = 900mW, so a 1W resistor is required.

In addition a 300mV (0.3V) range was included:

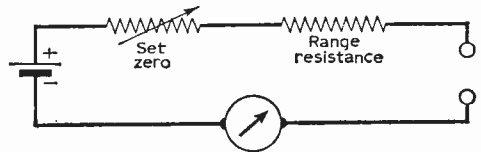


Fig. 8: The conventional ohmmeter which with a non-linear scale produces inaccuracies at the low-resistance end.

this is useful for work with transistors. On a low range like this, the meter resistance (5Ω with the 3mA shunt) becomes significant. However, a 100± 1% resistor was used as it was the nearest standard value and the 5% error was felt to be tolerable on this range.

Resistance Ranges

An ordinary ohmmeter (Fig. 8) has a non-linear scale and is only accurate for resistor values which produce about half-scale deflection. Since the surplus unit had a good calibrated 50Ω resistor in it (actually calibrated 0—25Ω) and since the meter was centre-zero it was decided to use a

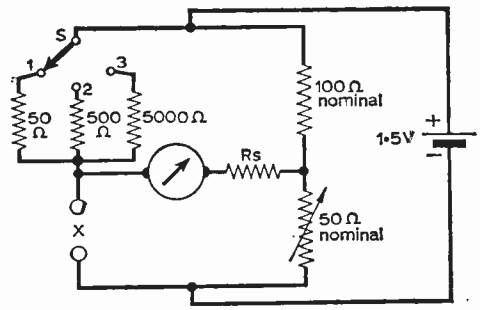


Fig. 9: A three-range bridge circuit for resistance measurements.

bridge circuit for resistance measurements.

The original instrument was a single-range one, but it is possible to make use of the calibrated resistor in a multirange instrument. To do this the circuit has to be rearranged as in Fig. 9. Here the 100Ω nominal resistor should be exactly double the value of the 50Ω nominal variable resistor. To make sure that this was so use was made of some of the components in the original circuit.

Referring to Fig. 4 it will be seen that the right-

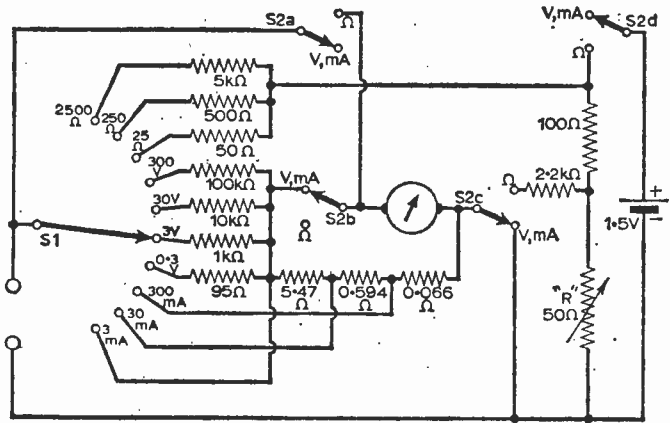


Fig. 10: The complete multimeter circuit.

Complete Circuit (Fig. 10)

Two switches are used. S1 selects the range on all measurements. S2 rearranges the circuit to measure either volts and milliamps or ohms. It is theoretically possible to do everything with one multi-wafer switch but there was not room for one in the rather shallow meter case.

Construction

The original meter box had a separate battery compartment. The partition which created this was removed to provide more space. The front panel is big enough for mounting all the components. For the battery use a Terry clip, which also provides contact with the negative terminal (the zinc case) if the outer paper is removed.

Contact to the positive terminal (the carbon rod) is made by soldering a lead to its brass cap—crude but effective.

The original instrument had various bits of webbing attached to it. These were removed and a simple handle screwed to the sides. This handle swivels and is proportioned so that it can just be tucked away below the bottom of the case for storage. The pivots are deliberately made stiff by means of friction pads (rubber tap washers) so that the handle can be positioned (Fig. 11) so as to prop the meter in a convenient attitude.

hand ratio arms are in the ratio 2:1. The technique is to use them as standards to select a suitable 100Ω nominal resistor. To do this the positions of the 50Ω variable and the X terminals are exchanged. The 50Ω resistor is set to maximum and left alone. Then various resistors of 100Ω nominal value are tried until one is found which balances the bridge. This resistor has twice the value of the variable resistor and is used in the final circuit.

The resistance standards (Fig. 9) should be close-tolerance components. RS is a safety resistor to

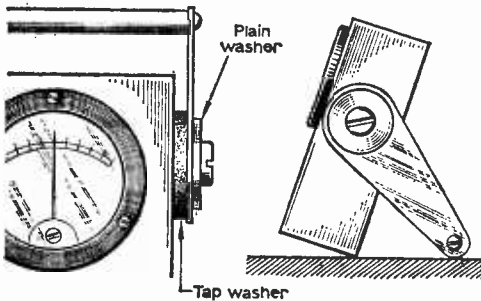


Fig. 11: Illustrating a suitable handle, for the meter which may double as an inclined support.

protect the meter against overload. A study of Fig. 9 will show that the meter receives the largest current when on the 25Ω range with nothing connected to the X terminals and with the 50Ω variable resistor set to zero. Then, if there were no RS, only the 50Ω standard would be effectively in the meter circuit. RS is chosen to limit the current to a safe value under these conditions.

It was originally intended to use the meter with its 3mA shunt for the bridge, but the sensitivity was poor on the 2,500Ω range. So in the final circuit it was arranged to disconnect all the meter shunts when measuring resistance. This meant having an underdamped meter but it takes a few seconds to find the null anyway, so the disadvantage is not so great.

ON THE SHORT WAVES

—continued from page 240

An undisclosed 25m band frequency has replaced 15.265kc/s for the transmission from 1830—1925 of the Radio Voice of the Gospel, P.O.B. 654. Addis Ababa, Ethiopia.

There are new frequencies for all the English transmissions to Europe of Radio Warsaw, Warsaw, Poland. The new schedule is 1830—1857, 1930—2000 and 2130—2155 on 7125/7, 285kc/s, 2030—2100 on 6,135/7, 270kc/s, 2230—2300 on 7,145/7, 270kc/s and 1,502kc/s medium wave. There are also multilingual music transmissions from 1900—2030 on 7,145/1,502kc/s and 2330—0100 on 9,675/7,125/1,502kc/s.

Cairo Radio's transmission to East and Central Africa from 1545—1830 is now on 17,920kc/s, where it is giving good U.K. reception. English is at 1745. This station wants reports, which should be sent to Propagation and Monitoring Department, U.A.R. Broadcasting and TV, Maspero Cairo, Egypt.

Finally N.H.K., Tokyo, Japan, now uses 11,780/15,135/17,870kc/s for its European transmission from 0615—0845. The English portion is from 0800—0845.

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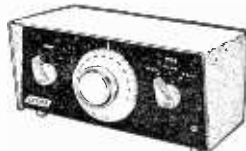
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G4HZ writes . . . I am delighted with it, it improves my Eddystone 640 in all respects. The difference with the Pre-selector is fantastic, a weak signal on 15 metres about S2 changed to S8. On the L.F. Bands, unwanted noise and mush is cut out.



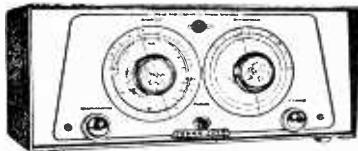
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LETTERS TO THE EDITOR

SINGLE SIDEBAND RECEPTION

SIR.—I wonder if users of simple short wave receivers have noticed how well single sideband transmissions can be tuned in with these sets. A test, and a little practice in tuning such s.s.b. signals, is best first made on the 80m amateur band. With an ordinary superhet, or with a t.r.f. receiver adjusted so that the detector is not quite on the point of oscillation, any s.s.b. signals will be quite unintelligible. If regeneration is then advanced very slightly, so that the detector is just oscillating, the s.s.b. can be received very well. Receiver tuning is adjusted so that the detector frequency is near the frequency of the eliminated carrier of the s.s.b. transmission. On the 14Mc/s band, many USA and other amateurs will be heard, using this system.—
F. G. RAYER (Upton-on-Severn, Worcestershire).

IF YOU CAN'T BEAT 'EM—JOIN 'EM

SIR.—With reference to the Leader Competition entry from Mrs. Joyce Burdett (page 62, May issue) who claims to be a "wireless widow". Why should she feel like this? The old adage, "If you can't beat 'em, join 'em" is the best cure for the XYL's blues. There are now well over thirty YL'S and XYL's in this country with their own callsigns and I don't think there is one amongst us who could be described as a blue-stockinged technical type; a R.A.E. pass does not require brains, only a little application of effort and is within the reach of all.

With her own ticket Mrs. Burdett would be in a position much envied by the unmarried licensed YL's and those XYL's who have their own ticket but whose OM's have no knowledge of radio to help them. She would have her (or even his) equipment built and maintained and her aerials rigged for her, unlike some XYL's with licenses who have to do their own construction and maintenance, and are even called in by the OM to mend a fuse!

Many radio societies, like our own, welcome YL's and XYL's and even the OM's of amateurs as members, though there are as yet, a few societies who have not seen the light and condescend to welcome their ladies only to the annual dinner as decoration (or more correctly, to ensure that the OM's do not get into trouble for being late home!)

How would your correspondent feel if she were the OM of a lady amateur—with strange men calling on her as the result of a mobile QSO, various men collecting her at odd hours to do a stint of Field Day operating or all night on a Scout Jamboree station?

I am sure that if some OM's can be tolerant of their wives' hobbies, whether they be knitting,

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

bingo or amateur radio, then it is up to the XYLs to do the same. I joined my husband's hobby (not radio) because I couldn't hope to beat it and he now even tolerates mine! After all, amateur radio is a hobby which can, to a large degree, be pursued at home, as long as the XYL doesn't drive the OM to the last resort of the henpecked ham—namely, mobile operation on his way to work!—"G3XYL" (name and address supplied).

MODIFICATIONS FOR P.W. SIXTEEN MULTIMETER

SIR.—I have recently completed the P.W. 16 Multimeter (described in your January 1964 issue) including modifications to extend the ranges available to eighteen. I am very pleased with the results achieved, and the general professional appearance of the completed instrument.

Construction of the instrument was straightforward, provided care was taken and the job not rushed. This applies particularly to the installation of switch S2, which is PVC insulated and very difficult to solder without damage. However, this was successfully accomplished by using a heat shunt and by not keeping the iron in contact after the solder had run.

The two additional ranges included in my meter extend the voltage readings up to 1,000V a.c./d.c. (Messrs Lasky Radio supplied the additional components required for seven shillings.) Two additional terminal sockets were fitted by drilling the escutcheon plate in line with existing holes to be found in the left-hand corner of the meter case when viewed from the rear. These two sockets then became the common positive and negative terminals of the published design. The original sockets of the meter are then used for the 1,000V ranges.

The positive socket becomes the 1,000V d.c. positive, and the negative the 1,000V a.c. The new common negative socket is used for all ranges.

Two additional 5mΩ resistors are wired in series between the 1,000V d.c. positive socket and terminal 5 of S1 and two 250kΩ resistors are wired in series between terminal 5 of S1B and the 1,000V a.c. socket. These additional resistors are housed vertically either side of the insulated posts used for holding the case together. The double solder tag "B" is not required and the connections originally taken to this point are soldered directly to the common negative terminal.

These modifications, besides making the meter more versatile, will enable use to be made of the Taylor HV probe which extends the range up to 25kV.—L. J. LYON (Lexden, Colchester, Essex).

TRIMMING TOOL OR TUNING TOOL

SIR,—I wish to thank you for the really valuable Trimming Tool Set which accompanied the April P.W. It will obviously be most useful for its intended purpose, but I have found that in an emergency, I can also use the No. 4 tool as a tuning-fork—as its shape, but not its material might suggest.

As a violin player, I always carry in my case a 440c/s tuning fork, but I have now found that if I grip the No 4 tool by the "plug" and gently hold the tines of the fork between finger and thumb of my other hand and then slide these digits off the fork, a tone equal to A-flat; i.e., just a semi-tone below the now standard pitch for "A" (A-natural); is emitted.

The sound is very quiet, of course, and I have to hold the tool close to my ear whilst stroking the tines, to hear the note. — L. F. HUNTER (Rugby, Warwickshire).

A CLOSED SHOP?

SIR,—I feel that I must object to one point in H. Naylor Caley's letter in May P.W. Although his suggestions for further study at evening classes are sound, I fear he gives the impression that all radio clubs are kinds of secret societies in the mystic of radio, and are restricted entirely to "ham" radio.

I would point out that most radio clubs are strictly "amateur radio societies", and although one of the main interests is usually ham radio, you will find members with interests in all fields of radio and electronics.

I joined my local club (Eccles and District) only six months ago, but in that time I have received encouragement and assistance in building an 11-valve double conversion receiver, more than doubled my technical knowledge, and become a member of the R.S.G.B. Hardly an example of a closed shop of licensed amateurs with very restricted interests. — W. R. BANNERMAN (Flixton, Manchester).

P.W. GUITAR AMPLIFIER

SIR,—I was rather puzzled to read in the article on the 35W Guitar Amplifier (P.W., May 1964), that many thousands of volts are present at the top cap of the 807 valves when the signals are present.

High anode voltages may be expected with inductive anode loads, (cf. line output transformers), but with an output transformer correctly loaded, the transformer behaves as an impedance matching device and not as an inductance. The anode load is therefore resistive and is equal to the transformer secondary load reflected back to the primary.

807 valves commonly exhibit internal fluorescence, which could give the impression of very high anode voltages when only relatively low voltages are present.

If the secondary load on the output transformer were removed, then it would not only be possible to break down the transformer insulation due to the generation of high potentials by what would be now an inductive load, but also cause risk of damage to the valve. There is the possibility of flash-over in the valve due to high voltages but

also the possibility of increased screen dissipation due to a lowering of anode voltage.—F. W. ADAMS, B.Sc. (Sheffield, 10).

SIR,—With reference to Mr. Adams' letter, I would like to clarify the paragraph referred to in my article.

To recapitulate, the sentence under discussion reads: "... keep away from the 807 top caps, high peak voltages of many thousands are present here when a signal is present, and severe burns can be had if they are accidentally touched during use".

What is meant by this is that, should the caps be touched (especially if the other hand or a part of the body is in contact with the chassis) a spark will be drawn between the top cap and the person's hand. Due to the spark comprising an alternating current component, the back e.m.f. across the output transformer primary winding is extremely high. The actual voltage developed depends upon the spark frequency, and the level of signal present in the amplifier at the time.

Placing part of the body across this circuit point, puts a relatively low resistance across the transformer, which of course upsets its matching. Once contact has been made and a spark drawn as the unfortunate constructor endeavours to move away, the transformer behaves as an inductance purely, and as stated, due to the increasing back e.m.f. produces a vicious circle with the spark voltage increasing until the gap is too large or the external resistance of the person's body has increased to a point where the current flow is too low to sustain the spark. I have had first hand experience of this effect, and nursed a nasty burn on one thumb for quite a few weeks afterwards.

Incidentally, Mr. Adams is quite right in his remarks—"high voltages are not present whilst the amplifier is operating normally", the anode voltages of the 807's being 450V under all conditions.—BRIAN L. PHILLIPS (Preston, Lancashire).

Sir—I would be grateful if any reader could sell or loan me . . .

. . . the February, March and September 1962 issues of P.W.—P. CUNNINGHAM, 20 Kenwood Gardens, Gants Hill, Hford, Essex.

. . . details about the Ekco Car Radio, No. CR74, especially of the external connections to the sockets.—P. BAYLISS, 18 Stuart Road, East Barnet, Hertfordshire.

. . . the February, March and April 1962 issues of P.W.—B. J. COLLINS, 54 White-Lion Road, Amersham, Buckinghamshire.

. . . the issues of P.W. dealing with the 19 set.—D. SYMONDS, 66 St. Barnabas Road, Cambridge.

. . . the information regarding the R1155: power, output, etc. All data received returned within 48 hours.—T. L. SADLER, 10 Sheaf Avenue, Abbeydale Road, Sheffield 7.

. . . data on the 19 set Mk. 3 (Canadian), particularly the Mk. 3 No. 2 supply unit.—R. AUBREY, 11 Addersley Road, Norton, S.O.T., N. Staffordshire.

. . . the service manual for the Sobell RS402 a.m./f.m. receiver.—F. CLARKE, 57 Woodcroft Road, Smithdown Road, Sefton Park, Liverpool 15.

. . . circuit, valve line-up and any information on ex-government type No. MCRI.—R. DAVIS, 11 Bishop's Lane, Robertsbridge, Sussex.

. . . written or printed notes leading to the MOT "Radar—Maintenance Certificate" standard or any other material on the subject.—M. FAHY, 1 Castle Street, Limerick, Eire.

. . . the circuit and any other data concerning the R107 set ZA3050.—R. WILD, 140 Nansen Road, Alum Rock, Birmingham 8.

. . . the September 1956 issue of P.W.—B. DODDS, 42c Alma Place, North Shields, Northumberland.

. . . circuit and/or manual of the Romac Radio Corporation Television set, Model 179/T.—J. McGRAIL, 494 Rochester Way, Sidcup, Kent.

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NEWS

No. 3

JUNE/JULY 1964

ANOTHER ACCESSORY FOR THE MICRO-6

Because of the enormous interest in the Micro-6, we at Sinclair Radionics have been devoting much of our time to the development of accessories which add to its usefulness. The first of these, the TR 750 power amplifier was introduced last month. This remarkably low priced high performance design has, of course, a great many applications but in conjunction with the Micro-6 or the Slimline it can form a really powerful car, home or portable radio.

The latest Micro-6 accessory is just as exciting! We have designed and produced an elegant nylon wrist strap which clips straight on to the Micro-6 converting it into a wrist radio—the first of its kind in the world! The earpiece lead may then be run up the sleeve and the radio listened to without any sign of trailing wires.

The wrist strap may be removed instantly when desired, but in use it is firmly attached and the set cannot come loose. It will add immensely to the pleasure and usefulness of your Micro-6, particularly when out of doors.

THE MICRO-6 CIRCUIT

Many readers may be curious to know how we achieve the high performance we claim for the Micro-6 in a set of such tiny size. That our claims are genuine is, of course, proved by the countless constructors' letters we receive, more of which we give below, but you may like to know more about the design. The circuit is a completely new one based on our micro-alloy transistors (MATs). These tran-

sistors have higher gains than any other types at low voltage levels and, as they are also very small, are ideal for miniaturised equipment. The Micro-6 has two high gain stages of R.F. amplification, a double diode detector and three stages of A.F. amplification. Thus we have used exactly the same number of stages of gain as are employed in conventional 6 transistor superhets.

We are able to do this because we use genuinely micro-miniature components not normally available to the home constructor. For example all the resistors are only $\frac{1}{8}$ " in length. These tiny components help to make the Micro-6 simple to construct because we don't have to pack them so closely together. If you would like more details just send 1/- for our booklet on the Micro-6 which gives the complete circuit diagram and technical description.

BRITISH BEATS THE WORLD!

We recently launched an export drive for all our products. We have already received enquiries for the Micro-6 from over 30 countries and samples are now going to agents throughout the world. One company in the U.S.A. has ordered 1,000 TR750 amplifiers and 1,000 micro-amplifiers. We were particularly pleased by this result as the orders were obtained in the face of very tough Japanese competition.

Cris S. ...

★ FROM OUR POST BAG

Enthusiastic letters continue to reach us unabated. A constructor from Aylesbury writes:—

"Many thanks for having dispatched my order of your little receiver the Micro-6. I built the set on Saturday evening and in less than two hours; the results being obtained straightaway. Home, Light, and Third, received on more than ample strength, and at least 12 foreign stations, such as Luxembourg, Paris, two German stations, and others. all these at more strength than needed, with good selectivity. Clarity is very good; and no fading on Luxembourg. Truly a remarkable achievement, to be heard and seen, indeed to marvel at less than a Match Box,"

(Signed) J.G.

D.M.F., Southport, states:—

"As one who remembers the days of bright-emitter valves and has seen radio grow from that to colour television I can still marvel at the design and performance of your amazing little Micro-6. Having built it, I find it hard to be without. I seem always to have use for it, and I find it absolutely fascinating that so much entertainment can be had from so tiny a set."

(Signed) D.M.F.

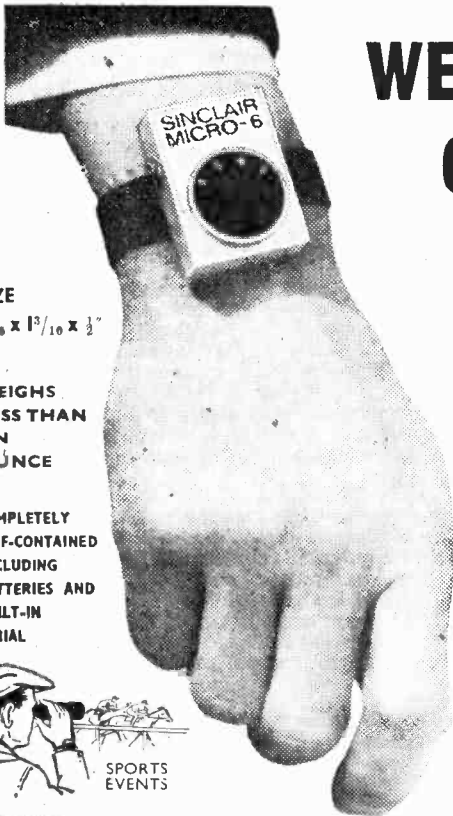
This time our devoted enthusiast MIKE FARAD says

"I've made two for me, one for Uncle Bert, one for Mabel, two for the kids and one for Grandma. The dog will have to wait!"



SINCLAIR MICRO-DESIGNS

WEAR THE MICRO-6 ON YOUR WRIST!



SIZE

1 1/8" x 1 3/10" x 1/2"

WEIGHS LESS THAN AN OUNCE

COMPLETELY SELF-CONTAINED INCLUDING BATTERIES AND BUILT-IN AERIAL



The unbelievably small size and fantastic power of the Micro-6 make it possible to wear it like an ordinary wrist watch, and for this we introduce our special "Transrista" reinforced nylon strap. The Micro-6 can be attached to it instantly and removed whenever required. This opens still further new and exciting approaches to radio listening and ensures your obtaining enjoyment such as you have never known before from any radio receiver.

You can build the Micro-6 and have it working within the space of a single evening! With a "Transrista" strap for using your set out of doors you will indeed have the radio of tomorrow today.

THIS IS THE SPEC THAT GETS SUCH WONDERFUL RESULTS

The Micro-6 uses Micro-Alloy Transistors in a completely new circuit. Two stages of R.F. amplification are followed by an efficient double diode detector which drives a high-gain 6-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.

SINCLAIR MICRO-6
THE SMALLEST SET IN THE WORLD



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, printed circuit board, micro-miniature components, case, dial and light-weight earpiece and instructions come to

MALLORY MERCURY CELLS FOR THE MICRO-6 ... 1/11 each

MICRO-6 "TRANSRISTA" WRIST STRAP

Stylishly finished, strongly made Nylon strap, black or grey, ready to take Micro-6.

59/6

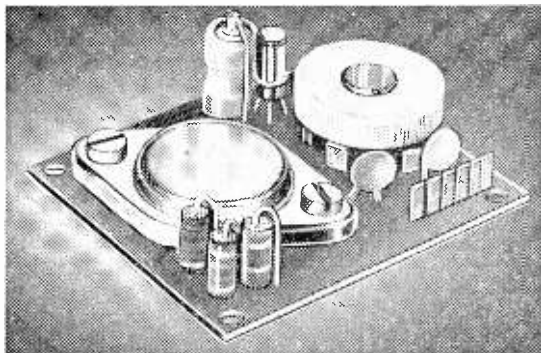
7/6



MALLYORY 6-CELL PACK OFFER

Always have power on hand for your Micro-6 with a Mallyory 6-cell pack—you save, too, buying this way. **1/10/6**

BRING 1970 STANDARDS TODAY!



ACTUAL SIZE—2" x 2"

THE TR750 HAS TREMENDOUS POWER

This latest Sinclair power amplifier builds on to a printed circuit board 2in. square and includes its own volume control with on-off switch. With a transformerless output of 750 milliwatts, the TR.750 is primarily intended to provide powerful loudspeaker reproduction from the Sinclair Micro-6 or Slimline receivers, thus enabling owners of these sets to use them also for car-radios, loudspeaker-portables or domestic sets. The TR.750 has many other applications. It makes an excellent record reproducer, singly for mono or paired for stereo. It can make the heart of an efficient intercom or baby alarm system and its tremendous power in relation to its size greatly enhances its usefulness.

BRILLIANT FEATURES OF

The performance characteristics are brilliant—3/4 W. transformerless output with frequency response \pm 1dB 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 ohm 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 transistor, exciting new "Magnagain" output transistor.

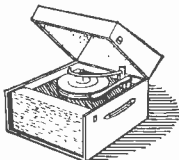
TR 750 POWER AMPLIFIER

All parts including printed circuit board, transistors, components and instructions come to a total of

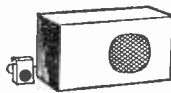
39/6

Ready built and tested

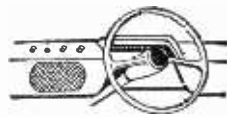
45/-



AS A RECORD PLAYER



RADIO REPRODUCER WITH MICRO-6 OR SLIMLINE



AS A CAR RADIO

★ OTHER OUTSTANDING SINCLAIR 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 1/8 x 1 3/16 x 1/2 in. excluding probe. All parts with instructions come to

27/6

Ready built and tested

SINCLAIR MICRO AMP.



Smaller than a 3d. piece. Frequency response 30 to 50,000 c/s + 1dB, 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

SINCLAIR "SLIMLINE"

Has self-contained ferrite rod aerial and takes standard PP5 battery, yet measures only 2 1/2 x 1 1/4 x 3/4 in. Tunes over the medium waveband Great power and quality. Building is particularly easy. All parts, including royal blue and gold case, earpiece, and instructions come to



49/6

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If you do not wish to cut this page, please mention PW.7 when ordering.

TO SINCLAIR RADIONICS LTD., 69 HISTON ROAD, CAMBRIDGE

PHONE: 53965

Please send items detailed below

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NAME

ADDRESS

TOTAL £

For which I enclose cash cheque money order

BLOCK LETTERS

P.W.7

RECEIVERS & COMPONENTS

TRANSISTORS! Give-away price. NKT124/5 Power Type. 6 for 10/-, 2S017 4W, up to 60mc/s, 5/- each. Post free. G F MILWARD, 17 Peel Close, Drayton Bassett, Staffs.

BRAND NEW Boxed Valves. Guaranteed twelve months. PCF80 9/6, PCL83 10/6, PCL84 9/6, EY86 7/6, U26 11/-, EP80 7/6, PY801 11/6, 30P12 11/-. Cash with order only please. Add post one valve 6d., three valves 1/-, six valves and over 2/-. **RAYAUDIO ELECTRONICS**, Dept. P1, Harley Road, Gt. Yarmouth, Norfolk.

RESISTORS! You can't resist this! 1W, 1W, 2W Polythene wrapped on cards of 10. Mixed values and wattages. 22/10/- for 1,000. Your selection 10/- per 100. G. F. MILWARD, 17 Peel Close, Drayton Bassett, Staffs.

Used E.F.80 Valves (guaranteed), 2/6 each, Post Free. S.A.E. for other types.

J. BARKER, Radio Dept.,
163 LAKE ROAD, PORTSMOUTH.
HANTS.

"MEATHKITS" can now be seen in London and purchased on easy terms. Free brochure. **DIRECT TV REPLACEMENTS LTD.**, Dept. PW7/9, 126 Hamilton Road, West Norwood, S.E.27. G.P.Sy Hill 6166.

SPEAKER REPAIRS, cones fitted. Satisfaction guaranteed. **L. S. REPAIRS,** Pluckley, Ashford, Kent.

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NEW MULLARD Transistors. OC70 6/-, OC71 6/-, OC72 7/-, OC44 8/9, OC45 8/6, OC170 9/-, OC171 10/- Post free in U.K. Cash with order. Full range of Mullard Transistors in stock. S.A.E. for list. **ARKAY ELECTRONICS LTD.**, 38 Church Road, Aldershot, Hants.



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Telephone 465

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Speakers, Ex-TV, 5in. round, 6 x 4in., 3/6; 8in. round, 6/-, post 2/-.

Line Output Transformers available. State set model No.

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Scan Coils etc., Quote set model No. with all enquiries and S.A.E. for prompt reply. All goods subject to satisfaction or money refunded.

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TRANSCEIVERS — 9 Transistor Two Way Radio. Complete with aerials, earpieces and cases. Range up to 5 miles. As new. £22 pair. **J.D.R. Cameras Ltd.**, 52 Market Street, Wigan, Lancs.

SALE. Ex Ministry Ground Radar Unit when built. Weight 3 cwt. Offers. **E. M. MARRINER**, 27 Hurworth Rd., Croft, Darlington.

MULLARD Stereo Amp. cost 14 gns. Unused, 8 gns. o.n.o. **LOBO**, 43 East-down Park, S.E.13. **LEE** 6951.

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To G3CHS, 45 GREEN LANE PURLEY, SURREY

CONDENSER BARGAIN! Miniature paper condensers, 4in. x 1/4in. Ideal for transistor sets. .0001, .001, .002, .005, .02, .04uf. Your choice. 7/6d. per 100 or £3 per 1,000. **G F MILWARD**, 17 Peel Close, Drayton Bassett, Staffs.

240WATT ELECTRIC POWER ANYWHERE
ANYTIME from 12V CAR BATTERY
WITH THE AMERICAN DYNAMOTOR UNIT
Small 12v unit 200/250/300/400/500/600/700/800/900/1000/1100/1200 watts.
Perfect for TELEVISION, POWER TOOLS and all universal A.C./D.C. ELECTRICAL EQUIPMENT, gives wonderful results. Price ONLY £8.95 inc. V.A.T. See standard envelope for full illustrated details. V.C. SCIENTIFIC PRODUCTS, CLEVELAND, LANCE.

5-TON FACTORY CLEARANCE. Radio, T.V. Electrical Components, in mixed parcels. Example: 28lb. mixed parcel £1, pp 5/-. Speakers, grills, valves, bases, i.f.s, covers, condensers etc. Hundred other items. S.A.E. List and Postal Orders to **P. NEWTON**, 16 Shalcross Crescent, Hatfield, Herts.

ALBATROSS ENG., CO.

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EX GOVERNMENT EQUIPMENT (mint condition)
Pocket Voltmeters 15/6-20/6, 9/6 (1/6). 4 Valve Modulators 11/6 (2/6). A.C. HV 1 1/2", 1 1/4", 1 1/2" (2/6). No. 19 Twin Control Unit, 5/- (2/6). 7 New TV Pots on Strip, 7/6 (1/-). Dimmer switches, 7/6 (6d.). Modulator Unit No. 2, 2/6. Modulator Unit No. 2S, 2/11. Pulse Generator, 1/9, 2/8. Test Set 8/11 & Receiver No. 1, 4/27. New Radio (plus 7/6 (2/6). Disc Langer, 1/2 (1/2). 600 Hz. C.F.M. Meters, 8/6 (2/6). Voltmeter (Welding) cases, 1/9 (6d.). Large Porol. Insulators Overhead: 2/8 pair (1/-). 6V 6P Vibrators, 5/9 (1/-).

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19in. RACK FITTING CABINET.
34" high by 21" deep with telescopic drawer slides. Louvred sides, back and top. Brand new Swedish make, £4.0.0 only, plus B.R.S. delivery.

ECR Tube with Screen and Base with ECR 35 data, 25/-.

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This item is brand new in varnished wood case original packing. Makes a good timer for exposure. Infinitely variable up to one minute. 24 volt operation. Containing motor, solenoid, clockwork mechanism. Driven by motor. 30/- post free.

Copper Laminate Board, single or double sided, 5/- per square foot panels, either type 3ft. by 4ft., 33/-.

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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Trade enquiries invited for large quantity OC201 Transistors, Printed Circuit Board.

U.K. ONLY

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off SHAW HEATH, STOCKPORT
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TESTED TRANSISTORS

1/- each, Red or White Spots.

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ZENER DIODES 4.7 v. to 33 volt 1/4 watt, 3/6 each. 1.5 watt, 5/- each, 7 watt, 6/- each.

Send 3d. stamp for Full Price List, and Free Equivalent Chart.

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Any type, or quantity

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Remote Control Unit Type F. New in sealed cartons, containing P.O. Relay 2,000 ohms Resistance, 100 volt Plessey Hand Generator, Telephone Ringing Bell A.C., 8 Morse Key on base, 2 D.P. D.T. Key Switches, Double Phone Jack, moulded, 5 position 6 pole Yaxley Switch, Induction Coil tapped 1-17-33 ohms, 7 Brass Screw Terminals on panels, plus Resistors, Condensers, Pointer Knobs. All in a handy metal box with hinged lid and side fasteners. Also we carry strap. Size 10 1/2 in. x 7 in., 25/-, post free. Or items may be purchased separately, Relay 5/-, Hand Generator 7/6, Bell 5/-, Morse Key 4/6, Key Switches 5/- pair, Double Phone Jack 2/6, Yaxley Switch 2/-, Ind Coil 2/-, Terminals 7 for 2/-, all post free.

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Plessey 2-4-12-25 way plugs and sockets, all 5/- pair.

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R.F. Coax R.F. Switch with 3 matching Plugs, 12/-.

Special Lightweight 7 in. x 4 in., 3 ohm P.M. Speaker, 6/-.

Murphy Radio Transformer, mains input—output 220 volts at 27 m/a twice 6.4 volts at 3.5 amp, 35 volts at .3 amps, 14/6.

Component Boxes 4 1/2 in. x 3 in. x 1 in., linen finish, White, 7 compartment, 10 for 2/6, 60 for 12/6.

Transformer PL1102 mains input, output 550-0-550 at 120 m/a, 5.7 volts at 2 amp twice, 5.7 volts at 4 amp, 7 volts at 4 amp, 7.2v at 125 m/a, 30/-.

Transformer PL1103 mains input-output 520-0-520 volt at 300 m/a, plus 170-0-170 volts at 1 amp, 22/-.

Metal Frames, suitable for stock, Job Cards, Bins, Crates, 2 1/2 in. x 5 in., 12/6 per 100—£4 per 1,000.

Packing List Envelopes, eyelet at each corner with fastener for flap, waxed, 4 1/2 in. x 5 1/2 in., 27/6 per 1,000. Samples both 6d. Tag Panels containing 150 items, 10/-.

150 kc/s Unit Motor Driven with crystal, slow motion drive gears, valves, variable condensers, etc. Brand new, boxed, B.R.S. delivery, 35/-.

U.K. ONLY

E. R. NICHOLLS

Mail Order and Retail Shop:
46 LOWFIELD ROAD
off SHAW HEATH, STOCKPORT
CHESHIRE

WANTED

(continued)

A PROMPT CASH OFFER for your surplus brand new Valves and Transistors. R.H.S., Beverley House, Mannville Terrace, Bradford 7.

**WANTED
VALVES ONLY**

Must be new and boxed
Payment by return.

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Then how about making yourself an electric organ? Constructional data available—full circuits, drawings and notes! It has 5 octaves, 2 manuals and pedals with 24 stops—uses 41 valves. With its variable attack you can play Classics and Swing.

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A UNIQUE BUY! Recording Tape, 60 brand, 54in., 1,200ft., 19/6; 7in., 2,400ft., D.P., 28/8. P. and P. 1/6 per spool. Bargains in all sizes. S.A.E. for list. E. C. KINGSLEY AND CO., 132 Tottenham Court Road, London, W.1. EUSTON 6500

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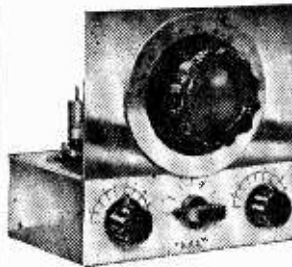
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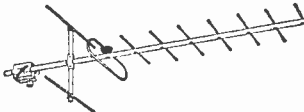
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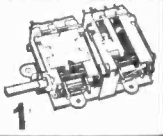
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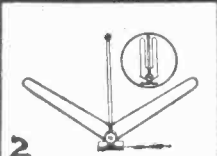
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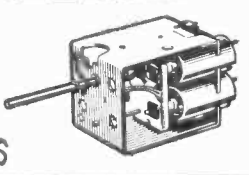
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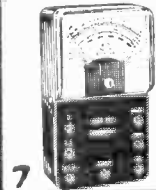
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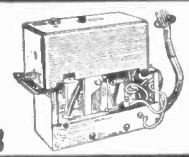
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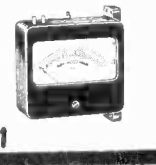
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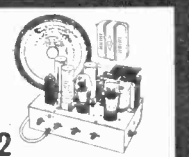
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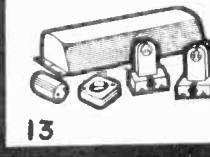
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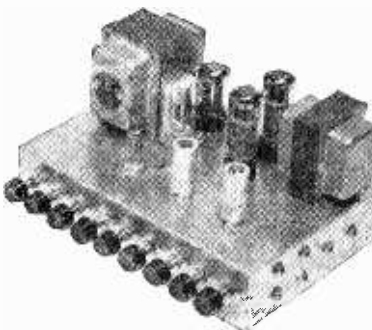
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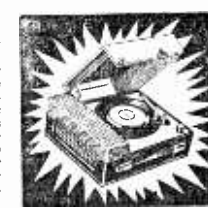
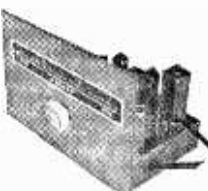
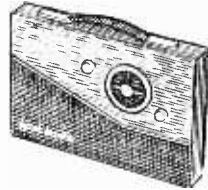
This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit has its own power supply for A.C. mains. Like 208.

Less valves only otherwise ready to use. 39/6

Plus 3/6 post and insurance.

CABINET & PICK-UP

Made for a famous company intending to make a Battery Record Player but changing their minds. This is an extremely fine looking cabinet, must have cost at least £2 to make. It is complete with handle and fasteners as illustrated. Also included in the parcel is a "commodor" pick-up with crystal cartridge and sapphire stylus. Both items new and perfect. Only 19/6, plus 4/6 post and insurance.



Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of 12/6, plus 4/6 post and insurance. Size 13 1/2in. x 8in. x 4in. and it is nicely covered in two tone I.C.I. fabric.

Speaker Bargain

12in. High-fidelity loudspeaker with a permanent magnet type with standard 3 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price 27/6 plus 3/6 post and insurance.

Make a Fan

Miniature motor 24 in. long x 1 1/2in. diameter, laminated poles. Operates off 20-30 v. D.C. Original cost at least £3 each. 8/6 plus 1/6 postage and insurance. Mains model 9/6 plus 2/6 postage and insurance.

TRANSISTOR SET CASE

Very modern cream cabinet, size 6 1/2 x 3 x 1 1/2in. with chrome handle, tuning knob and scale. Price 7/6 plus 1/6 postage.

Flood Lamp Control

Dim and full switch for controlling photo flood lamps; gives two lamps in series, two lamps full brilliance and lamps off. Similiar control of other appliances. With circuit 3/6 plus 6d. postage.

Adjustable Thermostat

Suitable for controlling furnace oven immersion heater etc. Can also be used as a flamesafe or fire alarm. Made by Sunvic, approximately 17in. long and adjustable over a range 0 to 550F. The contacts are rated at 15 amps., 230 volts. Listed at £3 or £4 each, these are offered at only 3/6, plus 2/6 postage and insurance.

Morganite Potentiometers

Single and 2-gang types available. Standard size with good length spindle, all new and boxed. Single types. 1/- each. Values available: 5K, 50K, 100K, 250K, 500K 2 meg. Gang type 3/- each—values available: 5K ± 5K, 100K ± 100K, 1 meg. ± 1 meg. 2 meg. ± 2 meg.

THIS MONTH'S SNIP

Complete kit of parts to build this transistor 2 wave receiver at only 39/6. Post and insurance 2/6.

"CORONET" MK. III

It fully covers the medium wave band and that part of the long waveband to bring in B.B.C. Light. The circuit includes a highly efficient slab aerial and Plesee's tuning condenser. Overall size approximately 4 1/2 x 1 1/2in. supplied complete with carrying case.

YAXLEY SWITCHES

Full range still available as our advertisement last month.

DO YOU EVER FORGET?

This Pocket Secretary could eliminate the trouble (often embarrassing) your forgetfulness causes you—she will stay in your jacket pocket and as fast as you can think she will capture and store—ideas—notes—formulae—appointments—anything you can say or sing! then at your command she will play them all back to you.

Undoubtedly one of the smallest precision tape recorders made. Entirely controlled by push buttons, you can record and play back with the instrument in your pocket. It is a full-function machine using standard 1in. tape and easy to replace batteries. Recording and playing back is from the same (crystal) microphone. Specifications: Dimensions: 9 1/4 x 2 1/2 x 1 1/2in. Weight: 14 oz. Reeling time: 12 mins., rewinding time 4 mins. Recording system: D.C. Bias. Erasing system: Magnetic erasing wow and flutter. Within 2% and frequency response: 500-1,200 c/s (within -6dB). Price £6.19.6 Complete ready to work.

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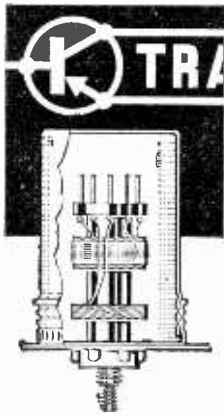
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RED — Oscillator coil for 465 Kc/s I.F.
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THE SKYROVER AND SKYROVER DE LUXE

GENERAL SPECIFICATION FOR BOTH MODELS
 7 transistors and 2 diode superhet—6 waveband portable receiver, covering the full Medium Waveband (130-576kHz) 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. I.F. frequency 470Kc/s. 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 under 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 2/- deposit and 11 monthly payments of 21/-.
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H.P. Terms 2/- deposit and 11 monthly payments of 24/6.
 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 'REALISTIC' 7

Transistorised Portable Receiver made to the highest professional standard. Comprises 7 Mullard Trans. plus Crystal Diode. 350 milliwatt output to 4in. speaker.—I.F. frequency 470 Kc/s.—fully tunable over medium and long wavebands. Two-tone plastic cabinet with handle—size 7 x 10 x 3 1/2 in. fitted socket for car aerial. Complete with full instructions.

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ONLY £1 EXTRA All parts sold separately. Battery 3/9 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. Leather case, ear-**12/6** extra
BUILT for 79/6 phone and battery
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READY BUILT BARGAINS Boy's 2 Transistor Pocket Radio

Ready made as illustrated—complete with personal earpiece, telescopic aerial, battery and carrying case! Wonderful value and performance—full medium waveband coverage—built in 2 1/2 in. speaker gives full tone reproduction. Works on single PP3 9 v. battery. In attractive plastic case—size only 4 x 2 1/2 x 1 1/2 in. All accessories included in the price. Not a toy.

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RECEIVER TYPE R.206. Frequency 0.55 Mc/s to 30 Mc/s in 6 bands. 100-250 v. A.C. or 12 v. D.C. Loudspeaker in power supply unit. High performance super-heterodyne, 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/-.

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Table listing various electronic components and their prices, including Panel Meters (round) with specifications like 0-20 microamps, 0-50 microamps, etc., and other items like 0-1 mA, 0-1 mA, 0-1 mA, etc.

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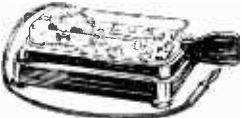
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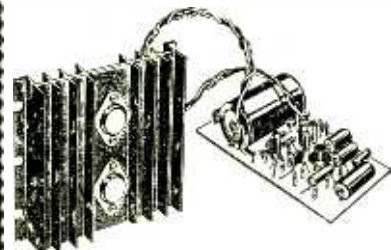
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For use with either of above amplifiers or valve amplifiers — Hum Free — High Sensitivity — 8 Inputs between 1.5mV and 300mV. For all pick-ups — Microphones, Tuners — Tape Replay. Separate treble and bass with cut and boost — 4 position Low Pass Filter — Volume etc. Panel size 9 x 2½ in. Battery operated or from power supply.

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● 3 ohm 10 Watt. ● 15 ohm 10 Watt.

BUILT **£5.10.0** BUILT **£5.19.6**

P.P. 2/6.

P.P. 2/6.

★ MAINS UNIT—will run 2-amplifiers for 3 ohm and 15 ohm. 69/6, P.P. 2/6. Each type.

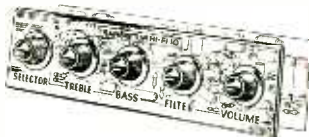
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Dark Brown and Gold Panel Plate. 8/6.

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● Amazing quality and value.



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(Available June)

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ALL PARTS SOLD SEPARATELY (Available June July)

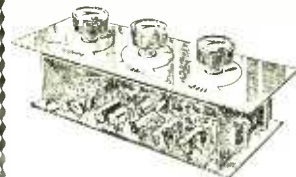
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12/18 volt for 15 ohm speakers. (mains unit now 60/- extra). 9/12 volt for 3 ohm speakers (mains unit 49/6 extra).

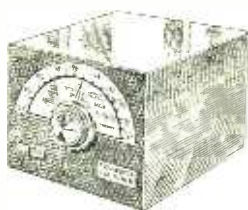
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