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MARCH
1971

17½p (3'6)

pw sound effects synthesiser

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THE 'TROJAN' TOP-BAND TRANSCEIVER
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ADCOLA Soldering Instruments add to your efficiency

ADCOLA 64

for Factory Bench Line Assembly

A precision instrument—supplied with standard 3/16" (4.75 mm) diameter, detachable copper chisel-face bit*.

Standard temp. 360°C at 23 watts.

Special temps. from 250°C—410°C.

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-  B 38 $\frac{1}{4}$ " — 3.2 mm CHISEL FACE
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-  B 44 LL $\frac{3}{8}$ " — 4.75 mm SCREWDRIVER FACE



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SUPERB PLYNTHS AND COVERS as illustrated

Suitable for Garrard AT60, SP25, 2000, 2500, 3000, 3500, 5100, 2025, 1025, SL65B and B.S.R. McDonald range. Superbly finished plynth, ready cut for use (fully assembled). Complete with tinted perspex cover. This unit is finished in Teak polish and will blend in any home. Please state deck when ordering. **(£4 Plus 50p P & P)**

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A COMPLETE STEREO SYSTEM FOR ONLY £37.80
- £1.25 p. & p.

ITS PERFORMANCE CAN BE COMPARED WITH EQUIPMENT COSTING AT LEAST £130 THE APOLLO 100% MADE IN ENGLAND

This modern compact unit has been specially designed to give the maximum stereo performance in your home. Specially designed, the unit employs the latest Garrard 2025TC record deck which enables you to play your records manually or allow the machine to auto-change up to eight records automatically. The Garrard record deck is fitted with a cue and pause control which allows you to manoeuvre the arm of the deck to any chosen track of your record. Also used is a locking device to prevent the arm from moving whilst unit is in transit. The amplifier used in this unit will give a true 5 watts (R.M.S.) per channel with maximum performance of base and treble. The controls are of a simple nature and allow you to adjust the balance of sound through each speaker, also the volume required, bass and treble. The two speaker systems supplied with this audio unit are designed to give the best possible sound reproduction, the twin cone base unit will give a good bass response and the parasitic tweeter employed will clarify the high notes in your listening pleasure. Finished in teak, this Hi-Fi compact unit will blend into any modern home and give you hours of listening pleasure in true stereo. 12 months guaranteed SPECIFICATION. Deck—Garrard 2025TC. Cartridge—Garrard G.C.538 with sapphire stylus. Output 5 watts (S.M.S.) per channel. Frequency: 40Hz to 20,000Hz. Speakers: Apollo 56 Three-way general purpose 15-16 ohms. 8" Twin cone base unit; 2 1/2" Parasitic Tweeter; L.C. Crossover; Suitable acoustic padding. Finish: Polished teak plinth and speaker cabinets; Charcoal tinted Perspex cover; Unit finished silver and black. Size: Unit 14 1/2" x 12 1/2" x 7 1/2". Speakers 14 1/2" x 8" x 6 1/2".

CARTRIDGES (p.p. 12 1/2p)

GOLDRING G850	£4.75
GOLDRING G800	£7.50
GOLDRING G800/E	£11.50
GOLDRING G800 Super E	£16.50
SONOTONE 8TAHC	£2.35

SCOOP BUY BY AUDIO SUPPLY OF THE SMC-101 AND THE MCI-5 CARTRIDGES, FULL SPECIFICATIONS BELOW.

SMC-101 MOVING MAGNET STEREO CARTRIDGE SPECIFICATIONS
Frequency response: 20-20,000Hz
Output voltage: 5mV at 1,000 Hz 5cm/s
Channel balance: ±1dB at 1,000Hz
Channel separation: better than 25dB at 1,000Hz
Impedance: 2,500 ohms at 1,000Hz
D.C. resistance: 600 ohms
Load resistance: 50-100K ohms
Compliance: 8 x 10-6cm/dyne
Tracking pressure: 3-5 grams
Stylus: 0.7 mil diamond
Cartridge weight 8 grams **PRICE ONLY**
Mounting: 1/4" or 12.7 mm **£3.25**

MCI-5 HIGH FIDELITY STEREO MOVING MAGNET CARTRIDGE FEATURES
Ultra-hard light alloy cantilever. Widest range of Hi-Fi High precision assembly. High balance and no distortion interchangeable needle of vertical tracking angle 15° plug in knob system.

SPECIFICATIONS
Frequency response: 15-20,000Hz
Output voltage: 5mV at 1,000Hz 5cm/s
Channel balance: ±1dB at 1,000Hz
Channel separation: better than 25dB/1,000Hz
Impedance: 2,200 ohms at 1,000Hz
D.C. resistance: 580 ohms
Load resistance: 50-100K ohms
Compliance: 8 x 10-6 cm/dyne
Tracking pressure: 3-5 grams
Tracking angle: 15°
Stylus: 0.7 mil diamond
Cartridge weight: 6.5 grams **PRICE ONLY**
Mounting: 1/4" or 12.7mm **£6.00**

TURNTABLES p.p. 60pp

GARRARD 5100 with Cartridge	£7.97
GARRARD 2025 TC with Sonotone 8TAHC Diamond Cart	£9.97
GARRARD 3000 with Sonotone 8TAHC Diamond Cart	£10.00
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GARRARD SP25 MK3	£11.50
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GARRARD AP76	£21.00
GARRARD SL72B	£25.00
GARRARD SL75B	£25.50
GARRARD SL95B	£36.97

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TELETON 10AT1	£105.00
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The Systems are housed in handsome Slim-Line Cabinets of Modern Design, finished in Polished Teak with Padded Front Panel covered in I.C.I. Vynair Grille.

THE APOLLO 3-WAY SPEAKER SYSTEMS are designed and built on the Infinite Baffle Principle and are completely Airtight and fully padded to damp out any Panel Resonance. Polished on all sides they can be used either vertically or horizontally and are ideal for Shelf or Wall Mounting. Below are just a few from the APOLLO comprehensive range starting with:

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APOLLO-7 3-WAY SPEAKER SYSTEM
As above but 7 Watts R.M.S. (14 Watts peak) F.R. 55 to 18,000Hz. Size 20 x 12 x 8in £8.87p (50p p & p).

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APOLLO-3 3-WAY SPEAKER SYSTEM
Impedance: 8 ohms. Power Handling: 15 Watts R.M.S. (30 watts peak). Frequency Range: 35Hz to 18,000Hz. Colour: Teak Size: 21 x 15 x 7 1/2in. Price £16.50 (p & p £1)

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Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-555m. + 1070-1870m. 41" loudspeaker. Transistors 3 x AF117, OC81D + 2 OC81. Also works off car-aerial. Full instruction book 2/6, free with parts. State preference red, blue or tan and give alternative. Requires PP7 battery, price 4/6 extra. All parts £6.17.6 + 4/6 post or £10.10.0 fully built + 4/6 post. A few left of Super Six Kit (see previous issues) at £4.5.0 (+ 4/6 post). 9 volt 6 transistor superhet using 3HF AA17 in RF and LF stages powered by a two stage AF amplifier using OC81D. 2 x OC81. Output approx. 500mW.

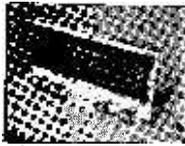
STEREO AMPLIFIER type HV—2 x 3 Watts

Fully built. On off sep. vol. and tone each channel 12 x 4 1/2 x 6in. high. EZ80. 2 x ECL86; for 3 ohm speakers, double wound main trans: fixing flanges and base plate, suitable for crystal cart, tuner etc. £6.10.0 (8/- p. & p.) 200-250V. A.C. Superior version — separate base, treble & vol. each channel with mono/stereo switch 16/- extra.



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Pre-amplifier EP9001 £3.2.0. 2 amps. EP9000 £2.18.0 each. Power Supply EP9002 £4.12.0. Control panel £2.10.0 or the lot for £15.10.0 post paid. Booklet 5/- (6d post)

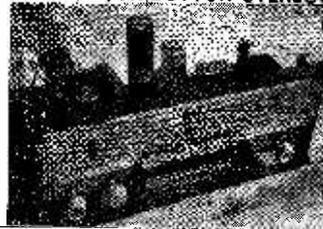


MONO GRAM CHASSIS 3 WATT

3 Wave band long-med-short. Gram., 200-250V A.C. Ferrite aerial. Chassis 13 x 7 x 5in. Dial 13 x 4in. Double wound mains transformer 5 valves ECH81, EFS9, EBC81, EL54, EZ80. Price £10.12.6 (7/6 p. & p.) Output trans. for 3-ohm speaker

NEW TAPE AMPLIFIER for 4 track B.S.R. Deck TD2. Mains and output Trans 10" x 6" x 4" overall. Rect; ECC83, EL54, Mfke and Gram Inputs. £7.5.0. (10/- p. & p.) For 3-ohm speaker. (For 200-250V. A.C.)

6 PUSH-BUTTON STEREOGRAM CHASSIS



M.W.; 8.W.1; S.W.2; V.H.F.; Gram: Stereo Gram Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6 1/2in. high. Dial silver and black 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 Mc/s. Valves: ECC85, ECH81, EFS9, 2x ECL86, EM84 and Rect. Price £19.19.0 carr. paid With Stereo Decoder fitted £7.10.0 extra.

1 1/2 W MAINS GRAMOPHONE AMPLIFIER

EZ80, ECL82, O.P. Transformer (3 ohm). Vol./On-off and Tone Control. Double wound mains transformer. 2 1/2 x 2 1/2in. separate but wired to chassis, 4 x 2 1/2 x 4 1/2in over valves 67/6 including 5in. Speaker (£5/- less speaker). (Post paid.) (Two less 10%)

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 90V at 20mA and 1.4V at 250 mA 10/- (2/6).

USEFUL BOX 3 1/2" x 3 1/2" x 1 1/2" with fixing bracket 2/6 (Postage 2/-). 25/- per dozen post free. Metal with grey-green finish.

Complete set of parts with wiring diagram for battery eliminator to give 90v. H.T. at 20-30m.a. and 1.4v. at 125 or 250m.a. (adjustable). With drilled aluminium box approx. 6 x 3 x 3", trans., choke, two rectifiers, condensers and plugs and sockets. Price 55/- plus 5/- p. & p.

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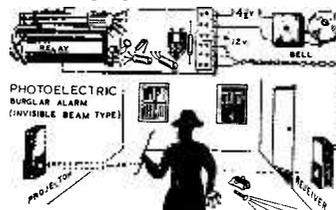
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CONTENTS: 2 P.C. Chassis Boards, Chemicals, Etching Manual, Infra-Red Phototransistor, Latching Relay, 2 Transistors, 3 Diodes, Resistors, Gain Control, Terminal Block, Elegant Case, Screws, etc. In fact everything you need to build a Steady-Light Photo-Switch/Counter/Burglar Alarm, etc. (Project No. 1) which can be modified for modulated-light operation.



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Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photoelec Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms, Counters, Door Openers, etc.

CONTENTS: 2 lenses, 2 mirrors, 2 45-degree wooden blocks. Infra-red filter, projector lamp holder, building plans, etc. Price £1.00 Postage and Pack. 5p (U.K.). Commonwealth: Surface Mail 10p, Air Mail 30p.

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Versatile invisible-beam, Relay-less, Steady-light Photo-Switch, Burglar Alarm, Door Opener, Counter, etc., for the Experimenter.

CONTENTS: Infra-Red Sensitive Phototransistor, 3 Transistors, Chassis, Plastic Case, Resistors, Screws, etc. Full Size Plans, Instructions, Data Sheet "10 Advanced Photoelectric Designs".

Price £1.00. Postage and Pack. 5p (U.K.). Commonwealth 10p; Airmail 20p.

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TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6x4x2 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 V battery. Coverage 88-108 Mc/s. Ready built ready for use. Fantastic value for money. \$37.75. P. & P. 12 1/2 p. Stereo multiplex adaptors \$4.97.

AVO CT47A MULTIMETER

Battery operated, fully transistorised. Sensitivity 100mΩ/v. Measures AC/DC Voltages 12mv to 1,200v. AC/DC Current 12uA to 1.2 Amp. Resistance 12 ohm to 120 MΩ. HF, VHF, UHF Voltage with multiplier 4v to 400v up to 50 Mc/s, 40mV to 4v up to 1,000 Mc/s. Offered in perfect condition. \$55 each. Carr. 50p.

CRYSTAL CALIBRATORS NO. 10



Small portable crystal controlled wave meter. Size 7 x 7 x 4 in. Frequency range 500 Kc/s-10 Mc/s. (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300V. D.C. 15mA and 12V D.C. 0.3A. Excellent condition. \$4.47. Carr. 37 1/2 p.

B.C. 221 FREQUENCY METERS

latest release 125 KHz-20 MHz. Excellent condition. Fully tested and checked and complete with calibrator charts. \$27.50 each. Carr. 50p.

AM/FM SIGNAL GENERATORS



Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmeq. Frequency coverage 20-80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1μV-100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 x 8 1/2 x 3 in. Supplied in brand new condition complete with all connectors fully tested. \$45. Carr. \$1.

AVO CT.38 ELECTRONIC MULTIMETERS

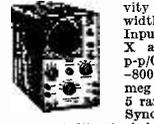
High quality 97 range instrument which measures A.C. and D.C. Voltage, Current, Resistance and Power Output Ranges D.C. volts 250mV-10,000v. (10 megΩ-11 Ohm Ω input). D.C. current 10uA-25 amps, Ohms, 0-1,000 megΩ A.C. volt 100mV-250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10uA-25 amps. Power output 50 micro-watts-5 watts. Operation 0/110/200/250V. A.C. Supplied in perfect condition complete with circuit lead and R.F. probe. \$25. Carr. 75p.

ADMIRALTY 62B RECEIVERS



High quality 11 valve receiver, manufactured by Murphy. Coverage in 5 bands 150-300 Kc/s, 560 Kc/s-1.5 Mc/s; 3.9-30.5 Mc/s I.F. 500/Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O. calibrator I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 vol A.C. Size 19 1/2 x 13 1/2 x 1 1/2 in. Weight 11 1/2 lb. Offered in good working condition. \$22.50. Carr. \$1.50. With circuit diagrams. Also available B41 L.F. version of above, 15 Kc/s-700 Kc/s. \$27.50. Carr. \$1.50.

TO-3 PORTABLE OSCILLOSCOPE



3in. tube. Y amp. Sensitivity 0.1v p-p/CM. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0.9v p-p/CM. Bandwidth 1.5 cps-800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps-300 KHz. Synchronisation. Internal external. Illuminated scale 140 x 215 x 330 mm. Weight 15 1/2 lb. 220/240V. A.C. Supplied brand new with handbook. \$27.50. Carr. 50p.

TO-2 PORTABLE OSCILLOSCOPE

A general purpose low cost economy oscilloscope for every day use. Y amp. Bandwidth 300K-1.5 MHz. Input imp. 2 meg Ω 25 P.F. Illuminated scale. 2in. tube. 115 x 180 x 230mm. Weight 8 1/2 lb. 220/240 V. A.C. Supplied brand new with handbook. \$22.50. Carr. 50p.



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100μA ... \$3.37
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500μA ... \$3.12
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50-0-50μA ... \$2.97
100-0-100μA ... \$2.87
500μA ... \$2.62
1mA ... \$2.47
20V. D.C. ... \$2.47

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4 1/2 in. x 4 1/2 in. fronts.
50mA ... \$2.60
100mA ... \$2.60
500mA ... \$2.60
1 amp. ... \$2.60
5 amp. ... \$2.60
15 amp. ... \$2.60
30 amp. ... \$2.60
20V. D.C. ... \$2.60
50V. D.C. ... \$2.60
150V. D.C. ... \$2.60
300V. D.C. ... \$2.60
15V. A.C. ... \$2.60
30V. A.C. ... \$2.60
S Meter 1mA ... \$2.60
VU Meter ... \$3.60
1 amp. A.C.* ... \$2.60
5 amp. A.C.* ... \$2.60
10 amp. A.C.* ... \$2.60
20 amp. A.C.* ... \$2.60
30 amp. A.C.* ... \$2.60

Type MR.38P. 1 21/32 in. square fronts.
200mA ... \$1.37
300mA ... \$1.37
500mA ... \$1.37
750mA ... \$1.37
1 amp. ... \$1.37
2 amp. ... \$1.37
5 amp. ... \$1.37
10 amp. ... \$1.37
30V. D.C. ... \$1.37
10V. D.C. ... \$1.37
15V. D.C. ... \$1.37
20V. D.C. ... \$1.37
100V. D.C. ... \$1.37
150V. D.C. ... \$1.37
300V. D.C. ... \$1.37
500V. ... \$1.37
750V. D.C. ... \$1.37
15V. A.C. ... \$1.37
50V. A.C. ... \$1.37
150V. A.C. ... \$1.37
300V. A.C. ... \$1.37
500V. A.C. ... \$1.37
S Meter 1mA ... \$1.60
VU Meter ... \$2.10

Type MR.52P. 2 1/2 in. square fronts.
50μA ... \$3.10
50-0-50μA ... \$2.60
100μA ... \$2.60
100-0-100μA ... \$2.37
500μA ... \$2.25
200μA ... \$2.75
500μA ... \$2.80
5mA ... \$2.00
10mA ... \$2.00
50mA ... \$2.00
100mA ... \$2.00
500mA ... \$2.00
1 amp. ... \$2.00
5 amp. ... \$2.00

Type MR.45P. 2 in. square fronts.
50μA ... \$2.25
50-0-50μA ... \$2.10
100μA ... \$2.10
100-0-100μA ... \$1.87
200μA ... \$1.87
500μA ... \$1.87
500-0-500μA ... \$1.50
1mA ... \$1.37
1-0-1mA ... \$1.37
2mA ... \$1.37
5mA ... \$1.37
10mA ... \$1.37
20mA ... \$1.37
50mA ... \$1.37
100mA ... \$1.37
150mA ... \$1.37

Type MR.65P. 3 1/2 in. x 3 1/2 in. fronts.
50μA ... 3.87
50-0-50μA ... 2.75
100μA ... 2.75
100-0-100μA ... 2.60
200μA ... 2.60
500μA ... 2.87
500-0-500μA ... 2.10
1mA ... 2.10
5mA ... 2.10
10mA ... 2.10
50mA ... 2.10
100mA ... 2.10
500mA ... 2.10
1 amp. ... 2.10
5 amp. ... 2.10
10 amp. ... 2.10
20 amp. ... 2.10
30 amp. ... 2.10
50 amp. ... 2.37
5V. D.C. ... 2.10

"SEW" BAKELITE PANEL METERS

Type MR.65. 3 1/2 in. square fronts.
500mA ... \$1.75
1 amp. ... \$1.75
5 amp. ... \$1.75
15 amp. ... \$1.75
30 amp. ... \$1.75
50 amp. ... \$1.75
5V. D.C. ... \$1.75
10V. D.C. ... \$1.75
20V. D.C. ... \$1.75
50V. D.C. ... \$1.75
150V. D.C. ... \$1.75
300V. D.C. ... \$1.75
30V. A.C.* ... \$1.75
50V. A.C.* ... \$1.75
150V. A.C.* ... \$1.75
300V. A.C.* ... \$1.75
500V. A.C.* ... \$1.75
1 amp. A.C.* ... \$1.75
5 amp. A.C.* ... \$1.75
10 amp. A.C.* ... \$1.75
20 amp. A.C.* ... \$1.75
30 amp. A.C.* ... \$1.75
VU Meter ... \$3.10

EDGWISSE METERS

TYPE PE.70. 3 17/32 in. x 1 15/32 in. x 2 1/2 in. deep.
50μA ... \$3.00
50-0-50μA ... \$2.87
100μA ... \$2.87
100-0-100μA ... \$2.75
200μA ... \$2.75

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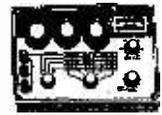
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100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, 81-07 P. & P. 7 1/2 p.

MARCONI TF142E DISTORTION FACTOR METERS. Excellent condition. Fully tested. \$20. Carr. 75p.

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A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-11.1 megΩ 6 Ranges ± 1% L.I. μH ± 1% HENRYS 6 Ranges ± 2% C. 10pF ± 110nF. 6 Ranges ± 2%. TURNS RATIO 1:1/1000-1:1100. 6 Ranges ± 1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2in. \$20. P. & P. 25p

COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES

D.C. coupled. Band width 1Kc/s. Perfect order. \$25. Carr. \$1.50.

TE-20 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s-250 Mc/s on 6 bands. Directly calibrated variable B.F. attenuator. Operation 200/240 V. A.C. Brand new with instruction. \$15. P. & P. 37 1/2 p. S.A.E. for details.

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Frequency 0-20 Kc/s. on 2 ranges. Output 500 Ω or 5k Ω. Operation 200/250V. A.C. Supplied in perfect order. \$12.50. Carr. 50p.

MARCONI TF85S VIDEO OSCILLATORS

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2 pF-3000 mFd 2 ohms 200 megohms. Also checks impedance, turns ratio, insulation, 200/250V. A.C. Brand New \$17.50. Carr. 37 1/2 p.



ADVANCE TEST EQUIPMENT

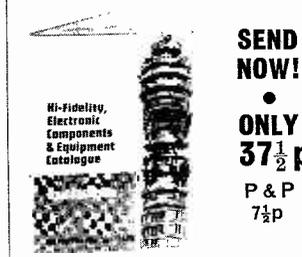
Brand new boxed in original sealed cartons VIM79. UHF MILLIVOLT METER. 100 Kc/s to 1,000 Mc/s. AC. 10mV to 3v. DC. 10 mV to 3v. Current 0.01 uA to 0.3 mA. Resistance 1 ohm to 10 megohm. \$125.
T115. TRANSISTOR TESTER. Full range of facilities for testing PNP or NPN transistors in or out of circuit. \$27.50. Carriage 50p per item.

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RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES
5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from 2 sec to 100 milli seconds.
Supplied complete with all accessories and instructions #27. Carr. paid.



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AF Absorption Wattmeter

1 μ/watts to 6 watts.
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Variable range 0-11dB. Connections, Unbalanced T and Bridge T. Impedance 600 Ω range (0.1dB x 10) + (1dB x 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200KHz (-3dB). Accuracy: 0.05dB. +Indication dB x 0.1. Maximum input less than 4W (50V). Built in 600 Ω load resistance with internal/external switch. Brand new. #27-50. P. & P. 25p.



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Sine 18-200,000 Hz; Square 18-50,000 Hz
Output max. + 10 dB (10 K ohms)



Operation - Internal batteries
Attractive 2-tone case 7 1/2" x 5" x 2".
Price #17-50.
Carr. 174p.

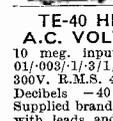
TE-16A Transistorised Signal Generator

400KHz - 50MHz. An inexpensive instrument for the handyman. Operates on 9V battery. Wide easy to read scale. 800KHz modulation. 5 1/2" x 7 1/2" x 3 1/2".
Complete with instructions and leads. #7-97 1/2. P. & P. 20p.



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New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240V. A.C. Size 215mm x 150mm x 120mm.
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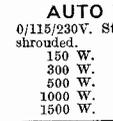
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10 meg. input 10 ranges: 0.1-0.002/1-3/11/3/10/30/100/300V. R.M.S. 4cps-1-2 Mc/s. Decibels -40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. #17-50. Carr. 25p.



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Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240V. A.C. Output continuously variable from 230-230V.
Model MR 2305 5 amp 68 x 46 x 43mm #3-37 1/2
Model MR 2310 10 amp 90 x 68 x 60mm #11-97 1/2. Postage 124p.

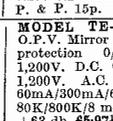


MULTIMETERS for EVERY purpose!

TEGH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/10/500mA. D.C. 0/100K. #1-97 1/2. P. & P. 124p.



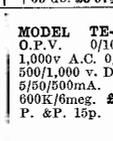
HONOR TE-10A. 20K Ω/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/500A/2.5mA/250mA. D.C. 0/5K/5 meg. ohm. -20 to +25 dB. 10-0-100 mfd. 0.100-0.1 mfd. #3-47 1/2. P. & P. 15p.



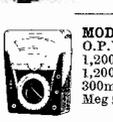
MODEL TE-200 20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000 V.D.C. 0/10/50/250/1,000 V.A.C. 0/50 uA/250 mA. 0/60K/6 meg Ω. -20 to +62 db. #3-75. P. & P. 15p.



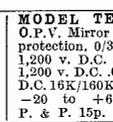
MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection. 0/6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/300mA/600mA/600A/300mA/600mA. 0/5K/80K/800K/5 meg. ohm -20 to +63 db. #5-97 1/2. P. & P. 15p.



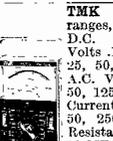
MODEL 500 30,000 O.P.V. with overload protection. mirror scale 0/5/2-5/10/25/100/250/500/1,000V. D.C. 0/10/50/250/1,000/500mA. 12 amp. D.C. 0/60K/6 Meg/60 Meg Ω. #3-87 1/2. Post paid.



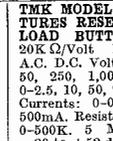
MODEL TE-80. 20,000 O.P.V. 0/10/50/100/500/1,000V. A.C. 0/5/25/50/250/500/1,000 v. D.C. 0-50uA, 5/50/500mA. 0/6K/60K/600K/5meg. #4-87 1/2. P. & P. 15p.



MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/300A/300/300mA. 0/10K/100K/1.6M/16 Meg Ω. #5-50. P. & P. 15p.



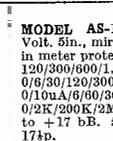
MODEL TE-90 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. D.C. 0/3/6/60/600mA. D.C. 10K/100K/1.6/16 MEG Ω. -20 to +63 db. #7-50. P. & P. 15p.



TMK MODEL TW-50K 48 ranges, mirror scale. 50K/Volt. D.C. 5K /Volt A.C. D.C.: Volts .125, .25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 2.5, 5, 10, 25, 50, 100, 250, 500mA, 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: -20 to +81-5 dB. #8-87 1/2. P. & P. 174p.



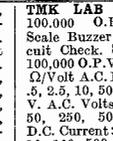
TMK MODEL TW-20CB FEAT. RESETTABLE OVERLOAD BUTTON. Sensitivity: 20K Ω/Volt D.C. 5K Ω/Volt A.C. D.C. Volts: 0-0.5, 2.5, 10, 50, 250, 1,000V. A.C. Volts: 0-2.5, 10, 50, 250, 1,000V. D.C. Currents: 0-0.05, 0.5, 5, 50, 500mA. Resistance: 0-5K, 50K, 0-500K, 5 MEG Ω. Decibels: -20 to +52 db. #11-50. P. & P. 174p.



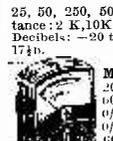
TE-900 20,000 Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 v. A.C. 0/25/12.5/10/50/250/1,000/5,000 v. D.C. 0/60uA/110/100/500mA/10 Meg. D.C. 0/2K/200K/20 MEG. OHM. #15. P. & P. 25p.



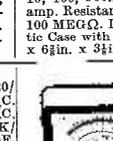
MODEL AS-100D. 100K Ω/Volt. 5in., mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200 v. D.C. 0/6/30/120/300/600 v. A.C. 0/10uA/6/60/300mA/12 Amp. 0/2K/200K/2M/200M Ω. -20 to +17 dB. #12-50. P. & P. 174p.



MODEL 5025. 57 Ranges, Giant 5 1/2in. Meter. Polarity Reverse Switch. Sensitivity: 50K /Volt D.C. 5K /Volt A.C. D.C. Volts: 125, 25, 1.25, 5, 10, 25, 50, 125, 250, 500, 1,000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1,000V. D.C. Current: 25, 50uA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 2 K, 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: -20 to +85 db. #12-50. P. & P. 174p.



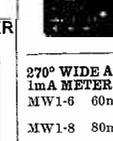
TMK LAB TESTER. 100,000 O.P.V. 6 1/2in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: 0-2.5, 10, 50, 250, 1,000 v. A.C. Volts: 3, 10, 30, 50, 250, 500, 1,000V. D.C. Current: 10, 100uA, 10, 100, 500mA, 2.5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100 MEG Ω. Decibels: -10 to 49 db. Plastic Case with Carrying Handle. Size 7 1/2in. x 6 1/2in. x 3 1/2in. #18-90. P. & P. 25p.



MODEL TE-12 20,000 O.P.V. 0/0.6/6/30/120/100/1,200/3,000/6,000V. D.C. 0/6/30/120/600/1,200V. A.C. 0/60uA/6/60/600mA. 0/6K/600K/6Meg/60 Meg. Ω 50pF. 0.2mFd. #5-97 1/2. P. & P. 174p.



SKYWOOD SW-500 50K Ω/Volt. Mirror scale. DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels -20 to +67 db. #7-50. P. & P. 15p.



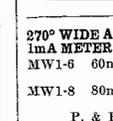
FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and IGO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. #3-97 1/2. P. & P. 15p.



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MW1-6 60mm square #3-97 1/2
MW1-8 80mm square #4-97 1/2
P. & P. extra

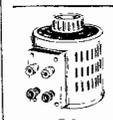


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Excellent quality - Low price - Immediate delivery

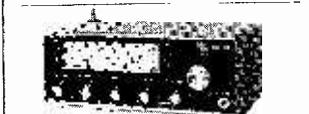
MODEL S-260	MODEL S-260 B
General Purpose Bench Mounting	Panel Mounting
1 Amp \$5-50	1 Amp \$5-50
2.5 Amp \$6-75	2.5 Amp \$6-82 1/2
5 Amp \$8-75	
8 Amp \$14-50	
10 Amp \$18-50	
12 Amp \$21-00	
20 Amp \$37-00	

Special discounts for quantity



UNR-30 RECEIVER
4 Bands covering 550kc/s-30mc/s. B.F. No. Built-in Speaker 220/240V. A.C. Brand new with instructions. #15-75. Carr. 374p.

WS62 TRANCEIVERS
Large quantity available for EXPORT 1 Excellent condition. Enquiries invited.



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4 Bands covering 550kc/s-30mc/s. FET, S Meter, Variable TFO for SSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240V. A.C. or 12v. D.C. 12 1/2" x 4 1/2" x 7". Brand new with instructions. #25. Carr. 374p.

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General coverage 150-400kc/s. 550 kc/s-30mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S. Meter, Bandspread, RF Gain. 15" x 9 1/2" x 2 1/2". 220/240V. A.C. or 12v. D.C. Brand new with instructions. #45. Carr. 50p.

LAFAYETTE HA-300 SOLID STATE AMATEUR COMMUNICATION RECEIVER

3.5-4, 7-7.3, 14-14.35, 21-21.45, 28-29.7 50-54 Mc/s. Dual conversion, 2 mech. filters, product detector, variable BFO, S Meter, 100kc/s calibrator. 220/240V. A.C. or 12v. D.C. 15" x 9 1/2" x 3 1/2". Brand new with instructions. #57-50. Carr. Paid. (100kc/s Crystal #1-97 1/2 extra.)

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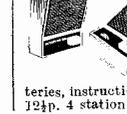
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Operative over amazingly long distances. Separate call and press to talk buttons. 2-way connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. #6-97 1/2. P. & P. 174p.

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Available only from us at this price. Due to entire purchase of manufacturer's remaining stock this fantastic offer is open only while stocks last.

- * High-fidelity reproduction due to broad frequency response (20-20,000Hz)
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- * Only expensive studio loudspeakers can match the reproduction quality of the K50.
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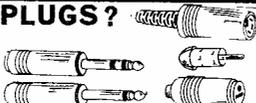
GARRARD SP25 mk II

£11.50 Plus 50p carriage

Normal price £15.56½

Single record playing unit. Features include cue and pause and automatic pick-up return and switch off. Wired with mains cable and 5ft. twin screened stereo cable, 5 pin din plug. 53p extra. AP75 Complete with base and cover £25 plus 1.75p carriage.

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Suitable for AT60; SP25; 3000; 2500; 3500. Superb finish. Spindle can be left in position with cover on. Cover of neutral smoke tint perspex. Also available for AP75; SL99; SL75 £6.87½ plus 50p carr.

Replacement Stereo **DIAMOND STYLI**

8TA 9TA 9TAHC
6P91 ST4 ST9
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.75 each p. & d. 7½p

Countdown SPEAKER

Teak Cabinet

£12 insurance & carr. 37½p

A speaker of outstanding specifications and technical merit. Solid teak cabinet size: 14" x 10" x 6". Originally designed for use with our Countdown stereo budget system but now available separately.

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13½" x 8½" elliptical loudspeaker and independent high frequency units with associated crossover network. Frequency range 55 to 12000Hz. The cone of the bass unit has a surround designed for high travel giving freedom from distortion when operated at low frequencies. Also 350 KIT 20W Frequency range: 20 to 20,000Hz. **£7.50** plus 40p p. & d. Also 150 KIT 10W plus **£2.50** 40p p. & d.

SINCLAIR Project 60

SAVE nearly £5 Normal price £23.90

Designed for building into plinths etc., complete with two Z30 Output stages **£19** plus 50p carr.

(20 watt) and power supply unit. Send S.A.E. for full technical brochure.

SINCLAIR 2000 AMPLIFIER SAVE £6.30 Our price **£24.15**.

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Ronette 105 Stereo cartridge (Sapphire 78 Diamond LP) **£1.25** 12½p. p. & d.

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Sensitivity: 9TA 80mV 9TAHC 55mV/cm/sec rms minimum at 45° at 1,000Hz measured on 12½p Decca SXL2057 p. & d.

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Useful response 45-13,000 c.p.s. POST FREE
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Latest catalogue 1/- with enclosure plans.

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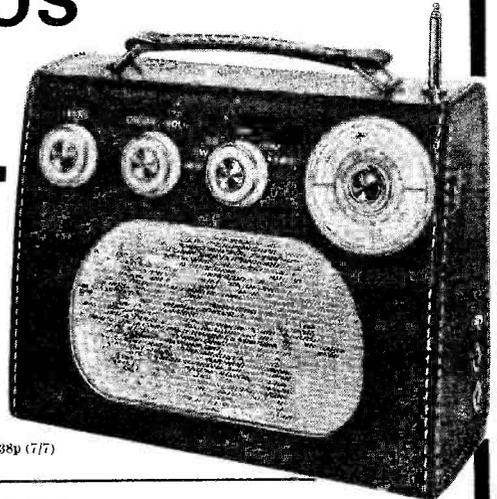
NEW! roamer eight mk 1 WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: Medium Wave 1, Medium Wave 2, Long Wave, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for Medium and Long Waves. 4 section 24" retractable chrome plateu Telescopic aerial for Short Waves for maximum performance. Push pull output using 600 mW transistors. Socket for car aerial. Tape record socket. Selectivity switch, switched earpiece socket complete with earpiece for private listening. Eight transistors plus 3 diodes. Famous make 7in. x 4in. Speaker. Air spaced ganged tuning condenser. On/Off switch volume control. Wave change switch and tuning control. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams make the Roamer Eight a pleasure to build.

Parts Price List and Easy Build Plans 25p (5/-)
(FREE with parts).

Total building costs £6.98 (£6.19.7)

Overseas P. & P. 86p (17/-)



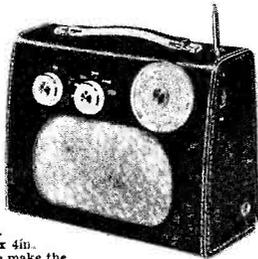
P. & P. 38p (7/7)

roamer seven mk IV

SEVEN FULLY TUNABLE WAVEBANDS—MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for Medium and Long Waves. Retractable 4 section 24in. chrome plated telescopic aerial for peak Short Wave listening. Socket for Car Aerial. Powerful push-pull output. Seven transistors and two diodes including Micro-Alloy R.F. Transistors. Famous make 7 x 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off control, wave change switches and tuning control.

Attractive case with carrying handle. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build. Parts price list and easy build plans 15p (3/-) (FREE with parts). Personal Earpiece with switched socket for private listening, 25p (5/-) extra.

Total building costs £5.98 (£5.19.7)
P. & P. 38p (7/7)
Overseas P. & P. 86p (17/-)

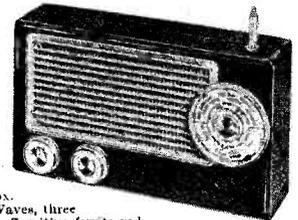


NEW! trans eight

SIX WAVEBAND
PORTABLE WITH
3in. SPEAKER

Attractive case in black with red grille and black knobs and dial with spun brass inserts. Size 9 x 5 1/2 x 2 1/2in. approx. Tunable on Medium and Long Waves, three Short Waves and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. Eight improved type transistors plus 3 diodes. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (5/-) (FREE with parts). Earpiece with switched socket for private listening 25p (5/-) extra.

Total building costs £4.48 (£4.9.7)
P. & P. 28p (5/7)
Overseas P. & P. 65p (13/-)

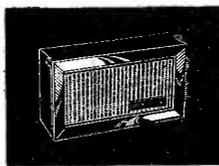


pocket five

MEDIUM WAVE, LONG WAVE
AND TRAWLER BAND PORTABLE
WITH SPEAKER

Attractive black and gold case. Size 5 1/2 x 1 1/2 x 3 1/2in. Tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Easy build plans and parts price list 8p (1/7) (FREE with parts).

Total building costs £2.23 (£2.4.7)
P. & P. 18p (3/7)
Overseas P. & P. 50p (10/-)



transona five

MEDIUM WAVE, LONG WAVE
AND TRAWLER BAND
PORTABLE
WITH SPEAKER

Attractive case with red speaker grille. Size 6 1/2 x 4 1/2 x 1 1/2in. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker. Easy build plans and parts price list 8p (1/7) (FREE with parts).

Total building costs £2.38 (£2.7.7)
P. & P. 19p (3/9)
Overseas P. & P. 50p (10/-)

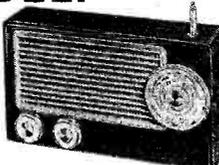


IMPROVED MODEL!

roamer six

SIX WAVEBAND PORTABLE
WITH 3in. SPEAKER

Attractive black case with red grille and black knobs and dial with spun brass inserts. Size 9 x 5 1/2 x 2 1/2in. approx. Tunable on Medium and Long Waves, two Short Waves, Trawler Band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and latest telescopic aerial for Short Waves. Improved circuit. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Easy build plans and parts price list 10p (2/-) (FREE with parts).



Total building costs £3.98 (£3.19.7)
P. & P. 23p (4/7)
Overseas P. & P. 65p (13/-)

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| POCKET FIVE | <input type="checkbox"/> | ROAMER SIX | <input type="checkbox"/> |

Parts price list and plans for

Name

Address

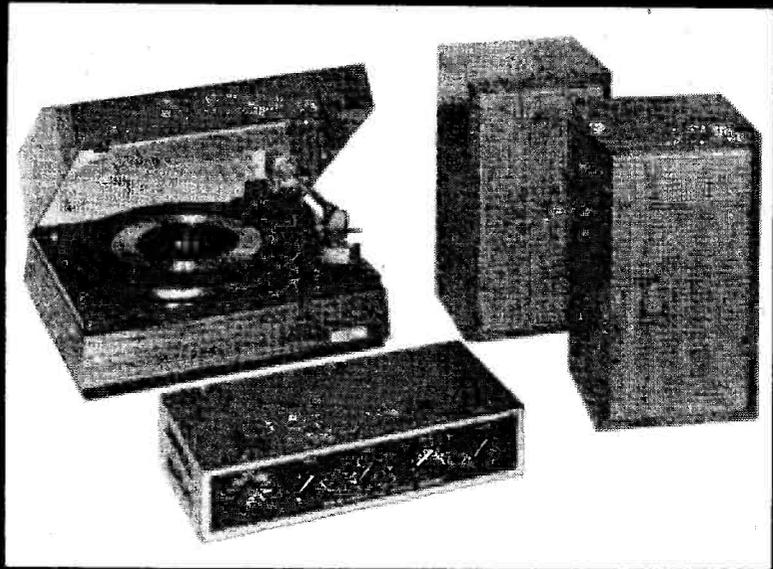
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Complete Stereo System £43

WITH VISCOUNT F.E.T. FIELD EFFECT TRANSISTORS AMPLIFIER



This superb stereo system is a real price break through. It comprises the VISCOUNT F.E.T. Mk I amplifier on which full details are given below, the famous Garrard SP 25 (including teak veneer base and transparent cover) with diamond cartridge or 2025 TC and the very successful DUO type 2 speakers. Measuring 17½in x 10½in x 6½in, the Duo type 2 speakers are teak finished with matching Vynair grills. They incorporate a 3 ohm. 13in x 8in drive unit and Parasitic tweeter. Max. power handling 10 watts. Price £13.50 per pair plus p. & p. £1.50.
Complete stereo system £43 plus £2.50 p. & p. or with Mk II Amplifier and Magnetic Cartridge £48 & £2.50 p. & p.

The Viscount F.E.T. Mk I £14.25 + 37p. p. & p.

High fidelity transistor stereo amplifier employing field effect transistors. With this feature and accompanying guaranteed specifications below, the Viscount F.E.T. vastly surpasses amplifiers costing far more.

Specification—Output per channel 10 watts r.m.s. into 3 ohms Frequency bandwidth 20 Hz to 20 kHz + 1db at 1 watt. Total distortion at 1 kHz at 9 watts 0.5% Input sensitivities CER. P.U. 100mV into 3 meg ohms. Tuner 100mV into 100K ohms. Tape 100mV into 100K ohms. Overload Factor Better than 26db.

Signal to noise ratio—70db on all inputs (with vol. max). Controls—6 position selector switch (3 pos. stereo and 3 pos. mono). Separate volume controls for left and right channels. Bass ± 14db at 60 Hz. Treble (with D.P.S. on off) ± 12 db at 10 KHz. Tape recording output sockets on each channel. Size 12½in. 6in. 2½in. in simulated teak case. **BUILT & TESTED.**

MkII (MAG P.U.) £15.75 plus 50p. p. & p. Specification same as Mk. 1, but with the following inputs. Mag. P.U. CER. P.U. Tuner. Spec. on Mag. P.U. 3mV at 1 kHz input impedance 47K. Fully equalised to within ±1db RIAA. Signal to noise ratio—65db (vol. max).

The £29-50 Stereo system

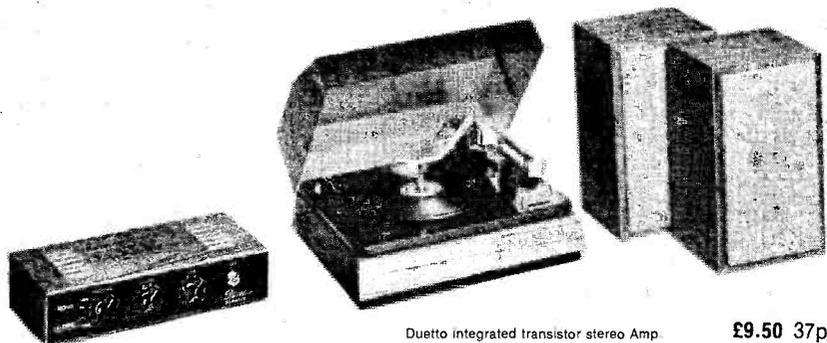
The Duetto is a good quality stereo amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.

SPECIFICATION—R.M.S. power output 3 watts per channel into 10 ohms speakers.

INPUT SENSITIVITY. Suitable for medium or high output crystal cartridges and tuners. Cross-talk better than 30dB at 1Kc/s.

CONTROLS: 4-position selector switch (2 pos. mono and 2 pos stereo) dual ganged volume control.

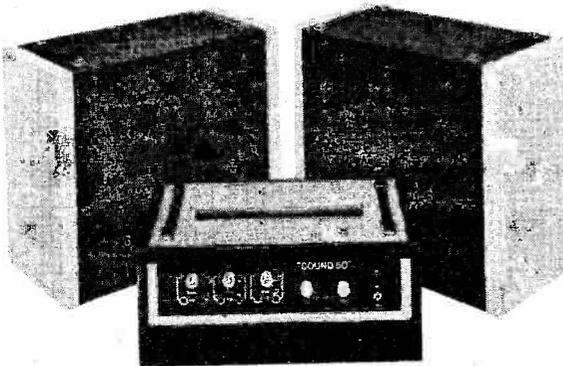
TONE CONTROL Treble lift and cut Separate on off switch. A preset balance control.



Duetto integrated transistor stereo Amp. £9.50 37p
 Garrard Changer from £7.97 37p
 Cover and teak finish plinth £4.75 37p
 Duo Type I speakers (see opp. page) £4.20 37p
The above items purchased together £29.50 £1.50

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



The Sound Fifty valve amplifier and speakers are sturdily constructed with smart housings and thoroughly tested electronics. They are designed to last—to withstand the knocks and bumps of life on the road. Built for the small and medium sized gig, they are easy to handle and quick to set up and can be relied upon to come over with all the quality and power you need.

Output Power: 45 watts R.M.S. (Sine wave drive). Frequency response: -3dB points 30Hz at 18KHz. Total distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB. Speaker Impedance: 3, 8 or 15 ohms. Bass Control Range: ± 13dB at 60Hz. Treble Control Range: ± 12dB at 10 KHz. Inputs: 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K. To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power. SPEAKERS: Size 20" x 20" x 10" incorporating Baker's 12" heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

COMPLETE SYSTEM £50 Plus £4 P. & P.
Sound 50 amp and 2 speakers

or available separately.

Amplifier £28.50 plus £1 P. & P.

Speakers £12.50 each plus £1.50 P. & P.

LIQUIDATED STOCK

DANSETTE

TOURISTE MK3

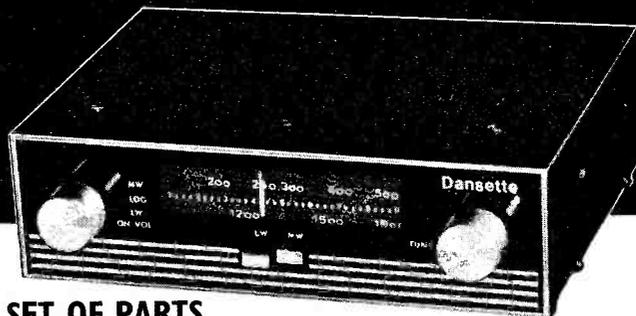
CAR RADIO

ALL TRANSISTOR

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1 MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts.

Originally sold completely built for £15.4.6 (£15.23) Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4½in deep.

See top of previous page for address



SET OF PARTS
£6.30

plus P. & P. 37p.

Circuit diagram 13p. Free with parts

Speaker, baffle and fixing kit

£1.25 extra plus 20p. p. & p.

Postage free when ordered with parts.

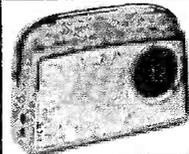
The ELEGANT SEVEN Mk. III (350mW Output)



7 transistor fully-tunable M.W.—L.W. superhet portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction. MAINS POWER PACK KIT: 47p extra.

Price **£5.25** plus 37p. P. & P.
Circuit 13p FREE WITH PARTS

The DORSET (600mW Output)



7-transistor fully tunable M.W.—L.W. superhet portable —with baby alarm facility. Set of parts. The latest modularised and pre-alignment techniques makes this simple to build. Size: 13 x 6 x 3in. MAINS POWER PACK KIT: 47p extra.

Price **£5.25** plus 37p P. & P.
Circuit 13p FREE WITH PARTS

The Classic

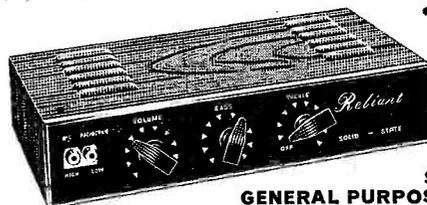
Simulated teak case

£9.50

Plus P. & P. 37p

SPECIFICATION:

Sensitivities for 10 watt output at 1KHz into 3 ohms. Tape Head 3 mV (at 3½ p.s.) Mag. P.U.: 2 mV. Cor. P.U.: 80mV. Tuner: 100mV. Aux. 100mV. Tape/Rec. Output. Equalisation for each input is correct to within +2dB (R.I.A.A.) from 20Hz to 20KHz. Tone Control Range: Bass: 18dB at 60Hz. Treble: ± 14dB at 15KHz. Total Distortion: (for 10 watt output) < 1.5%. Signal Noise: < -60dB. A.C. Mains 200-260V. Size 12½in long, 4½in deep, 2½in high. Built and tested



THE RELIANT MKII

SOLID-STATE

GENERAL PURPOSE AMPLIFIER

in simulated teak case **£7.25** plus P. & P. 37p

SPECIFICATIONS

Output ± 10 watts. Output Impedance—3 to 4 ohms. Inputs 1. extal mic 10mV Tone Controls—Treble control range ± 12dB at 10KHz. 2. gram/radio 250mV. Bass control range ± 13dB at 100Hz. Frequency Response—(with tone controls central) Minus 3dB points at 20Hz and 40KHz. Signal to Noise Ratio—better than -60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input—220/250V. A.C. Size of chassis—10½in. x 4½in. x 2½in. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Built and tested.

THE DUO SPEAKER SYSTEM

Similar in design to those on the previous page the 2-way speaker system is beautifully finished in polished teak veneer. It is ideal for wall or shelf mounting either upright or horizontally.

Type 1 SPECIFICATION — Impedance 8 or 10 ohms (please state requirement). It incorporates high flux 7in. x 3½in. speaker and 2½in. speaker. Teak finish 11½in. x 6in. x 5½in. £4.20 each. 37p P. & P.

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3Q5	45	6D6	25	6SA7M	40
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3V4	45	6F1	70	6SGT	30
5R4GY	60	6F5G	50	6SH7	16
5U4G	38	6F6G	30	6S7	32
5V4G	45	6F9G	35	6SK7GT	30
5Y3GT	35	6F11	35	6SL7GT	35
5Z4G	40	6F13	38	6SN7GT	25
630L2	75	6F14	65	6SQ7	40
6A7	75	6F23	80	6UG4T	60
6A8G	63	6F24	75	6U5G	39
6AK5	30	6F25	75	6V6M	60
6AM5	32	6F28	70	6V6G	23
6A8	35	6F32	25	6V9GT	38
6A95	35	6G6	25	6X4	40
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All prices in pounds and new pence

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20P5	£1.20	78	50	DF92	25	ECC85	25	EM34	90	PC97	50	PY81	30	UCF89	38
23A6	35	80	50	DF96	42	ECC88	40	EM80	40	PC84	40	PY82	30	UCG84	43
23BLGT	45	88A2	40	DH3-91	£2.13	ECH21	63	EM81	63	PC89	53	PY83	38	UCG85	40
23Y5	60	15032	60	DH77	30	ECH35	60	EM84	38	PC189	55	PY800	£1.00	UCF80	55
25Z4	53	25Z4	38	DK92	60	ECH42	70	EY61	40	PCF80	34	PY800	50	UCH42	70
25Z5	45	25Z5	55	DK93	60	ECH42	70	EY61	40	PCF80	34	PY800	50	UCH42	70
25Z6	55	25Z6	55	DK94	50	ECH83	43	EZ35	35	PCF84	35	PY801	60	UCH81	35
25Z7	55	25Z7	55	DK95	42	ECL80	40	EZ40	45	PCF86	60	R19	40	UCB3	60
25Z8	55	25Z8	55	DK96	50	ECL82	35	EZ41	45	PCF801	50	S130	£2.00	UF41	60
25Z9	55	25Z9	55	DK97	35	ECL83	65	EZ80	28	PCF802	50	SP4	40	UF89	38
25Z10	55	25Z10	55	DK98	35	ECL86	45	EZ81	28	PCF805	75	SP41	45	UL41	65
25Z11	55	25Z11	55	DK99	45	ECL800	45	EZ82	28	PCF806	70	SP61	55	UL84	35
25Z12	55	25Z12	55	DK100	45	ECL800	45	EZ83	28	PCF806	70	SP61	55	UL84	35
25Z13	55	25Z13	55	DK101	45	ECL800	45	EZ84	28	PCF806	70	SP61	55	UL84	35
25Z14	55	25Z14	55	DK102	45	ECL800	45	EZ85	28	PCF806	70	SP61	55	UL84	35
25Z15	55	25Z15	55	DK103	45	ECL800	45	EZ86	28	PCF806	70	SP61	55	UL84	35
25Z16	55	25Z16	55	DK104	45	ECL800	45	EZ87	28	PCF806	70	SP61	55	UL84	35
25Z17	55	25Z17	55	DK105	45	ECL800	45	EZ88	28	PCF806	70	SP61	55	UL84	35
25Z18	55	25Z18	55	DK106	45	ECL800	45	EZ89	28	PCF806	70	SP61	55	UL84	35
25Z19	55	25Z19	55	DK107	45	ECL800	45	EZ90	28	PCF806	70	SP61	55	UL84	35
25Z20	55	25Z20	55	DK108	45	ECL800	45	EZ91	28	PCF806	70	SP61	55	UL84	35
25Z21	55	25Z21	55	DK109	45	ECL800	45	EZ92	28	PCF806	70	SP61	55	UL84	35
25Z22	55	25Z22	55	DK110	45	ECL800	45	EZ93	28	PCF806	70	SP61	55	UL84	35
25Z23	55	25Z23	55	DK111	45	ECL800	45	EZ94	28	PCF806	70	SP61	55	UL84	35
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25Z28	55	25Z28	55	DK116	45	ECL800	45	EZ99	28	PCF806	70	SP61	55	UL84	35
25Z29	55	25Z29	55	DK117	45	ECL800	45	EZ100	28	PCF806	70	SP61	55	UL84	35
25Z30	55	25Z30	55	DK118	45	ECL800	45	EZ101	28	PCF806	70	SP61	55	UL84	35
25Z31	55	25Z31	55	DK119	45	ECL800	45	EZ102	28	PCF806	70	SP61	55	UL84	35
25Z32	55	25Z32	55	DK120	45	ECL800	45	EZ103	28	PCF806	70	SP61	55	UL84	35
25Z33	55	25Z33	55	DK121	45	ECL800	45	EZ104	28	PCF806	70	SP61	55	UL84	35
25Z34	55	25Z34	55	DK122	45	ECL800	45	EZ105	28	PCF806	70	SP61	55	UL84	35
25Z35	55	25Z35	55	DK123	45	ECL800	45	EZ106	28	PCF806	70	SP61	55	UL84	35
25Z36	55	25Z36	55	DK124	45	ECL800	45	EZ107	28	PCF806	70	SP61	55	UL84	35
25Z37	55	25Z37	55	DK125	45	ECL800	45	EZ108	28	PCF806	70	SP61	55	UL84	35
25Z38	55	25Z38	55	DK126	45	ECL800	45	EZ109	28	PCF806	70	SP61	55	UL84	35
25Z39	55	25Z39	55	DK127	45	ECL800	45	EZ110	28	PCF806	70	SP61	55	UL84	35
25Z40	55	25Z40	55	DK128	45	ECL800	45	EZ111	28	PCF806	70	SP61	55	UL84	35
25Z41	55	25Z41	55	DK129	45	ECL800	45	EZ112	28	PCF806	70	SP61	55	UL84	35
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25Z43	55	25Z43	55	DK131	45	ECL800	45	EZ114	28	PCF806	70	SP61	55	UL84	35
25Z44	55	25Z44	55	DK132	45	ECL800	45	EZ115	28	PCF806	70	SP61	55	UL84	35
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25Z47	55	25Z47	55	DK135	45	ECL800	45	EZ118	28	PCF806	70	SP61	55	UL84	35
25Z48	55	25Z48	55	DK136	45	ECL800	45	EZ119	28	PCF806	70	SP61	55	UL84	35
25Z49	55	25Z49	55	DK137	45	ECL800	45	EZ120	28	PCF806	70	SP61	55	UL84	35
25Z50	55	25Z50	55	DK138	45	ECL800	45	EZ121	28	PCF806	70	SP61	55	UL84	35
25Z51	55	25Z51	55	DK139	45	ECL800	45	EZ122	28	PCF806	70	SP61	55	UL84	35
25Z52	55	25Z52	55	DK140	45	ECL800	45	EZ123	28	PCF806	70	SP61	55	UL84	35
25Z53	55	25Z53	55	DK141	45	ECL800	45	EZ124	28	PCF806	70	SP61	55	UL84	35
25Z54	55	25Z54	55	DK142	45	ECL800	45	EZ125	28	PCF806	70	SP61	55	UL84	35
25Z55	55	25Z55	55	DK143	45	ECL800	45	EZ126	28	PCF806	70	SP61	55	UL84	35
25Z56	55	25Z56	55	DK144	45	ECL800	45	EZ127	28	PCF806	70	SP61	55	UL84	35
25Z57	55	25Z57	55	DK145	45	ECL800	45	EZ128	28	PCF806	70	SP61	55	UL84	35
25Z58	55	25Z58	55	DK146	45	ECL800	45	EZ129	28	PCF806	70	SP61	55	UL84	35
25Z59	55	25Z59	55	DK147	45	ECL800	45	EZ130	28	PCF806	70	SP61	55	UL84	35
25Z60	55	25Z60	55	DK148	45	ECL800	45	EZ131	28	PCF806	70	SP61	55	UL84	35
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25Z67	55	25Z67	55	DK155	45	ECL800	45	EZ138	28	PCF806	70	SP61	55	UL84	35
25Z68	55	25Z68	55	DK156	45	ECL800	45	EZ139	28	PCF806	70	SP61	55	UL84	35
25Z69	55	25Z69	55	DK157	45	ECL800	45	EZ140	28	PCF806	70	SP61	55	UL84	35
25Z70	55	25Z70	55	DK158	45	ECL800	45	EZ141	28	PCF806	70	SP61	55	UL84	35
25Z71</															



LIND-AIR AUDIO

C.1001 MULTI-TESTER

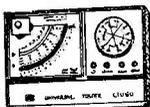


Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50 uA, 0-250 mA. Resistance 0-50K. Decibels -20 to +22dB.

Size of meter 4 1/2 x 3 1/2 x 1 in. Complete with case.

£45.0. P. & P. 3/6

C.1050 MULTI-TESTER



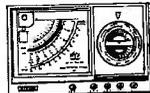
10,000 opv. RANGES: DC Voltage: 0-3-15-150-500-1200 Volt (10,000 ohms per Volt) AC Voltage: 0-6-30-300-1200 Volt (5,000 ohms per Volt).

DC Current: 0-120 uA, 0-300 mA. Resistance: 0-50K, 0-5 Meg (R x 10) (R x 1K)

Decibels: -20 to +17dB.

£519.6. P. & P. 3/6

C.1052 MULTI-TESTER



RANGES: AC Voltage: 6, 30, 120, 300, 1200 (15,000 ohm/V) DC Voltage: 0-6, 3, 15, 50, 300, 1200 (30,000 ohm/V)

DC Current: 0, 0-0.3, 3, 30, 300 mA

Resistance: 0, 6k, 60k, 600k, 6 M ohms

Decibels: -20 to +63dB.

£77.0. P. & P. 3/6

SM-370 MULTI-TESTER



20,000 opv. RANGES: DC Voltage: 0-5-25-100-500-1000V (20,000 ohms/V).

AC Voltage: 0-5-25-100-500-1000V (20,000 ohms/V).

DC Current: 0-50 uA, 0-250 mA

Resistance: RX10, RX1K (300 ohms and 30K ohms at centre scale).

Decibels: -20dB to +16dB.

£311.0. P. & P. 3/6

BATTERY ELIMINATOR



Enables transistor equipment to be operated from AC mains. 6/9/12v. output selector switch and instructions.

on/off switch. Case size 4 x 2 1/2 x 2 in. complete with mains lead, connecting leads and instructions.

£219.6. P. & P. 3/6

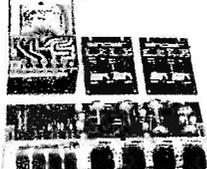
WELLER "EXPERT" SOLDERING GUN



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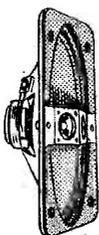
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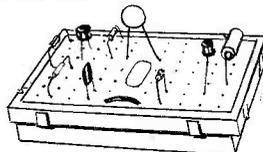
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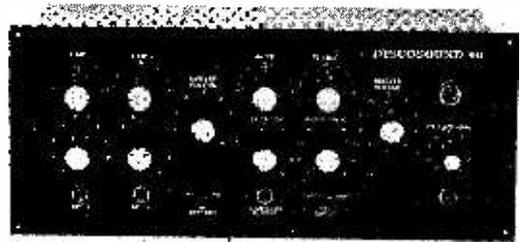
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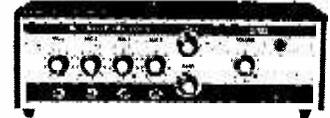
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A 100W RMS (8 Ohms) High Fidelity power Amplifier which utilises all silicon transistors of modular construction and features full automatic overload protection against short or open circuits. Frequency response 20-20,000Hz ± 2dB. The High output is ideally suited for discotheques, groups, clubs, etc., or anywhere where reliability and quality are required. This unit is the companion model for use with our control pre-amp Discosound 40, or can be used with any other high quality pre-amp control unit. Completely built and tested on steel Chassis.

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2N3038	30p	2N3415	281p	40314	471p	BCY31	271p	BSX31	32p	NKT402	75p
2N3039	30p	2N3416	371p	40320	471p	BCY32	271p	BSX32	32p	NKT403	75p
2N3039	15p	2N3417	371p	40323	471p	BCY33	271p	BSX33	32p	NKT404	621p
2N3039	15p	2N3418	371p	40324	471p	BCY34	281p	BSX34	271p	NKT405	75p
2N3041	281p	2N3572	971p	40326	371p	BCY35	281p	BSY10	271p	NKT406	621p
2N3041	281p	2N3572	971p	40329	30p	BCY39	581p	BSY11	271p	NKT451	321p
2N3066	20p	2N3605	271p	40344	471p	BCY40	371p	BSY24	15p	NKT452	321p
2N3066	20p	2N3607	271p	40347	271p	BCY42	15p	BSY26	15p	NKT453	471p
2N3068	25p	2N3702	121p	40348	581p	BCY43	15p	BSY27	171p	NKT603F	321p
2N706	121p	2N3703	121p	40349	451p	BCY54	381p	BSY28	171p	NKT674F	30p
2N705A	121p	2N3704	171p	40362	571p	BCY58	281p	BSY29	171p	NKT677F	30p
2N705	15p	2N3705	171p	40370	321p	BCY59	271p	BSY32	15p	NKT713	20p
2N709	621p	2N3706	121p	40370	321p	BCY60	971p	BSY38	25p	NKT731	30p
2N718	25p	2N3707	15p	40406	571p	BCY70	20p	BSY38	25p	NKT10419	30p
2N726	30p	2N3708	09p	40407	40p	BCY71	421p	BSY37	25p	NKT10439	371p
2N727	30p	2N3709	10p	40408	571p	BCY72	421p	BSY38	25p	NKT10439	371p
2N914	171p	2N3710	11p	40467A	581p	BCZ10	271p	BSY39	281p	NKT10519	371p
2N916	171p	2N3711	12p	40467A	581p	BCZ11	421p	BSY40	321p	NKT10519	371p
2N918	20p	2N3715	82-22p	40468A	571p	BD116	11-121p	BSY51	321p	NKT2032	471p
2N928	20p	2N3716	22-30	40600	30p	BD121	65p	BSY52	321p	NKT2039	321p
2N930	271p	2N3791	22-35	AC 107	15p	BD123	321p	BSY53	371p	NKT2039	321p
2N1090	221p	2N3819	35p	AC126	20p	BD124	60p	BSY54	60p	NKT2039	321p
2N1091	221p	2N3823	371p	AC127	20p	BD131	971p	BSY56	90p	NKT8011	771p
2N1131	35p	2N3854	271p	AC128	20p	BD132	971p	BSY78	471p	NKT8011	771p
2N1132	25p	2N3854	271p	AC129	20p	BDY10	11-371p	BSY79	45p	NKT8011	771p
2N1304	171p	2N3855	471p	AC176	621p	BDY11	11-621p	BSY82	521p	NKT8011	771p
2N1303	171p	2N3855A	30p	AC187	621p	BDY17	11-50	BSY80	571p	NKT80113	971p
2N1304	221p	2N3856	30p	AC188	371p	BDY18	11-75	BSY84	151p	NKT80211	921p
2N1305	221p	2N3856A	35p	ACY17	271p	BDY19	11-971p	BSW41	421p	NKT80211	921p
2N1306	35p	2N3858	30p	ACY19	25p	BDY20	11-121p	BSW70	271p	NKT80211	921p
2N1307	35p	2N3858A	30p	ACY20	25p	BDY38	971p	CL11	75p	NKT80211	921p
2N1308	30p	2N3859	271p	ACY21	25p	BDY60	11-25	C424	271p	NKT80211	921p
2N1309	30p	2N3859A	321p	ACY22	25p	BDY61	11-25	C425	25p	NKT80213	921p
2N1507	171p	2N3860	30p	ACY22	30p	BDY62	11-25	C426	40p	NKT80213	921p
2N1613	25p	2N3866	11-50	ACY28	30p	BF115	25p	C428	371p	NKT80214	921p
2N1631	35p	2N3877	40p	ACY40	30p	BF117	471p	C744	30p	NKT80214	921p
2N1632	30p	2N3877A	40p	ACY41	25p	BF163	371p	D16P1	371p	NKT80215	921p
2N1637	30p	2N3878	371p	ACY44	40p	BF167	25p	D16P2	40p	NKT80215	921p
2N1638	271p	2N3900A	40p	AD140	521p	BF173	321p	D16P3	371p	NKT80216	921p
2N1639	271p	2N3901	971p	AD149	571p	BF177	321p	D16P4	40p	NKT80216	921p
2N1711	25p	2N3903	35p	AD150	571p	BF178	521p	GET103	20p	OC20	75p
2N1889	321p	2N3904	35p	AD161	371p	BF179	721p	GET113	20p	OC22	50p
2N1893	371p	2N3905	371p	AD162	371p	BF180	35p	GET114	20p	OC22	50p
2N2147	321p	2N3906	371p	AF106	421p	BF181	321p	GET118	20p	OC23	50p
2N2148	321p	2N3906	371p	AF114	25p	BF184	25p	GET119	20p	OC24	50p
2N2150	571p	2N4059	10p	AF115	30p	BF185	421p	GET120	521p	OC26	271p
2N2198	40p	2N4060	121p	AF116	35p	BF194	171p	GET123	121p	OC28	621p
2N2193A	421p	2N4061	121p	AF117	25p	BF195	20p	GET124	20p	OC29	621p
2N2194A	30p	2N4062	121p	AF118	621p	BF196	421p	GET127	20p	OC35	50p
2N2217	271p	2N4063	121p	AF119	30p	BF197	421p	GET128	221p	OC36	621p
2N2218	321p	2N4064	121p	AF124	221p	BF198	421p	GET129	221p	OC41	221p
2N2219	321p	2N4065	171p	AF125	20p	BF200	521p	GET130	221p	OC42	221p
2N2220	35p	2N4066	171p	AF126	20p	BF224	30p	GET138	221p	OC44	20p
2N2221	25p	2N4067	171p	AF127	171p	BF225	221p	GET139	221p	OC44	20p
2N2222	30p	2N4068	171p	AF128	421p	BF238	221p	GET140	221p	OC44	20p
2N2287	11-071p	2N4069	171p	AF179	721p	BF244	321p	MJ400	11-071p	OC45	121p
2N2287	30p	2N4092	121p	AF180	521p	BFW61	471p	MJ420	11-121p	OC46	15p
2N2368	171p	2N4303	471p	AF181	421p	BFX12	221p	MJ421	11-121p	OC70	121p
2N2369	171p	2N5027	521p	AF229	421p	BFX13	221p	MJ440	95p	OC71	121p
2N2369A	171p	2N5028	571p	AF279	471p	BFX29	30p	MJ441	11-25	OC72	321p
2N2438	271p	2N5029	471p	AF280	621p	BFX30	30p	MJ490	11-071p	OC74	321p
2N2454	321p	2N5172	121p	AF211	321p	BFX32	30p	MJ491	11-371p	OC77	30p
2N2540	281p	2N5174	521p	ASY26	25p	BFX44	371p	MJ830	12-171p	OC81	20p
2N2613	35p	2N5176	521p	ASY27	371p	BFX68	371p	MJE340	621p	OC82	221p
2N2614	35p	2N5177	521p	ASY28	271p	BFX84	35p	MJE520	371p	OC83	25p
2N2614	35p	2N5178	521p	ASY29	271p	BFX85	35p	MJE521	371p	OC84	25p
2N2614	35p	2N5179	521p	ASY30	25p	BFX86	25p	MJE522	371p	OC84	25p
2N2614	35p	2N5180	521p	ASY31	25p	BFX87	271p	MJE523	371p	OC84	25p
2N2614	35p	2N5181	521p	ASY32	25p	BFX88	25p	MJE524	371p	OC84	25p
2N2614	35p	2N5182	521p	ASY33	25p	BFX89	621p	MJE525	371p	OC84	25p
2N2614	35p	2N5183	521p	ASY34	25p	BFX90	721p	MJE526	371p	OC84	25p
2N2614	35p	2N5184	521p	ASY35	25p	BFX91	721p	MJE527	371p	OC84	25p
2N2614	35p	2N5185	521p	ASY36	25p	BFX92	721p	MJE528	371p	OC84	25p
2N2614	35p	2N5186	521p	ASY37	25p	BFX93	721p	MJE529	371p	OC84	25p
2N2614	35p	2N5187	521p	ASY38	25p	BFX94	721p	MJE530	371p	OC84	25p
2N2614	35p	2N5188	521p	ASY39	25p	BFX95	721p	MJE531	371p	OC84	25p
2N2614	35p	2N5189	521p	ASY40	25p	BFX96	721p	MJE532	371p	OC84	25p
2N2614	35p	2N5190	521p	ASY41	25p	BFX97	721p	MJE533	371p	OC84	25p
2N2614	35p	2N5191	521p	ASY42	25p	BFX98	721p	MJE534	371p	OC84	25p
2N2614	35p	2N5192	521p	ASY43	25p	BFX99	721p	MJE535	371p	OC84	25p
2N2614	35p	2N5193	521p	ASY44	25p	BFX100	721p	MJE536	371p	OC84	25p
2N2614	35p	2N5194	521p	ASY45	25p	BFX101	721p	MJE537	371p	OC84	25p
2N2614	35p	2N5195	521p	ASY46	25p	BFX102	721p	MJE538	371p	OC84	25p
2N2614	35p	2N5196	521p	ASY47	25p	BFX103	721p	MJE539	371p	OC84	25p
2N2614	35p	2N5197	521p	ASY48	25p	BFX104	721p	MJE540	371p	OC84	25p
2N2614	35p	2N5198	521p	ASY49	25p	BFX105	721p	MJE541	371p	OC84	25p
2N2614	35p	2N5199	521p	ASY50	25p	BFX106	721p	MJE542	371p	OC84	25p
2N2614	35p	2N5200	521p	ASY51	25p	BFX107	721p	MJE543	371p	OC84	25p
2N2614	35p	2N5201	521p	ASY52	25p	BFX108	721p	MJE544	371p	OC84	25p
2N2614	35p	2N5202	521p	ASY53	25p	BFX109	721p	MJE545	371p	OC84	25p
2N2614	35p	2N5203	521p	ASY54	25p	BFX110	721p	MJE546	371p	OC84	25p
2N2614	35p	2N5204	521p	ASY55	25p	BFX111	721p	MJE547	371p	OC84	25p
2N2614	35p	2N5205	521p	ASY56	25p	BFX112	721p	MJE548	371p	OC84	25p
2N2614	35p	2N5206	521p	ASY57	25p	BFX113	721p	MJE549	371p	OC84	25p
2N2614	35p	2N5207	521p	ASY58	25p	BFX114	721p	MJE550	371p	OC84	25p
2N2614	35p	2N5208	521p	ASY59	25p	BFX115	721p	MJE551	371p	OC84	25p
2N2614	35p	2N5209	521p	ASY60	25p	BFX116	721p	MJE552	371p	OC84	25p
2N2614	35p	2N5210	521p	ASY61	25p	BFX117	721p	MJE553	371p	OC84	25p
2N2614	35p	2N5211	521p	ASY62	25p	BFX118	721p	MJE554	371p	OC84	25p
2N2614	35p	2N5212	521p	ASY63	25p	BFX119	721p	MJE555	371p	OC84	25p
2N2614	35p	2N5213	521p	ASY64	25p	BFX120	721p	MJE556	37		

DISCO THE QUE EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.II AMPLIFIER PR. R.S.C. L12/25 25W L/8 in cabinets Terms: Deposit £9 and 9 monthly payments of £5 (Total £54)	£39.50 £19.00	PACKAGE PRICE £48 carr. £1
F.A.L. PHASE 50 MK.II AMPLIFIER PR. FANE POP 50 L/SPEAKERS Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50)	£33.50 £21	PACKAGE PRICE £49.50 carr. £1
F.A.L. PHASE 100 AMPLIFIER PR. L125 50W L/8 in cabinets Terms: Deposit £12 and 9 monthly payments of £11 (Total £121)	£82.95 £59.80	PACKAGE PRICE £110 carr. £1.50
F.A.L. PHASE 100 AMPLIFIER 4 FANE POP 50 L/SPEAKERS Terms: Deposit £14 and 9 monthly payments of £10 (Total £104)	£122.75 £82.95 £42	PACKAGE PRICE £94 carr. £1.50

AUDIOTRINE HI-FI SPEAKER SYSTEMS
Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5.75**

OR SENIOR 15 WATT INC. HF126
15,000 LINE SPEAKER carr. 30p **£6.75** Carr. 30p

AUDIOTRINE HIGH FIDELITY LOUSPEAKERS
Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8-15 ohms. Please state choice. Exceptional performance at low cost.

HF801D 8" 8W	£2.71	HF120D 12" 15W	£4.40
HF120D 10" 10W	£3.40	HF128 12" 15W	£5.25
HF120 12" 15W	£3.99	HF128D 12" 15W	£5.75

FANE 807 HIGH FIDELITY LOUSPEAKER
A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosures. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25-15 KHz. Impedance 3 or 8-15 Ω. **£3.50**
Gauss 10,000. Remarkable value.

HI-FI SPEAKER ENCLOSURES
Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 25p. per enclosure
JES Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker. **£4.75**
SEB For optimum performance with any 8in. Hi-Fi speaker. Size 22 x 15 x 9in. Ported **£5.75**
SE10 For outstanding results SE12 For excellent performance with 12in. with 10in. Hi-Fi spkr **£5.99** Hi-Fi speaker and Tweeter. Size 24x15x10in. P.td **£5.99** Size 25 x 16 x 10 1/2in. **£6.99**

RECORD PLAYING UNITS
Money saving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amp. or Tape recorder.
RP2C Garrard SP25 Mk II (with heavy turntable) fitted Goldring C890 high compliance ceramic Stereo/Mono cartridge with diamond styli. Carr. 50p **£24.65**
RP6C Garrard 5200 Auto Unit fitted Stereo Cartridge Plinth & Cover as RP2C **£15**
Other types available with Magnetic cartridges and with alternative design plinths.

R.S.C. PLINTHS
Superior Solid Natural Wood Construction for Record Playing units, cut for Garrard 1025 2025, 3000 AT60, SP25 etc. **£3.15**
WITH TRANSP. PLASTIC COVER **£6.30**

LEADING MAKES HI-FI EQUIPMENT AT CLEARANCE PRICES
Available at branches only

SUPER 15 HIGH FIDELITY SOLID STATE AMPLIFIER
Approx. as Super 30 but single channel. Complete kit with full constructional details and point to point wiring **£13.15**
OR FACTORY BUILT **£16.50**
Carr. 60p. Terms: Deposit £4.20 and 9 monthly payments £1.55 (Total £18.15) Available in Teak or Afrormosia veneered housing. £20

R.S.C. BATTERY/MAINS CONVERSION UNITS
TYPE BM1
An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2in. approx.
Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram £8 or assembled ready for use **£3.50**

R.S.C. TA6 6 Watt HI-FI SOLID STATE AMPLIFIER
200-250v. A.C. mains operated. Frequency Response 30-20,000 c.p.s. -24dB. Harmonic Distortion 0.3% at 1,000 c.p.s. Separate Bass and Treble "lift" and "cut" controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 6mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9 1/2 x 2 1/2 x 5 1/2 in. Attractive brushed silver finish. Facia plate 10 1/2 x 3 1/2 in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7.35** Carr. 40p
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£9.45**

R.S.C. A11 HI-FI 12-14 WATT AMPLIFIER
PUSH-PULL OUTPUT. Two input sockets with sep. vol. controls for mixing. High sensitivity. 5 valves. Bass and treble controls. Response ±3dB 30-20,000 c/s. Hum level -60dB. Sensitivity 40 millivolts. For Crystal or Ceramic P.U.S. High Impedance "mikes". For Musical Instruments etc.
Std. A.C. mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. Carr. 60p SAE for leaflet. Twin handled metal cover **£1.75**
Factory built **£14.75** or Dep. £2 and 9 mthly pymnts of **£1.60** (Total £17.40)

R.S.C. COLUMN SPEAKERS IDEAL FOR VOCALISTS AND PUBLIC ADDRESS



All types 15 Ohms covered in Rexine Vynair
TYPE C4100 IS ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C485 25-30 WATTS
Fitted four 8" high flux 3 watt speakers. Overall size approx 48 x 10 x 5 in. Carr. 50p
Terms: Dep. £3 and 9 monthly payments £1.80 (Total £19.20) **£16.80**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 x 16 x 10" filled and pressurised. Terms: Dep. £8 and 9 mthly. pmts. £5.50 (Total £57.50). Carr. £1

TYPE C4125 50 WATTS
Fitted four 12" 11,000 line 15 watt speakers. Overall size approx 56 x 14 x 9 in. Carr. 75p
Terms: Dep. £4 and 9 monthly payments £2.95 (Total £20.55) **£27.50**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 x 16 x 10" filled and pressurised. Terms: Dep. £8 and 9 mthly. pmts. £5.50 (Total £57.50). Carr. £1

30 WATT HI-FI AMPLIFIER FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP.
A 2 or 4 input, 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold P.V.C. facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet.
Terms: Deposit £3.70 and 9 monthly payments of £2.10 (Total £22.60) **£19.95** Carr. 65p

HIGH QUALITY LOUSPEAKER UNITS
IN TEAK VENEERED CABINETS

L13 13" x 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. £5.25 carr. 40p	L12 12" 25 WATT 10,000 lines 15 ohms. £8.99 Carr. 45p	L125 50 WATT Two tone Rexine and Vynair finish. Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. 75p £29.40
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R.S.C. BASS REGENT 50 WATT AMPLIFIER
A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit horizontal or vertical mounting. **£60**
★ Two extra heavy duty 12in. Loudspeakers.
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes".
Bass and Treble controls. Send S.A.E. for leaflet.
Credit Terms Deposit £16 and 9 monthly payments of £5.75 (Total £67.75)

FAL PHASE 50 AMPLIFIER 50 Watt
Solid state 3 Separately controlled inputs Ind. Bass and Treble Controls. Output for Speaker/s 3-30 ohms. Size 17" x 7" x 7 1/2". 200-250v. A.C. mains.
Peak Output rating. For fuller details of Phase 50 send S.A.E. for leaflets. **£30.45** Carr. Free

FAL PHASE 100 AMPLIFIER 100W
Solid State. 4 Separately controlled inputs Plus master volume Control. Ind. Bass and Treble Controls. Output for speaker/s 3-30 ohms. Protective circuit to guard against damage from accidental shorts I.H.F.M. Output rating **£61.95**

FANE ULTRA HIGH POWER LOUSPEAKERS
All power ratings are R.M.S. continuous. 2 years' guarantee. High flux ceramic magnets. Heavy cast chassis. All carr. free.

'POP' 100 18" 100Watt 14,000 gauss 8/15Ω £22.05 Dep. £6 and 9 monthly pymnts £2 (Total £24). FOR BASS GUITAR, ELECT. ORGAN, ETC.	'POP' 60 15" 60 Watt 14,000 gauss 8/15Ω £12.90 Dep. £3.80 and 9 monthly pymnts. £1.80 (Total £15).	'POP' 50 12" 50 Watt 13,000 gauss 15Ω £10.50 Dep. £2 and 9 monthly pymnts £1.15 (Total £12.35) Pair suitable all purposes	FANE LOUSPEAKERS 'POP' 25/2 12in. 25 WATT Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). £6.75 Carr. free or Dep. £1 and 9 mthly payments 75p (Total £7.75)
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R.S.C. A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER
Highly sensitive. Push-Pull high output. Hum level -70dB. Response ±3dB 20-20,000 c/s. All high grade components. Valves EF86, EF86, ECC83, 807, 6X24. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres, Dance Halls, Outdoor Functions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. to be used for mixing purposes. 200-250 v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts with wiring diagram and instructions. Twin-handled perforated cover **£17.75** OR factory built with EL34 output valves and 12 months' guarantee for **£18.80** Carr. 65p
TERMS: Deposit £3.45 and 9 monthly payments of £2 (Total £21.45). Send S.A.E. for leaflet.

RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS
FULLY GUARANTEED. Impregnated and Interleaved where necessary

PRIMARYS 200-250v. 50c/s. Screened

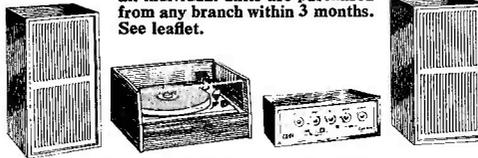
MIDGE CLAMP TYPE 2 1/2" x 2 1/2" x 2 1/2" 250v. 60mA. 6.3v. 2a. 90p	FILAMENT OR TRANSFORMER POWER PACK TYPE 6.3v. 1.5a. 45p; 6.3v. 2a. 49p; 6.3v. 3a. 69p; 6.3v. 6a. £1.15; 12v. 1a. 50p; 12v. 3a. or 24v. 1.5a. £1.20; 0-15v. 1.1a. 99p; 0-12-25-42v. 2a. £1.80
FULLY SHEATHED UPRIGHT MOUNTING 250-0-250v. 60mA. 6.3v. 2a., 0-5-6.3v. 2a. 125p	CHARGER TRANSFORMERS 0-0-15v. 1.1a. 99p; 0-0-15v. 1.1a. 99p; 2A. 89p; 3A. £1.10; 5A. £1.30; 6A. £1.49; 8A. £1.58
250-0-250v. 100mA. 6.3v. 4a., 0-5-6.3v. 2a. £1.99	AUTO (Step UP/STEP DOWN) TRANSFORMERS 0-10V/20V. 200-200-250V. 50-80 watts 99p; 50-150 watts, £1.70 250 watts £2.49; 500 watts £5.25.
300-0-300v. 100mA. 6.3v. 4a., 0-5-6.3v. 2a. £1.99	OUTPUT TRANSFORMERS Standard Pentode 5,000 Ω or 7,000 Ω to 8 Ω 45p
300-0-300v. 100mA. 6.3v. 4a., 0-5-6.3v. 2a. £2.40	Push-Pull 8 watts EL84 to 3 Ω or 15 Ω 75p
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R.S.C. HIGH FIDELITY STEREO PACKAGE OFFERS

Four fully wired units ready to 'plug in.'
 ★ SUPER 30 AMPLIFIER (15 + 15 watt) in veneered housing
 ★ GARRARD SP25 MK II Turntable on Plinth with cover
 ★ GOLDRING CS90 Ceramic P.U. Cartridge with diamond stylus
 ★ PR. OF STANWAY II Speaker Units **£79.80**
 Special Total Price Carr. £1.50

Matching as recommended for optimum performance. Send S.A.E. for coloured brochure showing other money-saving offers.

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★ TA12 AMPLIFIER 6.5+6.5 watt in veneered housing
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5 + 5 WATT OUTPUT

GARRARD 5200 Changer with low mass pick-up arm and Stereo Cartridge. CONTROLS: TREBLE, BASS, VOLUME, STEREO, BALANCE.
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Luxurious Teak Veneer Finished Cabinets. Transparent plastic (tinted) cover included for main unit. Silver finished fascia plate and matching control knobs.

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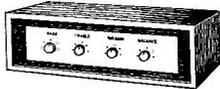
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Dual cone speaker. Imp. 3 or 15 ohms.

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FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION HIGH FIDELITY OUTPUT OF 6.5 WATTS PER CHANNEL

Designed for optimum performance with any crystal or ceramic Gram. P.U. cartridge, Radio tuner, Tape recorder etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output 3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 20-20,000 c.p.s. -24dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise -70dB ★ Sensitivities (1) 50mV (2) 40mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate and Knobs. Complete kit of parts with full wiring diagrams & instructions. Factory built with 12 months guarantee **£17.85** or Deposit £2 and 9 mthly pymts **£1.95** (Total £20.55). Or in Teak veneer housing Carr. 40p. **£21.50** Dep. £3.15 & 9 mthly payments £2.85 (Total £24.30). Send S.A.E. for leaflet



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High Grade Components, Specifications comparable with units costing considerably more.

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FREQUENCY RESPONSE ± 2 dB. 10-20,000 c.p.s.

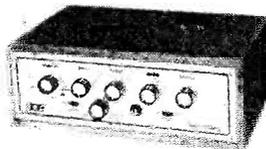
TREBLE CONTROL +17 dB to -14 dB at 10 Kc/s.

BASS CONTROL +17 dB to -15 dB at 50 c/s.

HUM LEVEL -80 dB. CROSS TALK 52 dB at 1,000 c.p.s.

HARMONIC DISTORTION 0.1% at 10 watts 1,000 c.p.s.

Employing Twin Printed Circuits. 200/250v. A.C. mains operation.



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FACIA PLATE Attractive design in rigid plastic, silver background black lettering. Silver finish matching control knobs as available.

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100	4p	6p	5p	13p	18p 23p 75p
200	5p	9p	6p	14p	20p 24p 81
400	6p	13p	7p	20p	27p 37p 21.25
600	7p	19p	10p	23p	34p 45p 21.85
800	10p	17p	13p	25p	37p 55p 22
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VBOM T05	T066	T048	
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UIC10 = 5 x 7410N	50p	UIC83 = 5 x 7483N	50p
UIC20 = 5 x 7420N	50p	UIC86 = 5 x 7486N	50p
UIC40 = 5 x 7440N	50p	UIC90 = 5 x 7490N	50p
UIC41 = 5 x 7441AN	50p	UIC92 = 5 x 7492N	50p
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UIC50 = 5 x 7450N	50p	UIC94 = 5 x 7494N	50p
UIC51 = 5 x 7451N	50p	UIC95 = 5 x 7495N	50p
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BP702C—SL702C	TO-5 8	OP Amp Direct O/P	63p 50p 45p
BP702—72702	D.I.L. 14	G.P. OP. Amp (Wide Band)	53p 45p 40p
BP709—72709	D.I.L. 14	High OP Amp	53p 45p 40p
BP709P—μA709C	TO-5 8	High Gain OP Amp	53p 45p 40p
BP741—72741	D.I.L. 14	High Gain OP. Amp (Protected)	75p 60p 50p
μA703C—μA703C	TO-5 6	R.F.—IF Amp	43p 35p 27p
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20 PROJECT SOLAR ELECTRONIC KIT Model R.128

This ultra modern Project Kit is shaped for the space age. Carried inside a transparent domed 4 1/2 in capsule the R.128 comes complete with a self-contained solar cell to power any one of 20 projects ranging from a one transistor radio to a morse set complete with key and morse training code. Supplied complete with easy to follow instructions and even the cement to assemble this unique electronic space capsule.

PRICE £4.50

2 OCTAVE ELECTRONIC ORGAN KIT Model R.129

Complete with a music book containing 10 easy to play songs the R.129 solid state organ kit covers 2 full octaves. Slotting into a fitted hardwood case the top panel carries the key assemblies and all the components including the loudspeaker. Like all Roc Electronic Kits every item is included down to the last nut and bolt so that the constructor can start assembly within minutes of opening the package.

PRICE £4.50

10 PROJECT INTEGRATED CIRCUIT KIT

Model R.127

Using a robust Solid State Integrated circuit the R.127 kits will build any one of these projects: (1) Germanium Radio. (2) Test Oscillator. (3) Morse Telegraph Training Set. (4) I.C.I. Transistor Radio. (5) Germanium 1 Transistor Radio. (6) Record Player Amp. (7) Continuity Tester. (8) AF Signal Tracer. (9) Radio Transmitter. (10) Water Purity Tester.

PRICE £3.50

2 TRANSISTOR SOLAR RADIO KIT Model R.126

Like all Roc Electronic Kits the R.126 uses reliable no-solder connections to produce a complete 2 transistor radio in under 2 hours. As well as battery operation the kit is supplied complete with a solar cell to provide power from the Sun or any strong light source.

PRICE £2.50

CRYSTAL RADIO KIT

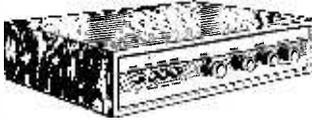
Model R.125

This easy to build Radio is based on the same circuit developed by Marconi for the very first radio transmission but uses a modern ferrite aerial for maximum efficiency. A perfect introduction to Radio Theory.

PRICE £1.50

16 WATT STEREO AMPLIFIER

Model R.138



As well as separate bass and treble controls the R.138 feature switched main and remote speaker outputs so that the same stereo installation can be used to drive independent stereo speaker systems. Fitted in a well finished walnut cabinet the brushed aluminium front panel and sensible control knobs set this amplifier in the professional class.

SPECIFICATION: Output: 16 Watts Total, 8 Watts per Channel. Frequency range: 30-20,000Hz. Inputs: Phono & Tuner. Outputs: Speakers Main, Speakers Remote, Tape Out, and Headphones. Controls: Bass, Treble, Volume, Balance (all ganged) Mode, Speakers Stereo/Mono and Power on/off.



PRICE £16.50

5 WATT 8 TRACK CARTRIDGE STEREO AMPLIFIER Model R.133

Just slot in one of the many 8 track cartridge tapes available for a continuous programme of your favourite music. A manual programme override switch enables you to switch from one track to the next at the push of a button at the same time a numbered indicator lights up to show which track is playing. Beautifully finished in an oiled walnut cabinet the R.133 is mechanically engineered to provide long and reliable service. **SPECIFICATION:**—Tape speed: 9.5 cm/sec (3 1/2 I.D.S.). Wow & flutter: better than 0.3%. Frequency range: 40-12,000Hz. Cross talk: better than 45dB at 1,000Hz. Output: 5W total. 2.5W per channel. Amplifier outputs: 200mV.



PRICE £36.00



STEREO HEADPHONES

Model R.328

Built up to a standard not down to a price, the R.328 stereo headphones represent a breakthrough in value for money.

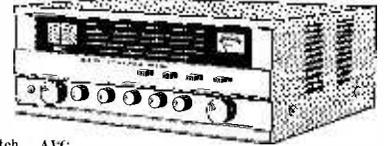
A valuable addition to any stereo installation they will provide many hours of listening pleasure.

SPECIFICATION: Matching impedance: 8-16 ohms. Frequency range: 30-15,000Hz.

PRICE £2.40

PROFESSIONAL SOLID STATE FOUR BAND COMMUNICATION RECEIVER Model R.135

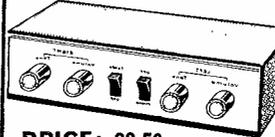
This is the communication receiver that you have long been waiting for. Fully transistorised and continuous coverage from 555 Khz-30 MHz in four bands including illuminated electronic bandspread for 100-10 metres. Also incorporated is an internal speaker, automatic noise limiter, SSB/AM/CW Switch, AVC Switch, 8 Meter, Receive and Standby Switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. The R.135 will run off 240v AC, dry batteries or any 12v DC negative ground source.



PRICE: £45.00



10 WATT TRANSISTOR STEREO AMPLIFIER MODEL R.137



With separate tone and volume controls on each channel and inputs for both phono and tuner, this 10 Transistor Amplifier is the ideal start to an excellent budget system. Frequency response 70-20 KHz. Output impedance 8-16 ohm. Attractively styled with brushed aluminium front panel.

PRICE: £9.50



10 WATT BUDGET STEREO ALL TRANSISTOR AMPLIFIER Model R.136



Ideal as a second stereo system or for the newcomer to Hi-Fi who wishes to upgrade existing equipment the R.136 sounds every bit as good as it looks. As well as inputs for crystal or ceramic cartridge the R.136 has a Stereo Tuner input which accepts the matching R.134 Stereo AM/FM Tuner.

The Satin Finish front panel carries a stereo headphone socket as well as volume, balance, walnut enclosure.

SPECIFICATION: Output: 10 Watts Total. 5 Watts per Channel. Frequency Range: 35-18,000Hz. Inputs: Phono and Tuner

PRICE: £13.00



AM/FM/MPX STEREO TUNER Model R.134



Perfect Matching Unit to the R.136 Amplifier. The R.134 Stereo Tuner is designed to give years of reliable performance. The Tuning Band covers AM & FM with a separate stereo beacon to indicate when stereo broadcasts are being received.

SPECIFICATION: FM: Frequency Range: 88-108MHz. Usable Sensitivity: 18µV. Stereo Separation: 26dB at 1kHz. Image Rejection: 55dB. AM: Frequency Range: 535-1,605Hz. Usable Sensitivity: 280µV.

PRICE: £21.00



STEREO FM/AM/MPX TUNER AMPLIFIER Model R.124

Another Roc Exclusive offering top value for money performance the R.124 is a Stereo Tuner/Amp with facilities usually found in much more expensive units. Features like separate bass and treble controls, automatic frequency control switch and stereo headphone socket give the R.124 a price to specification ratio second to none. Housed in a handsome walnut cabinet the classical low line styling of the R.124 will grace any home.



SPECIFICATION: FM: Frequency Range: 88-108 MHz; Usable sensitivity: 20µV; Stereo Separation: 26db at 1 KHz, 20dB Minimum.; Image Rejection: 55 dB; AM: Frequency Range: 535-1605 KHz; Usable Sensitivity: 300µV; Audio Section: Total Output Power: 4 Watts; Phono Input: 200mV at 1 megohm. Tape Input: 100mV at 100 Kohm.

PRICE £29.95



H.P. Terms available for personal callers on purchases over £30



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PRACTICAL WIRELESS

VOL 46 NO 11

Issue 769

MARCH 1971

Bring Back the Rod!

FOR the first time, our cover price shows preference for the decimal version; soon the old-style price will disappear altogether. Although there will be confusions after the official switchover on February 15th, we will soon settle down to decimal currency and the best way will be to forget, where possible, shillings and old pence, eschew conversions, and start *thinking* in terms of new pence. Old hands at Morse Code will know what we mean!

Decimal currency is now a fact of life. What we are more concerned about is Metrication (or as some prefer to call it Continentalisation). Obviously with an eye on the Common Market, a Government statement in 1965 proposed a switch to metrication spaced over ten years. The recommendations of the Standing Joint Committee on Metrication in the report *Change to the Metric System in the United Kingdom* published by the Ministry of Technology in September 1968 supported a complete conversion of all our standards to the metric system by 1975.

Such a programme will lay waste what many feel are anachronisms in this scientific age—12 inches to the foot, 3 feet to the yard, etc.—and put in their place metric progressions of millimetres, milligrams, litres, etc. Some industries are phasing out Imperial measures or have already converted to metric. There are advantages to be gained in international industrial operations, especially in the technical fields.

We are not, however, entirely convinced that metrication is necessarily the right step and are surely not alone in even *liking* some of our archaic standards, despite the scorn heaped on these old-fashioned measurements by some who are always ready to jump on the bandwagon if it looks like the 'in' thing to do.

In fact, some sections of industry, having converted to metric, are now reverting to Imperial measures—not only here but in some European countries.

And in this wonderland of logic will lurk that grand old dinosaur, the measurement of time. Also, circular measure, with its 360 degrees to the circumference and its minutes, seconds and quadrants.

Of course, we may not yet join the Common Market. If we don't, it would be great to commit scientific heresy and not only reinstate our inches and pints but dredge up those exotic measures of yesteryear, like the rods, poles and perches, the chains and hogsheads, the pecks and pennyweights, not to mention the scruple. Life would be very confusing, but much more fun!

Incidentally, how are the Americans going to take it when the vast quantities of goods that they import from us are found to be "metricated"? Perhaps we'll do a special line for them, in which case why bother in the first place?

W. N. STEVENS—*Editor*

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APRIL ISSUE WILL BE PUBLISHED
ON MARCH 5

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NEWS... NEWS... NEWS...

Miniature Jackson Capacitors

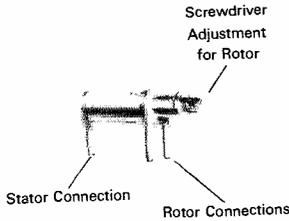


Fig 1

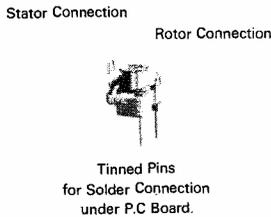


Fig 3

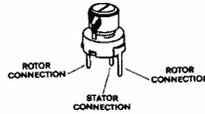


Fig 2

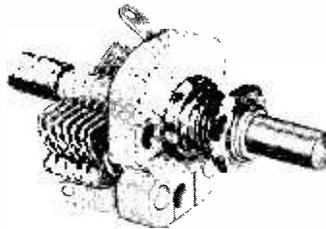


Fig 4

NS 838 A

Three new trimmer capacitors with PTFE dielectric are announced by Jackson Brothers (London) Ltd. All consist in principle of a brass rotor and PTFE sleeve which can be screwed into a brass stator. All have printed-circuit-board fixing pins to International Standard Spacing.

The Style 408 PC horizontal-mounting trimmer (Fig. 1), only 5mm diameter, has an exceptionally low minimum capacitance of $\frac{1}{4}$ pF. Capacitance swing: 8pF. The 8-mm Tetfer for h.f., v.h.f. and u.h.f. working (Fig. 2) has a circular ceramic base only 8mm diameter. The fixing-pins are also the stator and rotor connections. Minimum capacitance: below 2pF. Capacitance swing: over 8pF. The C16 Tetfer PM (Fig. 3) has a 9.5-mm square base and separate fixing-pins isolated electrically from stator and rotor connections, permitting high-frequency circuits to be sited above the printed-circuit board. Another new variable capacitor, the *Airtune C804E* (Fig. 4) is a vane type with air dielectric, with a rear shaft extension permitting ganging as required. Capacitance swing: 25, 50, 100 or 150pF. Further information from: *Jackson Brothers (London) Ltd., Kingsway, Waddon, Croydon CR9 4DG, England.*

Audio Fair

The 1971 International Audio Fair will be held at Olympia, London, from Tuesday, October 26, to Saturday, October 30. There will be a special trade and Press preview on Monday, October 25.

Further details can be obtained from *Iliffe Exhibitions Limited, Dorset House, Stamford Street, London SE1*, telephone 01-928 3333, or from *C. Rex-Hassan, the Festival Director, at 42 Manchester Street, London W1*, telephone 01-486 2080.

Bedford A.R.C.

The Bedford & District Amateur Radio Club meets every Thursday at the "Dolphin", The Broadway, Bedford. Future meetings include: (Feb. 11) "Make Magic with Transistors" by G3CWV. (Feb. 18) "Meteorological Electronics". (Feb. 25) "KW Atlanta Demo" by G3XNG. (March 4) "Shackability" by G3FWA. (March 11) "The Swiss Quad" by G3XDU. (March 18) "VHF Operating" by G8CXM and (March 25) "Discussion—What does Ham Radio mean to You?" by G2CLP. Further gen from *John Bennett, G3FWA, Hon. Sec., 47 Ibbett Close, Kempston, Bedford.*

E.M.I. Booklet

Career opportunities for the university graduate in activities embracing electronics, gramophone records, television and the entertainment business are outlined in a new publication from the EMI Group.

This 32-page booklet — 'EMI Careers for Graduates' — provides an insight into the variety of careers which can be pursued by graduates within EMI. The brochure also contains details of the Group's structure, activities, technological achievements, and growth—important facts which every graduate needs to know about a potential employer.

Through the nature of its operations EMI offers graduates with engineering, physics, chemistry, mathematics or arts degrees, both direct appointments and training in engineering, science and administration. The publication stresses the encouragement given to staff to further their careers by attending post-graduate studies and professional courses.

Copies of this publication are now available from university appointments boards or from *EMI Personnel Department (GCB), Hayes, Middlesex.*

An Apology

Jason Electronic Designs Ltd., 15-17 Queen's Street, Arundel, Sussex, are no longer wholesaling stocks of Dansette and Perdio spares. They would like to thank their many customers who have waited patiently for supplies and apologise to all those who have since written to whom they owe replies. All mail and enclosed monies are being returned just as fast as office and mailing conditions permit.

Bracknell Club

An amateur radio club is being formed in Bracknell, Berkshire. Will anyone who is interested in radio or electronics and who would like to attend contact *G8AMK at 13 Cannon Hill, East-hampstead, Bracknell.*

NEWS... NEWS... NEWS...

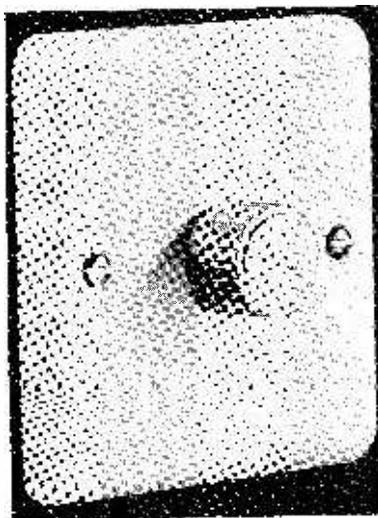
Stations Galore

BBC Radio Medway opened on December 18th with transmissions on 97.0MHz. BBC Radio Solent opened on December 31st. Transmissions are on 96.1MHz. BBC Radio Tees-side opened on December 31st with transmissions on 96.6MHz and BBC Radio Newcastle opened on January 2nd, transmitting on 95.4MHz. All stations are with horizontal polarisation.

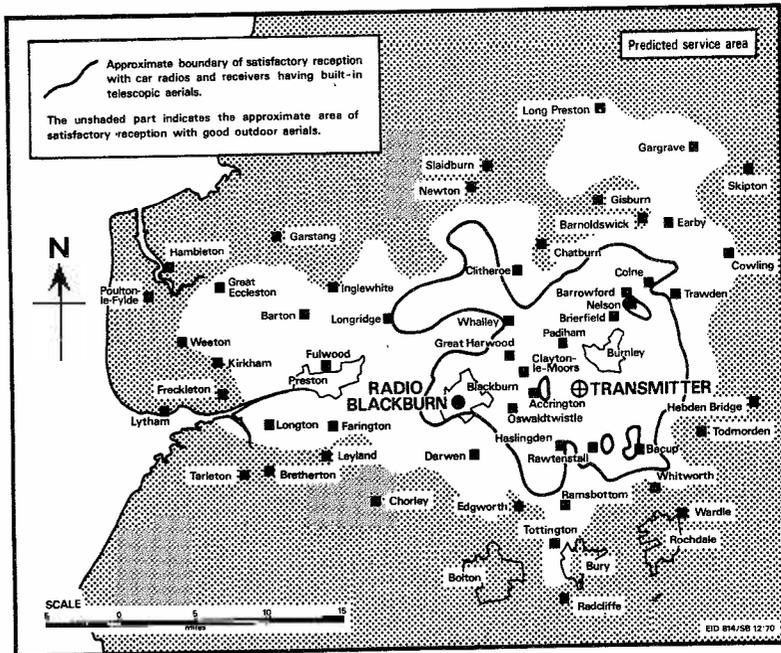
The Dim One

Many uses can be found for a Dimmaswitch. This is a unit with a mounting plate of the same size as a light switch, and in the usual ivory colour. The difference is that a Dimmaswitch plate carries a chromium plated knurled knob in place of the switch itself. The Dimmaswitch is connected in the same way as an ordinary light switch. Turn the knob and, click, your lights come on at full power. Continue to turn, and they dim gradually to complete darkness or any desired degree of light intensity between.

The Dimmaswitch will control up to 500 watts at mains voltages from 200-250 volts. It only costs £3 4s. plus 1s. 6d. post and packing. Dimmaswitches are also available in kit form at £2 14s. plus 1s. 6d. post and packing. *Dexter & Company, Ulver House, 19 King Street, Chester, CH1 2AH.*



B.B.C. Radio Blackburn



BBC Radio Blackburn opened on January 26. The transmissions are on 96.4MHz in the v.h.f. band, with slant polarization. Maximum ERP is 1.5kW.

The Radio Blackburn transmitter is sited on Hameldon Hill, near Accrington. The service area includes Blackburn, Burnley, Accrington, Haslingden, Oswaldtwistle, Padiham and Colne. For listeners using good outdoor aerials, the service extends to Preston, Darwen and Ramsbottom.

The inner and outer service area boundaries correspond to average

field-strength contours of 60 and 48dB (relative to 1mV per metre) respectively, for a receiving aerial height of 30ft. above ground level. The field strength at a particular site may differ by as much as 10dB from that indicated.

A service area map and an Engineering Information Sheet dealing with slant polarization are both available from *BBC Radio Blackburn, King Street, Blackburn, Lancashire, BB2 2EA*, or *BBC Engineering Information Department, Broadcasting House, London, W1A 1AA.*

In Stereo

Two stereo cartridges that are now available from Audio Supplies Ltd. are the MCI-5 at £6 and the SMC-101 at 65s. Both are moving magnet types. MCI-5 frequency response is 15-20,000Hz. Output voltage is 5mV at 1kHz; channel balance is ± 1 dB at 1kHz and channel separation is better than 25dB at 1kHz. Impedance is 2.2k Ω at 1kHz. D.C. resistance is 580 Ω . Load resistance is 50-100k Ω and tracking pressure 3-5gms. Stylus is 0.7mil diamond, and cartridge weight is 6.5gms.

The SMC-101 has similar speci-

fication but impedance is 2.5k Ω at 1kHz. D.C. resistance is 600 Ω and cartridge weight is 6gms. Compliance of both cartridges is 8×10^{-6} cm/dyne, and postage and packing on each cartridge is 2s. 6d. *Audio Supplies (PW), 50 Stamford Hill, London N.16.*

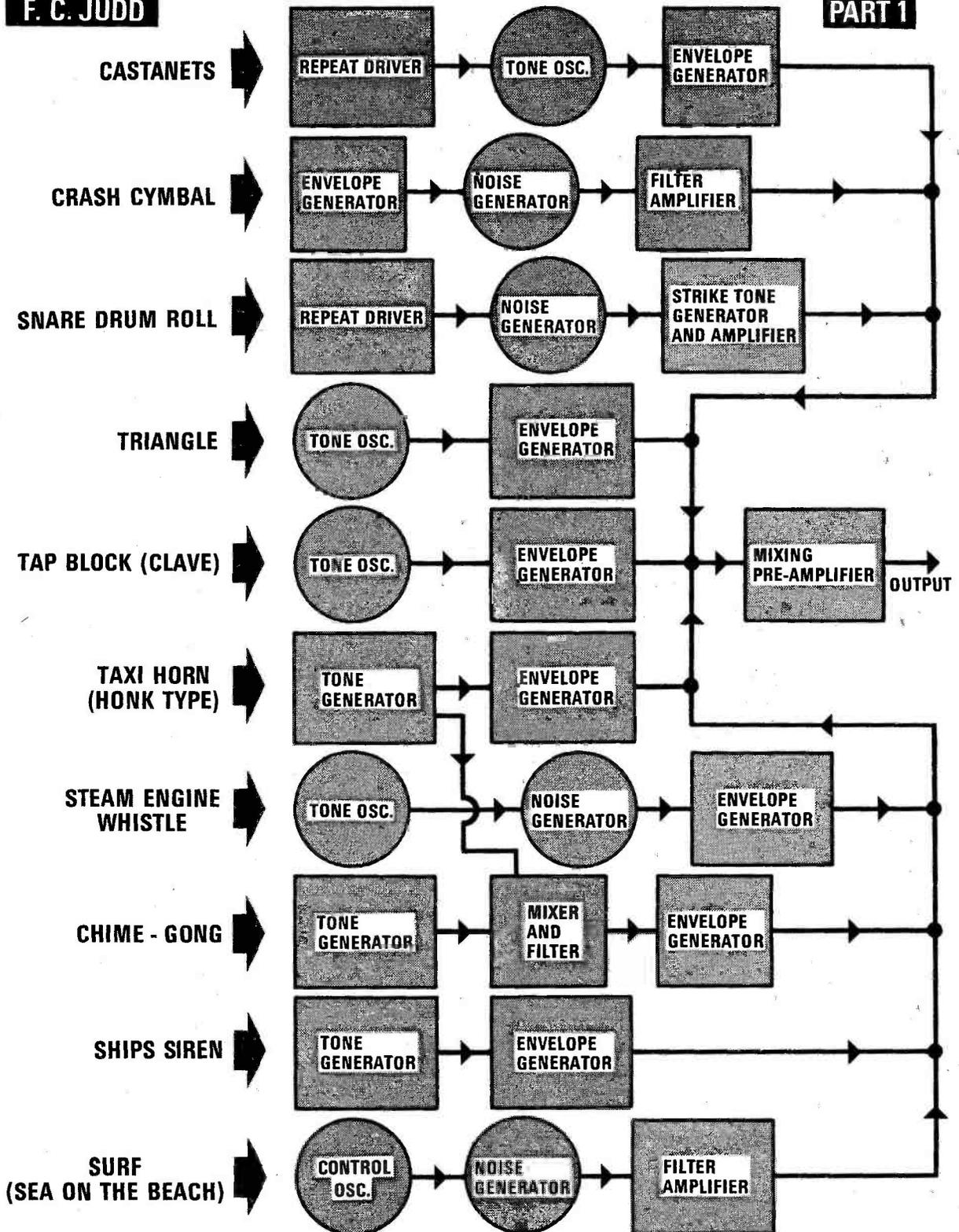
Ealing and District

A. P. (Bill) Teale, G3SGT, Hon. Sec. of the Ealing & District Amateur Radio Society informs us that he has changed his address to 11 Burns Avenue, Mount Pleasant, Southall, Middx.

PW SOUND EFFECTS SYNTHESISER

F. C. JUDD

PART 1



THE giant cinema organ is now regarded somewhat as a novelty but most of them were equipped to produce not only the sounds of percussion instruments but sound effects as well. Percussion sounds were usually derived from mechanically operated snare drums, cymbals, triangle, castanets and woodblock and even a bass drum and temple blocks, etc. Sound effects were produced by mechanical and/or wind-operated devices and included many sounds that could be used to enhance particular kinds of music. Train whistles for instance for tunes about trains and motor car horns for tunes about motoring. The full range usually consisted of bells, chimes, gongs, a ship's siren, klaxon horns, the sound of the sea, bird whistles, etc.

Since the modern electronic organ became popular, particularly for home use, a wide range of electronic percussion rhythm units have become available and many organ manufacturers now build such units into the organ. Whilst these imitate the various percussion instruments, they do so in continuous rhythm patterns. Very few will produce individual sounds like a snare drum roll or a single cymbal crash at the touch of a button and the writer does not know of any that will produce specific sound effects. Some organ manufacturers however are now incorporating special units to produce not only individual percussion sounds but sound effects as well. At present such facilities are only being included in some of the largest and most expensive electronic concert organs.

The electronic percussion and sound effects synthesiser to be described in this article has been designed for organists who require a compact unit that will produce a useful range of individual sounds and can be used with any external amplifier and loudspeaker or even the organ main amplifier. The completed unit, if constructed to the dimensions given, will fit underneath the lower manual at the front of an organ in such a way that the unit tabs are uppermost and within easy reach. The synthesiser does not play rhythms on its own but rhythmic snare drum rolls can be produced and the castanets can be sounded in rhythmic patterns simply by pressing the appropriate buttons rhythmically. All single sounds, i.e., the triangle, cymbal crash, train whistle, ship's siren, taxi horn, wood block and bell chime are produced once only when their respective buttons are pressed. The sound of sea, or surf on the beach, can be produced continuously by pressing the button which locks on. The signal stops when the button is pressed again. All the sounds are routed through a mixing pre-amplifier and the output from this is taken via a

volume control. The output signal level varies according to the sounds but averages about 500mV r.m.s. One or more sounds can be produced at the same time as each has its own generating circuit. For example, the "surf on the beach" sound can be run continuously for desert island type music and the ship's siren sounded as and when required.

The sounds and effects that the complete synthesiser will produce are as follows:—

- No. 1 Castanets (repeating)
- No. 2 Crash cymbal (single)
- No. 3 Snare drum (repeating or roll effect)
- No. 4 Triangle (single)
- No. 5 Wood block (tap box) (single)
- No. 6 Taxi horn (honk type) (single)
- No. 7 Train whistle (English steam type) (single)
- No. 8 Chime (deep grandfather clock type) (single)
- No. 9 Ship's siren (low pitched) (single)
- No. 10 Sea (sound of surf on beach) (continuous as desired)

There are altogether 12 circuit boards including the mixing pre-amplifier. The snare drum circuit requires two circuit boards whilst each of the others can be accommodated on a single board. As a complete circuit for the entire unit could not be printed within the page area of this magazine, each of the circuits for the sound generators, the mixing pre-amplifier and power supply will be given separately. It is worth noting that any of the sound generator circuits can be constructed and used individually as each provides more than 100mV signal output. Each circuit can therefore be constructed and tested before being incorporated into the complete unit.

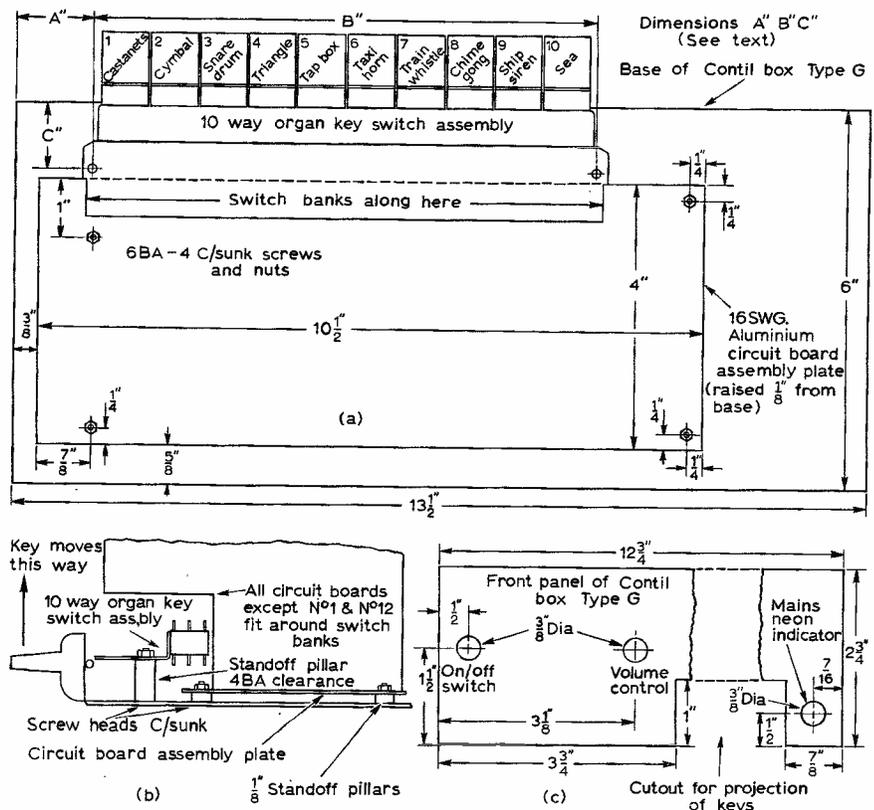


Fig. 1: The layout for the circuit board sub-chassis, controls, power supply and key switch assembly.

Construction

Before going on to describe the construction and circuitry, etc., the writer feels bound to point out that an audio signal generator and oscilloscope are *really essential* for checking that the various circuits function correctly and that a good quality amplifier and loudspeaker are necessary for accurate and reasonably lifelike reproduction.

The prototype unit, as shown in the photograph, was built into a **Contil Mod-2 case Type G** which has overall dimensions $13\frac{1}{2} \times 6\frac{1}{2} \times 3\frac{1}{2}$ in. The layout for the circuit board sub-chassis controls power supply and key switch assembly, etc., is shown in Fig. 1. Note that the key switch assembly and circuit boards are mounted on what is effectively the top of the case so that when the unit is finished and turned right way up, the bush buttons are at the top (see photos). No dimensions have been given for the location of the key switch assembly as these may depend on whether the recommended Contil case or a homemade case is used. If the Contil case is used the "A" dimension as in Fig. 1a should be $1\frac{1}{4}$ in. and the "B" dimension according to the fixing holes on the key switch frame. The "C" dimension should be such that the inner edges of the push buttons are just inside the lip of the base of the box, i.e., projecting inwards by about $\frac{1}{16}$ in. The method of mounting the key switch assembly is shown in Fig. 1b and details for the front panel drilling and the cut out for the key switch assembly are shown in Fig. 1c.

The positions of the circuit boards, as in the prototype, are shown in Fig. 2a. The space at the end, i.e. to the right of the dividing screen, is reserved for the power supply components. These can be mounted on the dividing screen which is

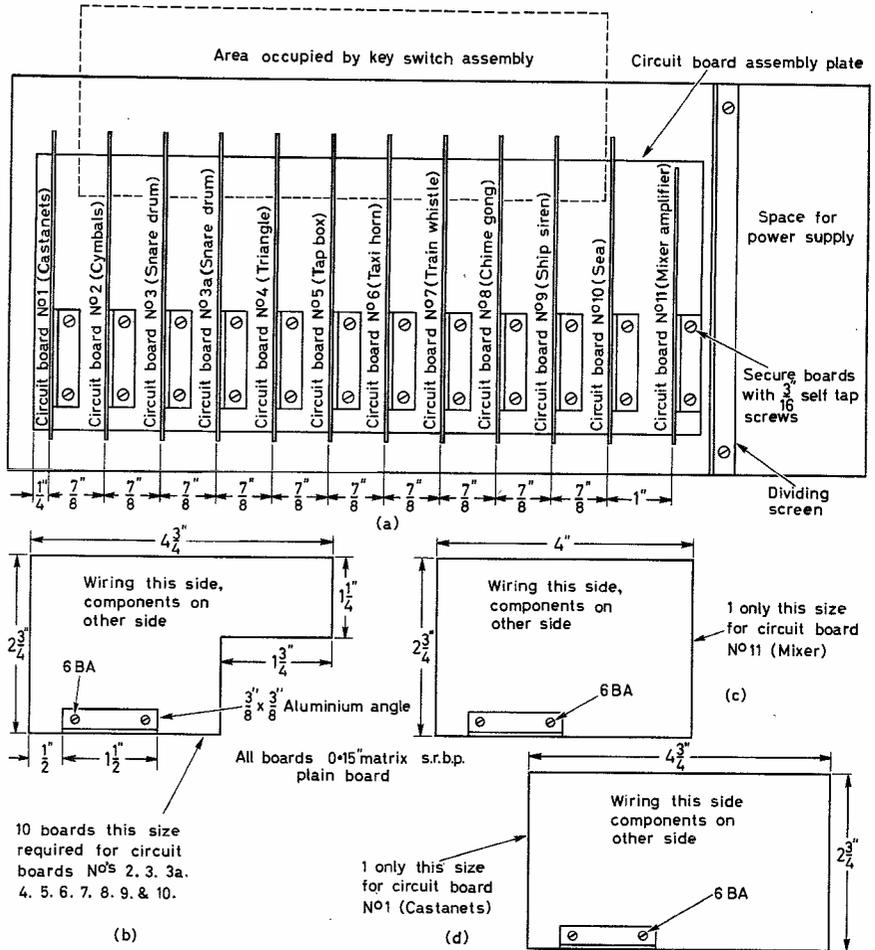


Fig. 2 (above): The positioning of the circuit boards and their sizes.

Fig. 3 (right): The circuit used with the noise generating diodes and the encapsulation of the Z1J.

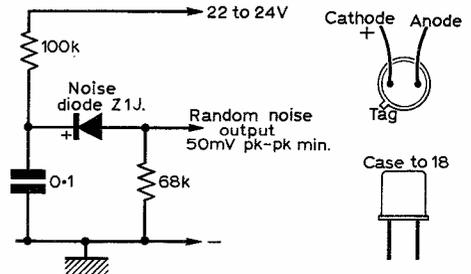
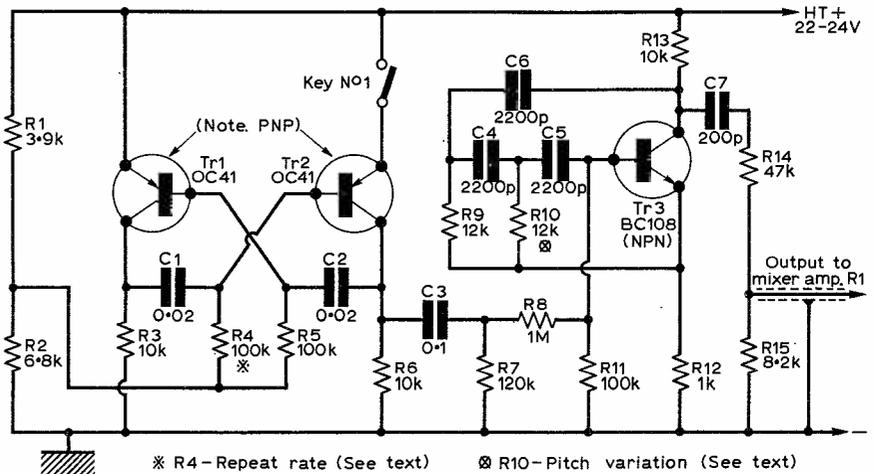


Fig. 4 (below): The castanets circuit.



supplied with the Contil case. There are 12 circuit boards and 10 of these are cut to shape and size as in Fig. 2b. The cutaway at the end of each board is to allow it to project over the key switch assembly as shown in Fig. 1b. The boards shown in Figs. 2c and 2d are for the mixing pre-amplifier and castanets circuits respectively.

Circuit Details—General

The schematic diagram, shows each of the circuits in block form and their final routing through to the mixer output pre-amplifier. In general each circuit consists of a basic tone oscillator, an envelope generator and a combined amplifier and voicing

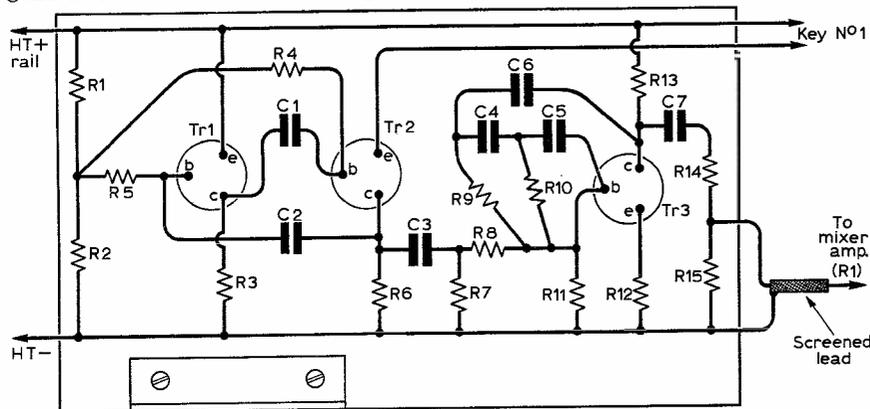


Fig. 5: The layout of the castanets circuit board.

circuit. Some of the circuits also have white noise generators. It is well known that all sounds have their own particular pitch and tonal characteristics as well as attack and decay (envelope) characteristics. It is for this reason that some of the circuits may be seemingly complex. In addition all the non-repeating sounds like the triangle, woodblock, taxi horn and train whistles, etc., must be produced once only regardless of whether the push button is simply depressed and instantly released or pressed and held down. Only the repeating sounds, i.e., the snare drum and castanets continue to sound whilst the key is held down. The keying circuits must not produce audible clicks and must restore instantly for a repetition of the sound.

The White Noise Generators

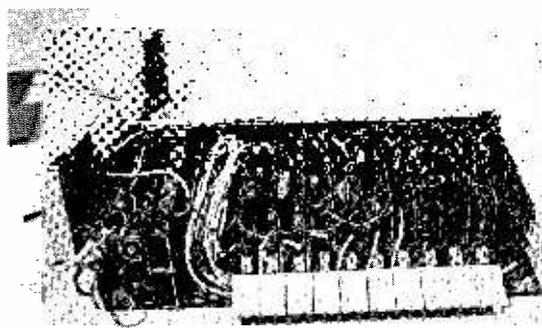
Many sounds have a noise component and notable are those of a cymbal and the snare drum. Steam train whistles have a fairly strong noise content and so also does the sound of the sea rolling up on the beach. This noise may in some instances have a definite pitch and in others no definable pitch. White noise has random frequency, amplitude and phase and audibly sounds like escaping steam, but when filtered can be made to assume a definable pitch. The production of white noise is not difficult and so called 'noisy' diodes will produce it, but only at very low amplitudes. To make any use of noisy diodes for the effects synthesiser would entail at least two amplifier stages just to build the noise up to a usable amplitude.

The writer has, therefore, arranged with Semitron Limited to produce and supply a special noise diode for the synthesiser circuit. This is known as "noise generator diode type ZIJ" and when connected in the circuit shown in Fig. 3 will produce not less than

50mV peak of white noise. Please note that the synthesiser circuits which have these noise generators will not operate with any other type of diode. Details concerning the suppliers and price, etc., are given in the components list.

Circuit for Castanets—No. 1

The circuits will be dealt with and published in order as in the layout shown in Fig. 2, i.e., Castanets No. 1, Crash Cymbal No. 2 and so on. The circuit for castanets is shown in Fig. 4 and the layout and component wiring in Fig. 5. In this circuit Tr1 and Tr2 are p-n-p transistors operated as a conventional multivibrator with a repetition frequency of approximately 15Hz. The repetition frequency can be adjusted by altering the value of R4 slightly one way or the other but for realistic effect the frequency should be as near 15Hz as possible. The waveform from Tr1 and Tr2 is applied to the emitter circuit of Tr3 which is a phase shift oscillator, biased to cut-off. This is tuned to oscillate at around 1500Hz and when triggered by Tr1, Tr2 produces the characteristic



An internal view of the completed sound synthesiser.

and slightly musical click of the castanets with a waveform like that shown in Fig. 10 (Castanets Circuit B). The triggering waveform from Tr1/Tr2 is shown in Fig. 10 (Castanets circuit A). The small value output capacitor (C7, 200pF) and R14/R15 between them form a combined voicing and attenuation network. The pitch of the castanet sound can be adjusted by slight variation of R10. The decay time, which is very short, can be adjusted by slight variation of R7.

Circuit for Crash Cymbals—No. 2

This is shown in Fig. 6 and the layout for components and wiring is given in Fig. 7. This circuit employs a Semitron ZIJ noise diode (ND1) and two transistors, Tr1 and Tr2. The noise generator runs continuously and the output signal at C4 is connected to the amplifier/voicing circuit, Tr2. This transistor is not connected to the supply and is, therefore, not conducting. When the key (No. 2) is depressed

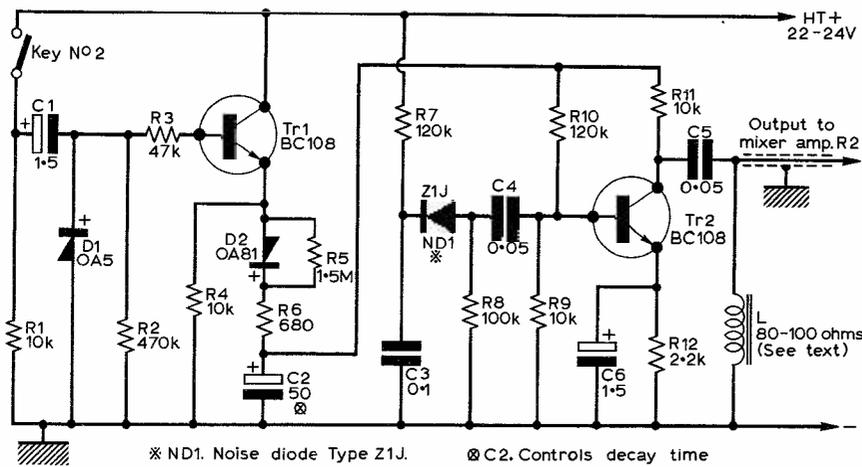


Fig. 6: The circuit of the crash cymbal.

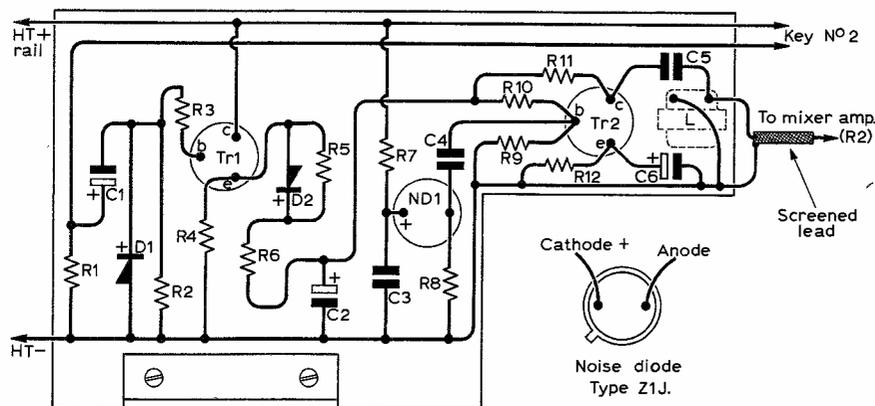


Fig. 7: The layout of the crash cymbal circuit board.

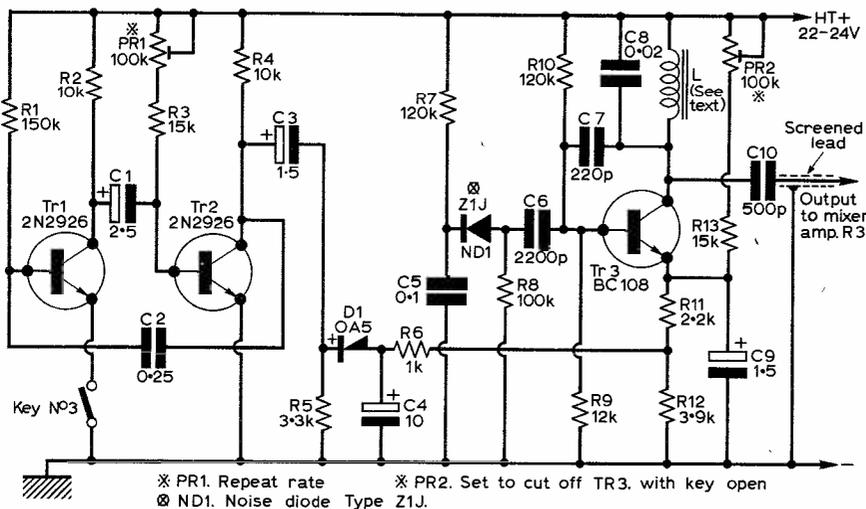


Fig. 8: The circuit of the snare drum synthesiser.

a pulse (Fig. 10 crash cymbal waveform A) is produced which immediately switches Tr1 so that C2 becomes charged to about two thirds of the supply potential. This allows Tr2 to conduct at a decaying rate lasting for about two seconds. The noise passed via Tr2 is filtered by the inductance L to achieve a slightly definable pitch.

The circuit should require little or no adjustment but the decay time can be modified by changing the value of C2; a larger capacitance for a longer delay time and vice versa. The output waveform is shown in Fig. 10 (crash cymbal circuit C). The inductance L can be derived from the secondary winding of a Henry's Radio driver transformer, type 033, which has a secondary d.c. resistance of 116Ω. Any small transformer or choke winding (iron cored) of around 100Ω d.c. resistance should suffice.

The Snare Drum Circuit—No. 3

This requires two circuit boards as in Fig. 9 which shows layout and wiring. The circuit is given in Fig. 8 and is a little more complex than those so far dealt with. When a snare drum is struck two basic sounds are produced (a) the strike tone of the drum stick on the drum head and (b) the noise of the snare wires. This generator produces both these sounds and, like the castanet circuit, produces a continuous repetition of the sound whilst the key is held down. The transistors Tr1 and Tr2 between them form a multivibrator with a repetition rate of approximately 20Hz. The repetition rate can be set accurately by the pre-set PR1. The waveform from Tr1/Tr2 triggers the amplifier/voicing circuit Tr3. This waveform is as shown in Fig. 10 (snare drum circuit A). When Tr3 conducts, noise from the generator ND1 is amplified and at the same time filtered by the inductance L and capacitor C8. However, Tr3 must be in a state of cut-off and this is achieved by the pre-set PR2. This should be adjusted

until continuous noise from the amplifier output is just stopped. When the key (No. 3) is actuated, Tr3 conducts at the repetition rate of Tr1/Tr2 and would normally only produce bursts of noise (the snares). The strike tone is produced by ringing due to the inductance L which is further assisted by a small amount of feedback to sustain the ring. This is done by means of the capacitor C7 between the collector

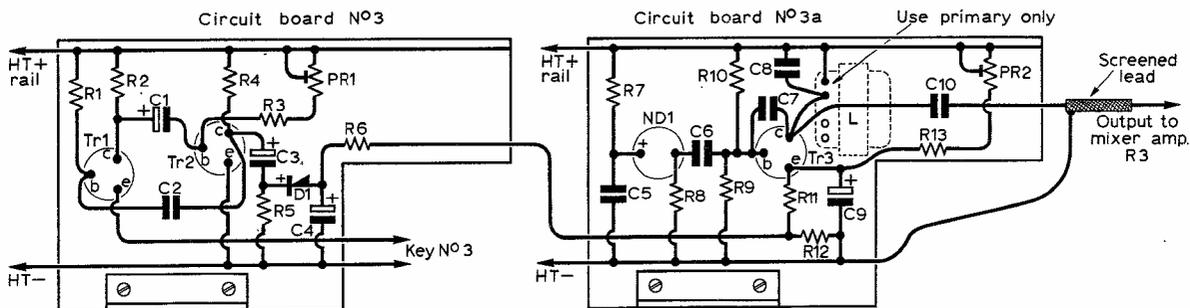


Fig. 9: The components layout of the snare drum circuit on the two boards.

★ components list

Case

Contil Mod-2 type G. Price £2.75 plus 22½p packing and postage. West Hyde Developments Limited, Ryefield Crescent, Northwood Hills, Northwood, Middlesex.

Panel Controls

Organ key switch assembly 10-way. Henry's Radio Ltd.
Volume Control 10k Ω log
Toggle on/off switch
Mains neon indicator, 240V

Miscellaneous

Plain Veroboard 0.15in matrix as Fig. 2. ½ x ¾ in aluminium angle (board supports). 16 s.w.g. aluminium (board assembly plate) as Fig. 1
Control knob for volume control

Castanets circuit No. 1

Transistors

TR1, TR2 OC41
TR3 BC108

Resistors

R1 3.9k Ω	R6 10k Ω	R11 100k Ω
R2 6.8k Ω	R7 120k Ω	R12 1k Ω
R3 10k Ω	R8 1M Ω	R13 10k Ω
R4 100k Ω	R9 12k Ω	R14 47k Ω
R5 100k Ω	R10 12k Ω	R15 8.2k Ω

All ½W, 10% tolerance

Capacitors

C1 0.02μF	C4 2200pF	C7 200pF
C2 0.02μF	C5 2200pF	
C3 0.1μF	C6 2200pF	

Crash Cymbal Circuit No. 2

Transistors

TR1, TR2 BC108

Diodes

D1 OA5
D2 OA81

Noise Diode

Type ZIJ (see below) Semitron Limited

Inductance (L)

Transformer type HR-033 Henry's Radio Limited

Resistors

R1 10k Ω	R5 1.5M Ω	R9 10k Ω
R2 470k Ω	R6 680 Ω	R10 120k Ω
R3 47k Ω	R7 120k Ω	R11 10k Ω
R4 10k Ω	R8 100k Ω	R12 2.2k Ω

All ½W, 10% types

Capacitors

C1 1.5μF	C4 0.05μF
C2 50μF	C5 0.05μF
C3 0.1μF	C6 1.5μF

Snare Drum Circuit No. 3

Transistors

TR1, TR2 2N2926
TR3 BC108

Diodes

D1 OA5

Noise Diode

Type ZIJ (see below) Semitron Limited

Inductance (L)

Transformer type HR OLI30 Henrys Radio Limited

Resistors

R1 150k Ω	R6 1k Ω	R11 2.2k Ω
R2 10k Ω	R7 120k Ω	R12 3.9k Ω
R3 15k Ω	R8 100k Ω	R13 15k Ω
R4 10k Ω	R9 12k Ω	
R5 3.3k Ω	R10 120k Ω	

Capacitors

C1 2.5μF	C6 2200pF
C2 0.25μF	C7 220pF
C3 1.5μF	C8 0.02μF
C4 10μF	C9 1.5μF
C5 0.1μF	C10 500pF

Pre-sets

PR1, PR2 100k Ω

Noise Diodes

A total of 5 special noise diodes type ZIJ are required for the complete synthesiser. These are available in quantities from 1 to 5 at 7/6d each plus 4s. post and packing regardless of the quantity ordered. Order direct from Semitron Limited, Cricklade, Wiltshire.

and base of Tr3, i.e., the circuit tries to oscillate whilst Tr3 is conducting. The waveform from the output should appear as shown in Fig. 10 (snare drum circuit B). The inductance L is the primary winding of a Henry's Radio transformer type HR-OL130. The secondary is not used.

The next article will deal with further circuits. It should be mentioned that all circuits will operate individually from a battery supply of 22V to 24V and, as each has an output of more than 100mV, they can be individually built and tested through an amplifier with an appropriate input sensitivity.

Will readers please note that the writer cannot provide circuits for other sounds or modifications of any description.

All the circuits to be published have been

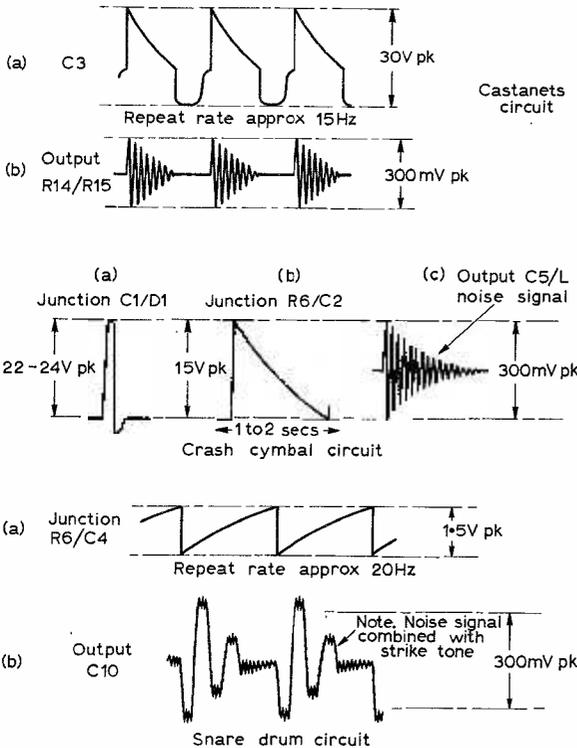
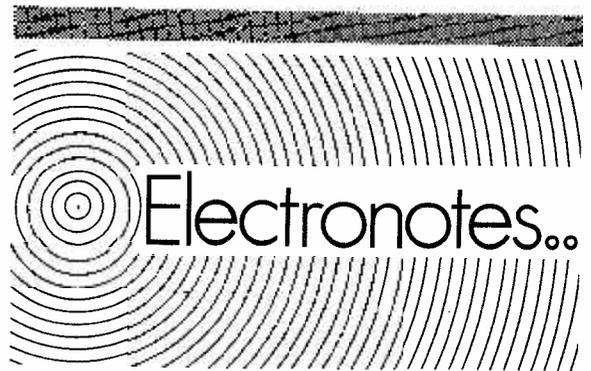
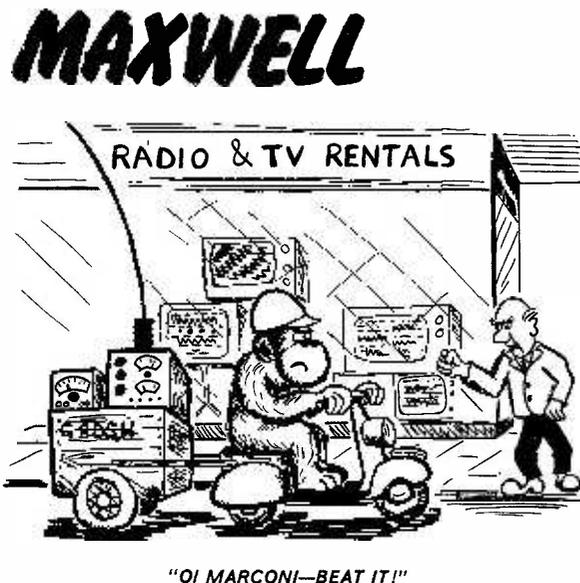


Fig. 10: Oscilloscope waveforms for the castanets, crash cymbal and snare drum.

thoroughly proved and the prototype electronic percussion and sound effects synthesiser was demonstrated at the *International Audio and Music Fair at Olympia, 1970*.

TO BE CONTINUED



S. GINSBERG

ELECTRONICS is moving at such a rate that it is often difficult to keep pace with every advance in the field. The purpose of this column is to keep the reader in touch with some of the many new devices and applications which come into this category. Almost every field of industry, from the production of motor cars and colour television sets to underwater guided weapons, uses some form of electronics and each month we will be discussing some device and/or its applications.

Lasers offer a good example. Most people will tell you that the word is a quick way of describing a beam of intense, coherent light. Ask what the device is used for and you will probably get references to James Bond or to hearing "rumours" about some form of death ray. Although the laser found it difficult to become accepted in its early life, uses are growing almost daily and it can be found employed in a wide variety of applications.

In America, it was desired to feed a big atom smashing machine with a device called a linear accelerator. The latter consisted of a tube some two miles in length. Problem was that the tube had to be in a straight line otherwise the particles being accelerated along it would strike the sides and lose energy. A laser beam allowed engineers to build the pipe such that it does not vary from a straight line by more than half a millimetre over the two miles. No other device known could have aligned the pipe so accurately.

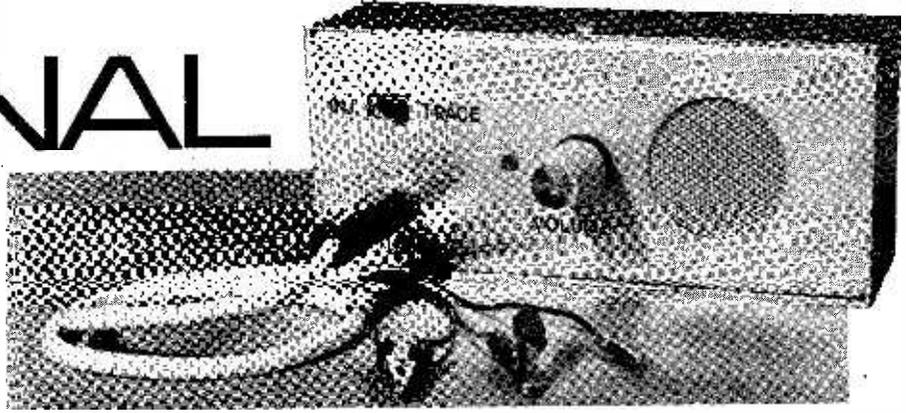
Accuracy is a very useful property of the laser. In one instance, a laser interferometer was carried in an aircraft which flew across a football pitch at many thousands of feet. The interferometer was able to detect discrepancies in the height of the goal posts.

In engineering, lasers are being used to burn holes in metal. Advantages are speed and a saving in drills. The latter would require regrinding at intervals which would depend upon the hardness of the metal being drilled. Surgery is another field which offers openings for the laser. The beam can be focused to a very fine point and used instead of the surgeon's knife. Great advantage here is that the beam is completely sterile, requiring no boiling or cleaning up after an operation—simply switch off.

Perhaps the best known use of the laser is in holograms. By using the laser beam as a reference source, a three-dimensional image can be stored on a two-dimensional medium such as a photographic plate. An extremely interesting application of this is in computers. Since the image is three-dimensional, information can be stored in layers, one behind the other.

SIGNAL

E. BUCKLAND



INJECTOR/TRACER

WHEN repairing radios or similar equipment, or even during original design work, signals continually need to be traced and it is also often useful to be able to inject a signal into a circuit. The usual trick of dabbing a damp finger at an early point in the amplifier is all very well but it doesn't give any idea of the actual amplification taking place.

The unit described here has been designed to trace both r.f. and audio signals in one mode and to inject an a.f. square wave in the other. It is a simple matter to design a high gain, reasonable quality amplifier that can be converted into a multivibrator with a double pole switch, and this is in fact all we are doing.

Originally, attempts were made to design an amplifier that would automatically detect r.f. signals but although this is fairly easy, normal a.f. sources were badly distorted. The quality of the amplifier is not over-important but it should be good enough to trace severe distortion in a circuit, and so this was abandoned in favour of a separate r.f. probe.

THE CIRCUIT—SIGNAL TRACER

The circuit of the signal injector/tracer is shown in Fig. 1. Three inputs are shown on the left; one chassis connection, one direct to the slider of VR1 via a d.c. blocking capacitor and the third via an additional germanium detector diode, D1.

VR1 is connected rather unusually; normally of course the input is applied across the total resistance of the control, the output being taken from the slider. The arrangement shown here, however, works perfectly well and is essential for controlling the output level of the injector which will be described later.

The high value of VR1 (for transistor work) enables an input impedance of at least 250kΩ to be achieved when VR1 is near its centre position; this high impedance input is very useful for certain work.

The top of the volume control is connected to the base of Tr1 through C2 which blocks the d.c. path. C3, a 0.01μF capacitor connected between the base of Tr1 and chassis, smoothes r.f. signals and in addition adds stability to the circuit. The high value of VR1 means that the base of Tr1 is almost 'floating'

and the high gain of the amplifier can lead to instability. C1 only goes to chassis in the Trace mode; it has quite a different function on Inject.

R2 acts as the collector load and R1 provides the bias.

The output is coupled to the base of Tr2 via C4, a 0.1μF capacitor. Even though Tr2 is a silicon type, it is essential to stabilise this stage by inserting R5 and C5 in the emitter. The quiescent current through this transistor can run away without them. Further d.c. stabilisation is provided by the base bias resistor of Tr2 being connected to the collector of that transistor rather than to the 9V rail.

In the signal Trace mode, the collector is switched to a high impedance loudspeaker as this avoids the need for an output transformer; a 40Ω one was used in the prototype but 75Ω or 80Ω types are more common and work just as well.

INJECT

When SW1 is thrown, C3, which previously damped

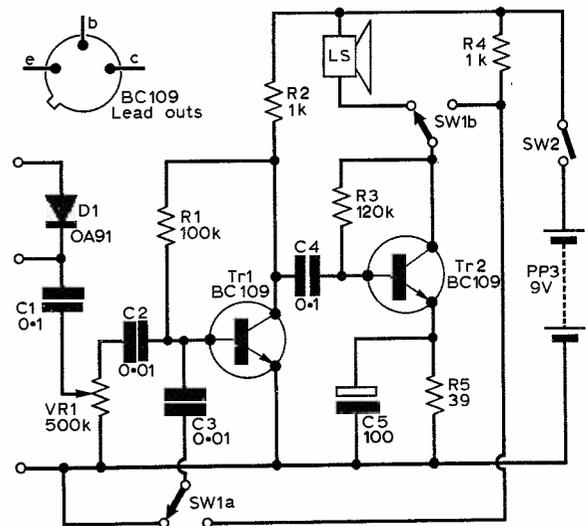


Fig. 1: The circuit of the signal injector/tracer.

high frequencies at the base of Tr1, is connected to the collector of Tr2 and the load of this transistor is replaced by a 1kΩ resistor rather than the loudspeaker.

Now the circuit becomes as in Fig. 2 and readers will have no difficulty in identifying this as a standard multivibrator. VR1 becomes an output level control rather than a volume control and allows the level of the injected signal to be altered to meet the particular need.

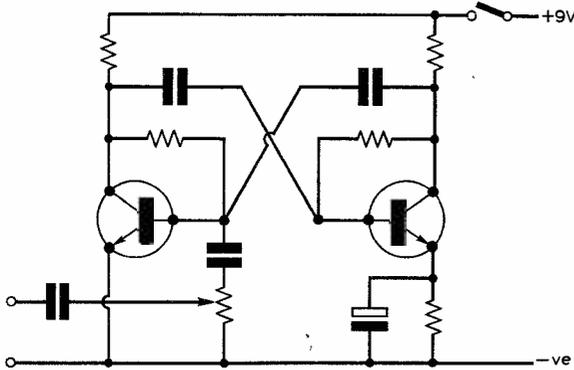


Fig. 2: The effective circuit on "inject".

In the Inject mode R5 and C5 serve no real purpose as the collector load of Tr2 is greatly increased but their presence doesn't hinder operations.

A multivibrator, of course, produces a square wave and this can be described as a particular frequency with all its harmonics. These harmonics reach way up into the r.f. region and traces of the one here were still evident at 100MHz. The fundamental frequency is about 1kHz and this is the note that will be heard on all frequencies.

In practice when viewed on a 'scope the waveform is not a square wave exactly but it does have a very, very rapid rise time which serves the same purpose.

CONSTRUCTION

All the components are built into a small lidded aluminium instrument case sized 6³/₈ x 2³/₄ x 1⁷/₈in. outside measurements available from H. L. Smith Ltd. Apart from the battery, which is held by means of a small bracket in the body of the box, all the components are mounted on the lid as shown in the photographs and drawings.

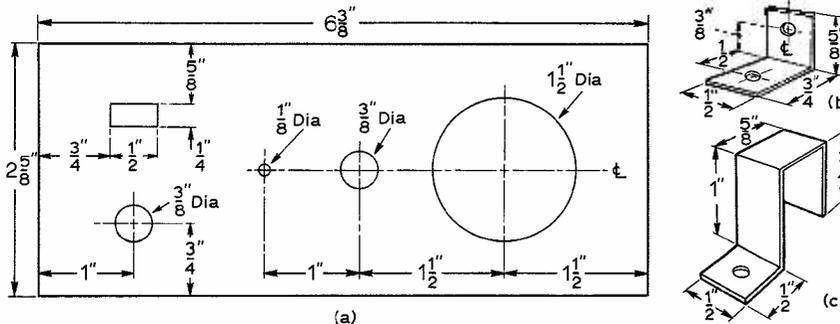


Fig. 3: The drilling of the lid and the construction of the brackets.

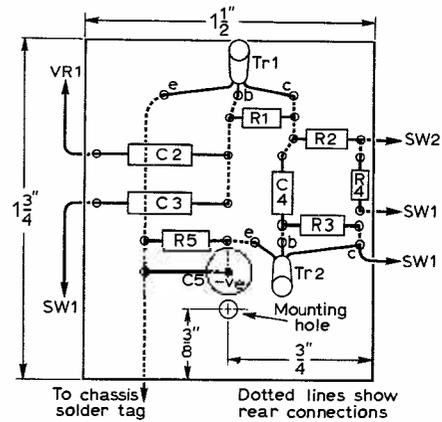


Fig. 4: The component layout on paxolin board.

The drilling details of the lid and the construction of the brackets are shown in Fig. 3.

The hole for the slide switch can be made either with a cold chisel or by drilling a series of holes and filing. The hole for the loudspeaker can be made similarly or with a 1 1/2in. diameter chassis cutter.

Loudspeakers without mounting holes are always difficult to fit, especially if expanded metal is fitted over the face as is done here, so it was decided to glue both these permanently in place. 'Araldite' is the only adhesive strong enough for this and since some was going to be mixed anyway, it was decided to glue SW1, the small slide switch, also.

The output/input socket has got to have three connections and a stereo jack and socket accomplish this, D1 being connected on the terminals of the socket.

The component board is mounted at right angles to the face and held by the small bracket shown

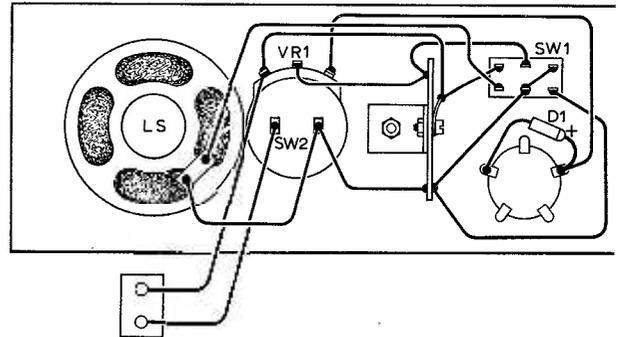


Fig. 5: The wiring of the signal injector/tracer.

in Fig. 3b. VR1 is fitted between this and the loudspeaker.

A plain sheet of paxolin can be used as the component board but the author prefers plain Veroboard (that is without the copper strips). The component layout is shown in Fig. 4.

Wires from the component board should be sol-

dered at the same time as the components; this will greatly help when wiring up later. The wiring is shown in Fig. 5.

Three probes are required as mentioned before

★ components list

Resistors :

R1 100k Ω
R2 1k Ω
R3 120k Ω

R4 1k Ω
R5 39 Ω

Capacitors :

C1 0.1 μ F
C2 0.01 μ F
C3 0.01 μ F

C4 0.1 μ F
C5 100 μ F 6V

Semi-conductors :

Tr1 BC109
Tr2 BC109
D1 OA91

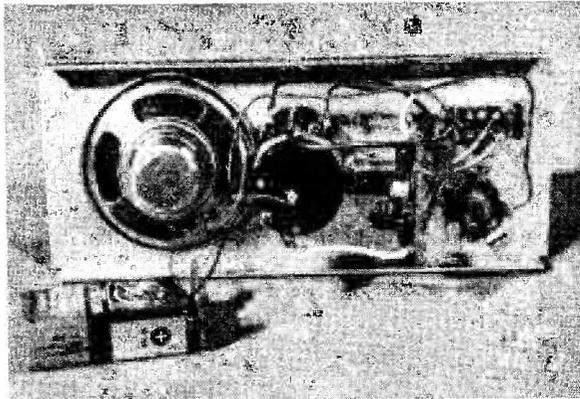
Miscellaneous :

VR1 500k Ω log. pot with switch
L.S. 80 Ω loudspeaker, 2 $\frac{1}{2}$ in.—see text
SW1 Miniature two-pole, two-way slide switch
PP3 9V battery
Plain Veroboard, battery clips, aluminium chassis (H. L. Smith), stereo jack plug and socket, three croc clips, 18in. mains lead

and an 18in. length of three-core mains lead was

used, the outer covering of the lead being stripped back about 4in. at the probe ends.

Crocodile clips are fitted to the ends of these wires, each of which will be colour coded. It is worthwhile selecting good croc clips for a unit of this sort as



Internal view of the completed project.

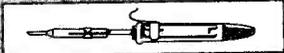
they will be frequently used. Crocodile clips vary enormously in quality and ones which don't stick but grip firmly should be chosen.

Current consumption is in the order of 18 to 20mA in the completed unit and the specified battery, a PP3, will give this perfectly well.

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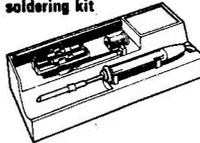


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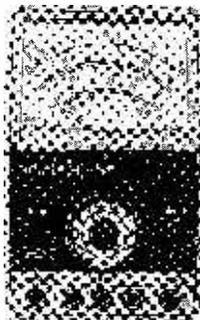
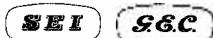
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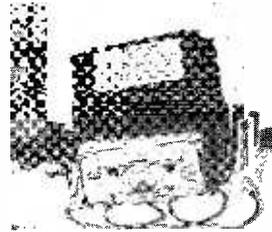
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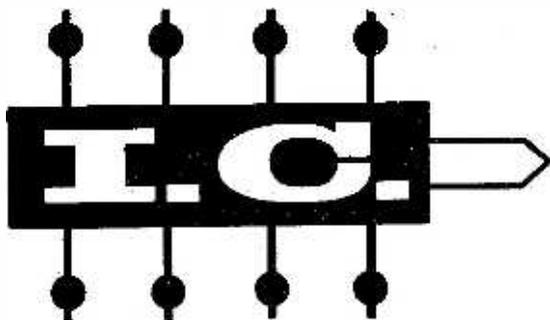
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Number 17

National Semiconductors (USA) AM TUNER LM 372

IN the February 1970 issue of "P.W." the Mullard type TAD100 a.m. tuner i.c. was reviewed, an article which attracted considerable reader interest, to judge by the number of letters received. However, it does appear that supplies of the filter unit designed by Mullard to operate in conjunction with the TAD100 have dried up, perhaps as a result of the adoption of the unit in several commercial radios and the consequent industrial demand.

This month an alternative a.m. circuit is discussed, the National Semiconductors (U.S.A.) type LM372, available in the U.K. through the distributors, Rastra Electronics Ltd., 275 King Street, Hammersmith, London W.6, or Athena Semiconductors Ltd., 140 High Street, Egham, Surrey.

Application

The block diagram, Fig. 1, indicates the function of the LM372 in an a.m. receiver. Separate frequency changer and audio sections are required, but the i.c. takes over the high gain amplification of the i.f. signal, the determination of receiver selectivity through an associated filter, a.m. detection with audio preamplification and the provision of an automatic gain control to cope with variations in signal level or fading.

The device can operate with signal frequencies in the range 50kHz to 2MHz, which of course spans the standard a.m. intermediate frequency of 470kHz, and even the 1.6MHz sometimes found in communications receivers. Further, the medium wave broadcast band of 540kHz to 1.6MHz lies within the capability of the circuit, making possible an i.c. t.r.f. receiver of superior performance.

Operation

First, some consideration of the operation of the LM372 in a superhet i.f. application. It will be noted that, unlike the standard circuit using discrete transistors, the gain and the a.g.c. functions are separated. The a.g.c. action operates on the i.f. signal immediately it enters the i.c., since transistors Q2 and Q3 form a voltage controlled attenuator, Fig. 2.

When no a.g.c. control voltage is returned from the detector stage, Q2 operates as an emitter follower, with, of course, unity gain. As control is applied Q3 begins to conduct, shunting part of the signal, while the emitter resistance of Q2, in series with the signal, increases producing further attenuation up to a maximum of 69dB. The unit is therefore capable of operation with any input signal from 5 microvolts to greater than 50 millivolts.

The signal is passed from the a.g.c. stage through an external capacitor (or tuned filter, if desired) to the high gain direct coupled amplifier, basically Q6-Q8 and associated components. Q9 and Q10 are voltage regulators for the gain transistor load resistors; they replace the decoupling components of a conventional transistor unit.

Since this technique is used throughout the circuit, it also compensates for falling battery voltage; the current drawn does not depend directly on supply voltage, but remains relatively constant while the applied voltage can vary from 15 volts down to 6 volts. In amateur applications a 9 volt supply will be a popular option.

The detector stage also is an advance on the familiar diode. It is a variation of a system developed for use with operational amplifiers, in which a diode

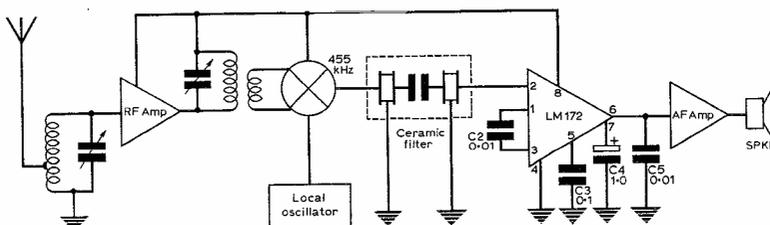
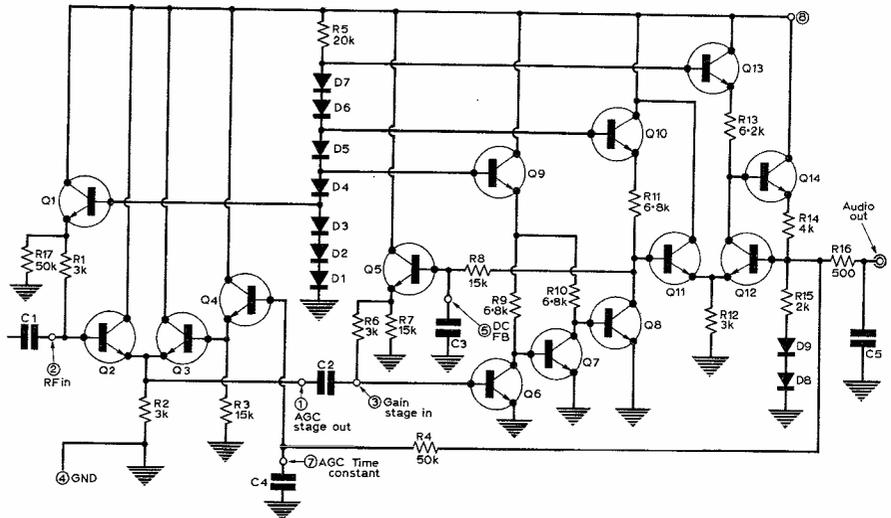


Fig. 1 Block diagram of a superhet receiver utilising the LM372 (not LM172 as indicated).

Fig. 2 Circuit of the LM 372 i.c. Note Q1-Q14 are not discrete components but are encircled for clarity.



is used as the feedback element. It avoids the distortion inevitably introduced by a simple diode due to the requirement for a small forward bias to initiate conduction, and the non-linear nature of its characteristic curve.

With the diode in a feedback loop, though, it will set its own bias, and the audio output will follow the modulation envelope exactly. The reader will identify the differential pair, Q11 and Q12, as the operational amplifier in this case, with an emitter follower providing the diode feedback effect. The detector provides a low output impedance, ideal for driving further transistor stages, and a voltage gain of 3, determined by the integrated resistors R14 and R15.

Practical Considerations

As for practical construction details, the only point to remember is that long external connections or crossed wiring can lead to instability through their capacitive effect, and should be avoided. The manufacturer recommends a transfilter for the input circuit; the Clevite 3-terminal unit, type TC-01A is freely available from advertisers in this magazine, and is quite suitable.

Indeed, for the perfectionist, a second similar transfilter can be used between pins 1 and 3 of the i.c. as an interstage coupling unit. The i.c. itself is

presented in a standard TO-5 can, with pin 8 indicated by a spigot.

The use of the LM372 as a t.r.f. or straight receiver, without oscillator or i.f. stages, but amplifying and detecting the radio frequency directly, was mentioned above. The input emitter follower loads the aerial circuit only lightly, so that the selectivity of the set, while not of superhet standard, at least rates as superior to the normal t.r.f.

An interstage network, tuned by a second section of the tuning capacitor can be inserted between pins 1 and 3; this would improve selectivity further, but requires careful screening. Any commercially available ferrite rod aerial and its matching tuning capacitor may be used; Fig. 3 shows a tapped aerial coil, in use with capacitive interstage coupling and followed by a simple audio amplifier. ■

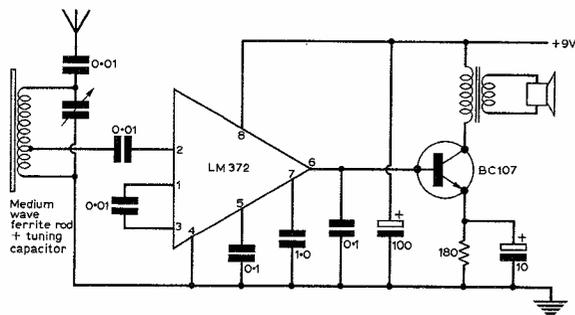


Fig. 3 Use of the LM372 in a t.r.f. receiver.

TELEVISION

We are pleased to inform readers that our sister journal Television has now resumed publication following settlement of the recent printing dispute.

Issue dated **January 71** was published on January 22

Issue dated **February 71** will be published on February 12

Issue dated **March 71** will be published on March 8

We apologise to readers of Television for the loss of the December 70 issue and late appearance of subsequent issues.

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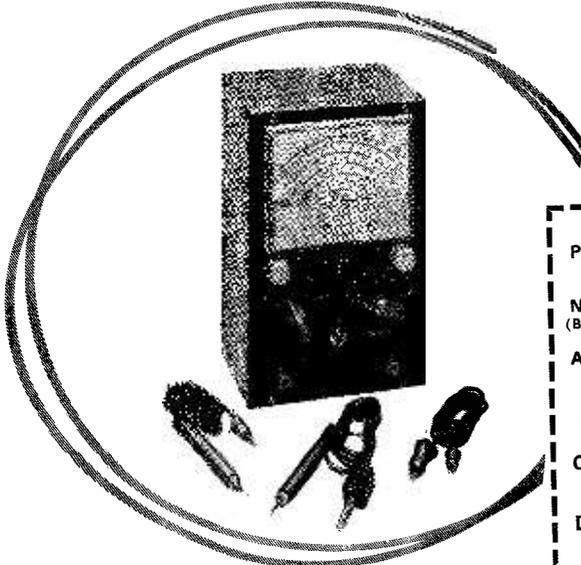
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TWIN GANG 40 205pF +179pF, 11/-; Slow motion drive 365 +365 with 25 +25pF. 11/-; 500pF slow motion, standard 9/-; small-3 gang 500pF 22/-; SHORT WAVE. Single 55pF 11/-; CHROME TELESCOPIIC AERIAL, swivel base, 23in. 4/-; TUNING. Solid dielectric. 100pF, 500pF, 7/- each. TRIMMERS. Compression 30, 50, 70pF, 1/-; 100pF, 150pF, 1/7; 250pF, 1/7; 600pF, 760pF, 2/-; 1000 pF, 2/-
RECTIFIERS. 0.5A, 1A, 2A, 3A, 5A, 10A, 15A, 20A, 30A, 50mA 7/7; 85mA 9/7. SILICON BVY13 6/-; BVY100 6/-
Full wave Bridge Rectifiers 75mA 10/-; 150mA 10/7.
EX-GOVERNMENT RECTIFIERS 250v. 200mA. 6/-
NEON PANEL INDICATORS 250V AC/DC Red or Amber 4/-
RESISTORS. Preferred values, 10 ohms to 10 meg. 1/2 w. 1 w. 20% 3d.; 2 w. 1/4/-
HIGH CAPACIT. 10 v. 20 10 ohms to 10 meg., 2/-
Ditto 5% Preferred values 10 ohms to 10 meg. 9d.
WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt, 10 ohms to 100K. 2/- each; 2 1/2 watt. 1 ohm to 8.2 ohms 2/-

Q MAX CHASSIS CUTTER

Complete; a die, a punch, an Allen screw and key
3in. 16/7 1in. 17/7 1 1/2in. 19/7 1 3/4in. 24/- 2 1/4in. 44/8
3 1/2in. 16/7 1in. 19/7 1 1/2in. 20/7 1 3/4in. 29/- 2 1/4in. 57/8
3 1/2in. 16/9 1 1/2in. 19/7 1 3/4in. 21/7 2in. 39/9 1in. sq. 38/7

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Super quality small size 1 1/4 x 1 1/2in. plus spindle 1 1/4 x 3in. 365 + 15pF with 25 + 25 pF. British made. Plastic dust cover. Single motion drive. 6.1. Plastic dust cover. 6BA tapped front fixing. **10/-** Post Free



MAINS TRANSFORMERS Post 5/- each

250-0-250 50 mA. 6.3 v. 2 amp, centre tapped . . . 22/-
250-0-250 80 mA. 6.3 v. 4 amp. 28/-
250-0-250 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a. or 5 v. 2 a. 38/-
350-0-350 90 mA. 6.3 v. 3.5 a. 6.3 v. 1 a. or 5 v. 2 a. 38/-
300V-300 v. 100 mA. 6.3 v. 4 a. C.T.; 6.3 v. 2 a. 50/-
MINIATURE 200 v. 20 mA. 6.3 v. 1 a. 2 1/2 x 2 1/2in. 15/-
MIDGET 200 v. 45 mA. 6.3 v. 3 a. 2 1/2 x 2 1/2in. 15/-
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Ditto tapped sec. 1.4 v., 2, 3, 4, 5, 6.3 v. 1 1/2 amp. 16/-
GENERAL PURPOSE LOW VOLTAGE. Tapped Outputs 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. at 2 amp. 28/-
1 amp. 6, 8, 10, 12, 15, 18, 20, 24, 30, 40, 45, 60, 38/-
AUTO TRANSFORMERS 0-120, 0-240, 0-360, 0-480, 0-600, 0-720, 0-840, 0-960, 0-1080, 0-1200, 0-1320, 0-1440, 0-1560, 0-1680, 0-1800, 0-1920, 0-2040, 0-2160, 0-2280, 0-2400, 0-2520, 0-2640, 0-2760, 0-2880, 0-3000, 0-3120, 0-3240, 0-3360, 0-3480, 0-3600, 0-3720, 0-3840, 0-3960, 0-4080, 0-4200, 0-4320, 0-4440, 0-4560, 0-4680, 0-4800, 0-4920, 0-5040, 0-5160, 0-5280, 0-5400, 0-5520, 0-5640, 0-5760, 0-5880, 0-6000, 0-6120, 0-6240, 0-6360, 0-6480, 0-6600, 0-6720, 0-6840, 0-6960, 0-7080, 0-7200, 0-7320, 0-7440, 0-7560, 0-7680, 0-7800, 0-7920, 0-8040, 0-8160, 0-8280, 0-8400, 0-8520, 0-8640, 0-8760, 0-8880, 0-9000, 0-9120, 0-9240, 0-9360, 0-9480, 0-9600, 0-9720, 0-9840, 0-9960, 10000, 10200, 10400, 10600, 10800, 11000, 11200, 11400, 11600, 11800, 12000, 12200, 12400, 12600, 12800, 13000, 13200, 13400, 13600, 13800, 14000, 14200, 14400, 14600, 14800, 15000, 15200, 15400, 15600, 15800, 16000, 16200, 16400, 16600, 16800, 17000, 17200, 17400, 17600, 17800, 18000, 18200, 18400, 18600, 18800, 19000, 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104200, 104400, 104600, 104800, 105000, 105200, 105400, 105600, 105800, 106000, 106200, 106400, 106600, 106800, 107000, 107200, 107400, 107600, 107800, 108000, 108200, 108400, 108600, 108800, 109000, 109200, 109400, 109600, 109800, 110000, 110200, 110400, 110600, 110800, 111000, 111200, 111400, 111600, 111800, 112000, 112200, 112400, 112600, 112800, 113000, 113200, 113400, 113600, 113800, 114000, 114200, 114400, 114600, 114800, 115000, 115200, 115400, 115600, 115800, 116000, 116200, 116400, 116600, 116800, 117000, 117200, 117400, 117600, 117800, 118000, 118200, 118400, 118600, 118800, 119000, 119200, 119400, 119600, 119800, 120000, 120200, 120400, 120600, 120800, 121000, 121200, 121400, 121600, 121800, 122000, 122200, 122400, 122600, 122800, 123000, 123200, 123400, 123600, 123800, 124000, 124200, 124400, 124600, 124800, 125000, 125200, 125400, 125600, 125800, 126000, 126200, 126400, 126600, 126800, 127000, 127200, 127400, 127600, 127800, 128000, 128200, 128400, 128600, 128800, 129000, 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154200, 154400, 154600, 154800, 155000, 155200, 155400, 155600, 155800, 156000, 156200, 156400, 156600, 156800, 157000, 157200, 157400, 157600, 157800, 158000, 158200, 158400, 158600, 158800, 159000, 159200, 159400, 159600, 159800, 160000, 160200, 160400, 160600, 160800, 161000, 161200, 161400, 161600, 161800, 162000, 162200, 162400, 162600, 162800, 163000, 163200, 163400, 163600, 163800, 164000, 164200, 164400, 164600, 164800, 165000, 165200, 165400, 165600, 165800, 166000, 166200, 1

SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE first report this month comes from a new contributor, **Ian Hamilton** of Ayrshire. Ian used his Ekco Zodiac domestic receiver and 'Joy-stick' antenna to hear the following stations:

- 6010 Rome, Italy in English at 0100 to 0135
- 6025 Lisbon, Portugal from 0200 to 0245
- 15115 *WIBS*, Grenada in English, 2000 to 2130
- 15185 Lagos, Nigeria from 0530 to 0730
- 17710 Bucharest, Rumania at 1300 to 1330
- 21460 *HCJB*, Quito, Ecuador from 1930 to 2000
- 21680 Melbourne, Australia, 0800 to 0900

Roderick J. Downes of Bournemouth does not mention what equipment he has but I assume that he used more than his ears to hear:

- 5920 *Radio Kiev*, Ukrainian SSR, English, 1930
- 11960 *Radio Australia* in English at 0645
- 12175 *Radio Tehran*, Iran in English, 2000-2030
- 15115 *WIBS*, Grenada in English from 1945-2130
- 17845 *WNYW*, USA at 1700. // with 21525

A. J. J. Trelinski of Rugby used his Skyrover Mark II and 50 foot long wire in addition to his ears and heard:

- 4940 *Radio Abidjan*, Ivory Coast at 2300
- 9670 *Radio Ceylon* in English at 2115
- 9680 *All India Radio* in English at 2100
- 9805 *Radio Cairo*, Arabic, Fr., It., Eng., 1955

Maurice Williams of Sleaford is another reporter who does not mention what equipment he has but he heard the following:

- 5047 *Radio Togo* in French at 2130
- 5050 *Radio Singapore* in English at 1540
- 9690 *WNYW*, USA in English at 2130
- 15195 *VOA*, Monrovia, Liberia, English at 2030
- 21540 *Radio Australia*, English at 1000

Nigel Milner of Sutton Coldfield used his Invicta domestic superhet and 35 foot long-wire to hear some interesting stations including:

- 15240 *Radio Sweden*, music at 1400
- 17705 *Radio Havana*, Cuba in English at 2010
- 17720 *WINB*, Red Lion, USA, English at 1900
- 17885 *HCJB*, Quito, Ecuador, English news at 2000
- 17895 *Radio Portugal*, Lisbon, close-down at 0900
- 17900 *Radio Bucharest*, Rumania, Eng. news at 1115

Terry Gibbs of Swindon used his Murphy 'Overlander' Receiver and 120 foot long-wire to hear the following:

- 6030 Muhlacker, Germany in German, 0800-1120
- 6170 Seoul, South Korea from 1300 to 1500
- 6255 Schulungssender, Austria from 1830 to 1903
- 7255 Kuwait B.S. in Arabic at 2115
- 11880 *Radio XERH*, Mexico at 0800
- 11965 *Radio Australia* from 0830 to 0915

All reports please to me at 5 Ranelagh Gardens, Cranbrook, Ilford, Essex, by the 17th of the month.

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

DX News

Information in the form of news items has been sent in by **Roy Patrick** of Derby (RP) and **John H. Saunders** of Wellington, New Zealand (J3).

ARGENTINA *Radio Exterior*, Argentina has been heard with a clear signal at 0600, the frequency was 11780. (JS.)

BOLIVIA *Radio Fides*, CP72, was noted with a good signal at 1058 on 4845. The station has moved, as stated in a verification letter, from 4850. (JS.)

CEYLON *Radio Ceylon* in Colombo is using the frequency of 17830. The English programme is aired at 1100. At 1130 the broadcast is in local languages then at 1145 the programme reverts to English with close down at 1200. (JS.)

CUBA *Radio Havana*, Cuba, broadcasts to Europe in English from 2010 to 2140 on 17705. (RP.)

GUINEA (EQUATORIAL) *Radio Santa Isabel* has been noted at around 1910 on 6250. The station has an English programme from 1900 and this includes a news bulletin at 1930. (JS.)

IRAN *Radio Tehran*, Iran continues to be heard using the off-band frequency of 12176, at present it is received with English news at 2000. (JS.)

ISRAEL *Radio Jerusalem* on 9624 has been heard with a very good signal at 2100 in English (RP.)

LUXEMBOURG *Radio Luxembourg* on 6090 has been noted with a very strong signal from time to time. This could be the new short-wave transmitter which has been promised for some time. The new transmitter is of 250kW and another transmitter of the same power is to be added in 1971. (RP.)

MONACO *Radio Monte Carlo International* has an English programme from 2300 to 0200 from December 1st. The two frequencies used are 6035 and 7135. (RP.)

NIGERIA *Radio Nigeria* from Enugu on 7305 has been heard opening with drum-beats at 0500. The station was also noted with popular music and news at 0530. (JS.)

PERU *Radio Cuzco*, OAX7A on 6250 now closes at 0400 on weekdays and at 0515 on Sundays.

Radio Tahuantisuyo, OAX7C on 6175 signs-off at 0500. This transmission is mixed with a Brazilian station, ZYV74, on the same frequency and later suffers interference from ORTF, Paris which signs-on at 0500.

Radio Villarica, OAX5V on 4885 closes at 0500. Before sign-off the station relays the recorded sound of Radio Victoria in Lima, which uses the familiar 'V' morse sign as its interval signal. (JS.)

SAUDI ARABIA *Radio Jeddah* has been heard on 11855 from 1900 until 2000. (RP.)

SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz ● Times in GMT

IT is surprising what you can do without a receiver. If you live in or near Cambridge then all you will need is a pair of headphones. Sink two copper rods (as long as possible) into the ground about 20 feet apart and connect the headphone leads one to each rod. Callsign to listen for is G9BIB who has a special licence to carry out experiments at very low frequencies through the earth. Technical information received points to a c.w. signal at 1kHz with the transmitter running at around 25W. (Worms with BRS numbers please note.)

News has arrived of a DX-type net on Topband. Friday nights from 2200 onwards on 1.829MHz±1kHz will be all you need tell your receiver. This is a really splendid idea and I will be pleased to hear what you can hear. One thing is almost certain. You will hear a number of Lids calling CQ on this frequency, having cross-town natters and running endless tests calling "Haallo" in the mike with some 500 per cent mod. If you do hear these Lids please note that time bombs should be sent to their home addresses and not to G3JDG or Practical Wireless!

Good news for the h.f. DX types. **Gus Browning** is reported as having an AC5 licence granted so we should hear a squeak or two from Bhutan. But don't be surprised if Gus, home callsign W4BPD, doesn't pop up from other exotic places. He is well worth listening out for if only to hear some first-class operating and to discover where he will be located next.

Letters arriving this month have had their share of interesting info. **J. Sparrow** (N.W.10) has a CR70A with an end fed at 40ft. He reports hearing IILCF in QSO with G3ZGO using slow-scan television.

Tim Thornton (Berks) bemoans the characters who seem bent on trying to disrupt DX nets on 3.5MHz. Wouldn't it be nice if every time someone did something stupid on the amateur bands, he got a couple of thousand QSL cards from irate s.w.l's. pointing out the crime?

Sentence of the month award goes to **J. Young** (Surrey) who writes, "I know s.s.b. only takes up half the space of a.m. but why don't more people use a.m. on the DX bands?"

Complaints from many l.f. fans who say that 3.5MHz is a good DX band but that reception is made extremely difficult by local stations who call CQ on top of DX. A listen first would often avoid this but there are times when it appears that people just switch on the TX and blast.

Spies inform that the prefix for Norwegian Antarctica and Bouvet Island now appears to be 3Y3. Back on 3.5MHz, **R. Squires** (Glamorgan) hints at hordes of DX loitering around 0930hrs on Saturdays. He claims success with perseverance but says his gear is "primitive". Wait till you get that new cat's whisker OM.

J. Moore (Leicester) confesses that he didn't realise just what went on below 1850kHz. Things like: DKØKC, DLICF, DL8CM, GM3PFQ/A, HB9NL,

OK1ATY, OL1ANE, PAØCC. Gear in use a CR100/2, 130ft. long wire and an a.t.u.

C. Manuel (Kent), six-valve homebrew plus sixty feet of wire wound round the loft, heard some goodies on 3.5MHz. These include: FB8XX, HK3AVK, HK6BRK, JW8IL (Bear Island), KL7GDU, KP9ACL, K3NPV, K9TZX, T2CMF, VE1AJI, VE2BAR, VE3PT, VE8YL, VU2BEO, W2MCM, W3FPX, W4EKA, W9YT, ZC4IK, ZS1MH, 3A3EE.

J. Hickman (Hants) gives a list of stations heard on an "old Government receiver". (Does this imply that one must labour hard to hear anything?). Log for 14MHz s.s.b. reads: AX3AMN, AX4NB, AX9XK, JA1KSO, JR4FGW, KH6BB, KX6BQ, MP4TCS, OA9KAZ, PJ2CC, PY2ATG, VK2ARG, VK9SM, VS9SM, ZD7SD, ZM2PX, ZM3GS, ZM6JBR, ZP5XE, ZS4AJ, 9H1CD, 9Q5AB, 9Q5GG. Antenna is a 75ft. long wire at 30 feet.

"I am 13 years old" warns **R. Mortimore** (Glamorgan). His letter also informs of the H.A.C. DX receiver plus amplifier and a 14MHz dipole hidden in the loft. Tunes in the headphones from: FP8CS, FP8CT, K2GGB, PY1CAD, SV1CK, VE1ATP, VE3BZK, VE7HP, WA6ZZK, YV1LA.

C. Henderson (I think) is fifteen and lives in Kent. Gear in use is a B40 receiver, a 75ft. end fed and the P.W. frame aerial which, claims master Crispin, rakes in DX on ten metres. (Charles Molloy shall here of this).

A peep at 14MHz revealed signals from: AP6CG, AX3MM, AX7GK, AX7RX, CT3AS, EA4CX, EP3XL, KH6GKE, OA7PI, SV1AN, SV1DB, VEØNEF, VE1ADV, VE2BVP, VK2VQ, VK3WX, W6CLS, W7NG, YBØAAD, YTINPF, YT2GE, ZL2BDG, ZS1JP, ZS2MI, ZS6BBK, 9Q5AB, all on s.s.b.

Ten metres, using the you-know-what aerial, provided s.s.b. squeaks from: CR6MT, CT1LN, EA7DB, EL2AW, PY2HY, VK5QG, VS6CH, VU2CK, W5ILR, ZB2BV, ZE1DP, ZL3RB, ZS6BDO, 4X4AB, 9E3USA, 9H1AF, 9J2BR.

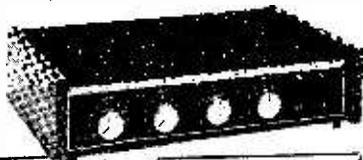
P. Beeson (Staffs), HA500, 67ft. end fed, logged these on ten metres s.s.b.: AX5DE, AX6LM, K2BQO, OZ5KF, VE3EWY, ZC4JW, ZE3JO, 7Q7AA.

A. White (Bucks), SP400 plus G3TYJ 2-transistor preselector and ten metre dipole bagged: CEØAE, FR7ED (Reunion Island), JX3LY (Spitsbergen), KC6ES, MP4QUQ, PY7OS, RA3ACQ, U18AJ, 4X4RQ/MM, 5Z4ZJ., 9Y4AA. On 144MHz, A. White Esq. used an SQ-2 receiver and an 8-over-8 at a nearby amateur's QTH. Stations received included DJ4HI, DJØTL, DK2ER, F1SS, F6AAQ, G8CCE, G3GZJ, GC8ECL, HB9AEN, PAØSHT.

Contests

Contests for February include: 6-7, ARRL DX contest (phone section); 13-14, Topband contest; 20-21 ARRL DX contest (c.w. section); 27-28, REF, contest (phone). March 6-7 is the second part of the ARRL DX phone section contest.

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED PRINTED CIRCUIT BOARD FOR EASY CONSTRUCTION

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board, attractive front panel, knobs, wires, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response $\pm 3dB$ 12-30,000 Hz Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: $\pm 3dB$ 12-15,000 Hz. Bass boost approx. to $\pm 12dB$. Treble cut approx. to $-16dB$. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall Size 12" w. x 8" d. x 2 1/2" h.

Fully detailed 7 page construction manual and parts list free with kit or send 15p plus large S.A.E.

PRICES
AMPLIFIER KIT £10-50 P. & P. 15p
POWER PACK KIT £3-00 P. & P. 25p
CABINET £3-00 P. & P. 25p
(Post Free if all units purchased at same time)

Full instructions and parts list included. Also available ready built and tested £20-50. Post Free.
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discosque use, etc.

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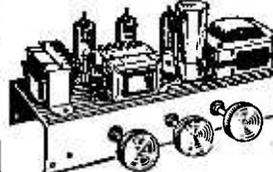
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“TO business that we love we rise betimes, and go to it with delight.”

So said Antony, according to the Bard, and so say all of us who like to roam the waves in search of the intriguing, the instructional or the downright insolent. You would be surprised what you get on top band some nights! Henry has not yet got around to calling his rig Cleopatra, despite its often exhibiting decidedly feminine traits. But he certainly does rise betimes—and lately has stayed risen well into the small hours.

The reason for this burning of the midnight oil has been the receipt of a multiband, high-powered, roam-the-globe receiver for review and a reawakening of lost enjoyments as Henry tries it out.

If the rest of the family are not to share my pleasure, willy-nilly, and if the neighbours are to be maintained in the state of uneasy truce that the average radio and hi-fi fanatic has to live with, such small-hours listening must call for headphones. Loudspeakers are noisy intrusions upon privacy.

My own headphones vary between the severely practical and the impossibly exotic. Far removed from the ‘cans’ with which Dad used to impress the relatives as he whiskered in 2L0, the modern headset is the epitome of

physiological contouring, the lap of aural luxury. I am playing with a pair at present that cost—or would cost, if I could afford to buy them—about three times as much as the f.m. radio on which I attempt to capture that elusive stereo radio.

Now and again, the headset gets an insidious boost by being seen on the napper of studio manager or musical director as the television camera artfully shows us life behind the scenes. Large, well-muffed cans these... chosen as much for their external noise exclusion as for any other virtue. 40dB is the minimum, I am told, and must be weighed against comfort.

The last point matters: I once tested a pair of headphones with a reputable name and impressive specification. Measuring those figures was not easy—one needs a special coupler, a special microphone, and access to an anechoic chamber. But as far as I could judge, the makers made no exorbitant claims. The X-phones were nudging at Koss’s pedestal. And then Henry came to the subjective tests....

Disillusion rapidly set in. An hour trapped in that vicelike clamp was equivalent to a Star Chamber torture. One heard no electronic distortion, true, but the physical singing in ones ears made up for the straight and level response curve. Bits and pieces of cotton wool did no more than alleviate a problem that stemmed from the fact that the designer had used a model Japanese midget when organising his headband curvature. But the noise exclusion was marvellous.

This private world of the headphone listener can lead to some funny situations. A while ago we received a National product, a rather expensive novelty, a headset with built-in battery portable radio and a pair of moon-probe style antennae. They had good exclusion, too, as our sales man-

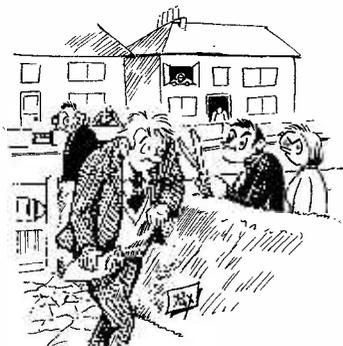


Wearing a rapt expression and rod aerials.

ager found when testing them. The shop is electrically noisy and in true—“come into the light and see the true colour, madam”—fashion, he wandered into the road. Whereas the passing public would not have looked twice at a purchaser fingering the fabric, the sight of JDO stalking a main city thoroughfare wearing a rapt expression and shiny rod aerials was too much for the traffic, which squealed to a halt. It took him several minutes to realise that another world—a curious, frightened world, SF-conditioned—existed beyond his earmuffs.

We have come a long way from the pair of cocoa tins and a length of string. Henry’s personal headset boasts the appellation CAD. Not inappropriately, says Joe, unkindly. But these initials stand for Computer Aided Design. Presumably, all the data was fed into the electronic maw—the size of one’s cranium, the projection of the average ear, the amount of inadvertent blast one could withstand before ones stirrups flipped... and out came a set of instructions. I must admit that the exercise was not wasted for my headphones represent a retreat, a refuge, a comfortable escape into a binaural hi-fi world while the rest of the world lies sleeping.

Now some clot has come up with ideas for four-channel headphones and we shall have computer-aided-quadrophonics before long. Is there never to be any peace?



... in the state of uneasy truce.



New Books

Books reviewed on this page are normally obtainable through any retail bookshop. In this instance, the information printed in heavy type should be quoted.

TAPE RECORDERS (HOW TO USE AND CHOOSE)

By **H. W. Hellyer**

Published by **Fountain Press Ltd.**

239 pages, price **£2.25.**

AN author of a domestic-based, popular technical subject, like hi-fi and tape recording, is faced initially with the task of deciding the level at which to reach the majority of his readers. Then, having made the decision, to stick to it throughout the book.

In reality this can never be so absolute because of the varying technical nature of the material presented and the general expanse of its range. The craft lies in securing logical balance and easy-to-assimilate style, devoid of ambiguity. This has undoubtedly been achieved by Mr. Hellyer in his new book on tape recorders.

Coverage is remarkably wide, embracing no fewer than 12 chapters, ranging from the background story of tape recording and basic principles, through heads and gaps, the tape deck, portable recorders, tracks and speeds, microphones, special applications (taking in slide sync, though I was surprised to see no mention of my scheme based on 'pauses', now coming into educational and industrial use) and various servicing procedures, concluding with an enlightening essay on tests and measurements.

General bias (!) is towards principles and servicing, which is by no means a bad thing handled as it is by a master of the subject; but it fails exactly to suit the 'How to Use and Choose . . .' part of the title, even though many words of wisdom on these themes are interspersed beneath the cover of other text.

Many circuits and circuit sections are featured, along with an abundance of line drawings, interesting photo reproductions from various sources, including some from the author's own bench-side camera.

Here, then, is a work which undoubtedly gave Mr. Hellyer great joy to write, aided, so my grapevine telegraph informs, by background music through headphones. From tape? A very well planned book and one which investigates the subject in far greater depth than told by the title, ideal for the tape enthusiast as well as the practising tape recorder technician. In fact, a book that can be summed up as the top of the tape recorder pops. Well done Mac!—GJK.

THE ENCYCLOPEDIA OF TAPE RECORDING (22 PARTS)

Pt. 1 "Natural History Sound Recording"

By **Richard Margoschis**

Published by **Print and Press Services Ltd.**

28 pages, 10½ × 8½ in. Price 40p.

BUY now, collect later, is a proven method of attracting the reader with a direct and maybe specialised interest. It works in the educational

field, and in the quasi-educational area also. By the evidence of this opening contribution to a very ambitious project inspired by Douglas Brown, it should also succeed in the less popular but more intense region of tape recording.

The author of this first section is well known for his contributions on field recording to the specialist press. He is a man of forthright and honest views. As he tells us, this is his first attempt at writing a book. Albeit this is a rather thin volume, its place in the 22-section encyclopedia is ensured, and if later parts maintain Mr. Margoschis' standard the publishers should be pleased.

He introduces the subject of outdoor recording briefly, goes on to discuss the machine itself, without being too specific, and as succinctly treats microphones and the parabolic reflector. If any criticism could be levelled, it is that more detail could have been given in this section. But this is not a work of reference, and the practical details are worth more than reams for theoretical treatment.

Further parts (for this book is not divided into conventional chapters, but parts as informal as a friend's letter) outline the most effective use of the machine, its handling on site, and then the very special methods used to record mammals, insects and even atmosphere. Mr. M. is concerned also to show a business-like approach to field recording, described the building of a programme, indexing, filing and finally the sale of the precious tapes.

He ends with a fairly comprehensive bibliography and discography, leaving the reader with a satisfied feeling of having been in the presence of a true enthusiast, a most meticulous man.

This first part is published coincident with the August issue of *Tape Recording Magazine*. The next two parts, in successive months, will be 'Writing a Script' by Terry Deveraux, and 'ABC of Recording Terms' by H. W. Hellyer. Further information on the series is available from Print & Press at a cost of 6s. The whole work will be, as publisher Douglas Brown has promised, a full survey of the whole field.—HWH.

WHAT'S IN FEBRUARY'S TELEVISION ?

(On sale February 12th)

■ **SIMPLE EHT METER**

Constructional details of a simple and safe meter.

■ **IMPROVE YOUR TV AUDIO**

How the Mullard 3-3 amplifier can be adapted to improve the audio from a TV set.

■ **D.C. RESTORER MOD.**

A simple d.c. restorer circuit which can be added to many Pye/Ecko sets to give greatly improved 625-line reception.

PRACTICAL WIRELESS

ALL IN THE
APRIL ISSUE, ON
SALE MARCH 5th

PW WORKSHOP OSCILLOSCOPE

"How did I ever do without one?" is what you invariably hear from the constructor when he has got his first 'scope—and not surprisingly!

An oscilloscope is the only piece of test gear that allows you to see what is going on inside a circuit—the examination of waveforms, distortion and pulses are just some of the things that it can do.

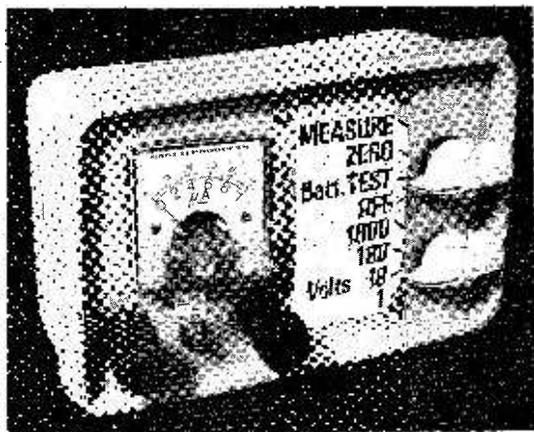
And this particular one is not only very versatile but has been designed just for you—the home constructor—readily available c.r.t. and other components are used, even the case is a stock item!

The design has been thoroughly tried and tested and will prove to be a very popular article.



EXTRA GUIDE TO Test Instruments SUPPLEMENT

An eight-page supplement giving the low-down on current test gear—complete in itself but also providing an introduction to our new series on servicing which begins in the May issue of Practical Wireless.



HIGH IMPEDANCE VOLTMETER

It had to be good to win the **Project Autumn Trophy** and we are proud to present it. Ranges are 1-10-100-1000V—with input impedances of at least 3M Ω . The cost is small—a 50 μ A meter and three 2N2926 transistors form the basis of operation of this ingenious project.

PLUS THE REGULAR "TAKE 20" AND "I.C. OF THE MONTH" SERIES AND OTHER CONSTRUCTIONAL ARTICLES AND FEATURES—ON SALE MARCH 5th—PRICE 17½p

AS a life-long c.w. enthusiast the author is very gratified to see so many newly licensed amateurs beginning their activities using c.w. especially on Top Band. Indeed the number of recently issued call signs appearing near the top of the lists of contest results must make many old-timers goggle in disbelief!

This equipment is suitable for newcomer and old-timer alike and is a true transceiver insofar as the transmitted and received frequencies are the same at all times and controlled by the main tuning dial. Intended for c.w. operating on Top Band this transceiver facility is of great benefit in contests obviating the necessity for continually 'netting' the transmitter to the receiver as is required in some so-called 'transceivers' which are really a transmitter and receiver in a box with only the power supply in common.

True 'break-in' is possible in this design whereby incoming signals can be heard in the spaces of the actual dots and dashes. Alternatively a time delay of a second or two may be obtained between the end of a transmission and the receiver becoming operative again. The keying relay has only one single pole changeover contact the switching of the individual circuits being achieved with cheap silicon diodes.

Using a genuine 10 watts input (the legal limit on Top Band) the transceiver has given very good results on the air and using a half wave aerial excellent signal reports have been received from all over UK and some European countries. In contest operation it has left little to be desired. In practice it has been found that certain controls on the front panel could very well be relegated to the rear of the chassis.

Some refinements have been built in such as an output indicator and a p.a. grid current meter in

order to make the transceiver as complete as possible but these can well be left to the discretion of the constructor.

OPERATION

The basic operation of the transceiver is best illustrated by reference to the block diagram Fig. 1. On receive the signal is amplified by V1 and passed to the mixer/oscillator V2 the output being amplified at 465kHz by V3 and V4 before being passed to the product detector. This uses diodes D1 and D2 to which is also fed the output of the b.f.o., the triode section of V4. The triode section of V3 functions as an audio amplifier feeding the headphones. As a refinement the audio also goes to the small speaker situated in the power supply unit.

On transmit the output of the first oscillator and the b.f.o. are fed into the transmitter mixer valve V5 the output of this being amplified by V6 which drives the p.a. stage V7. The triode section of V6 is a keyed tone oscillator feeding into the audio stage.

To obtain adequate selectivity a Q multiplier valve V8 has been included in the receiver.

CIRCUIT DESCRIPTION

On Receive Reference should be made to Fig. 3. Valve V1 is an ECC85 double triode used in a cascode configuration as an r.f. amplifier. In the author's experience this is the only worthwhile circuit that is effective against cross-modulation which can be a serious problem on Top Band shared as it is with various coastal stations on a.m.

Note that the input tuned circuit (1.8 to 2.0 MHz) for V1 is also the pi-network output circuit for the p.a. thus performing a dual function. The r.f. stage is fitted with a manual gain control VR1.

The r.f. stage is inductively coupled to the receiver mixer stage V2 which is the old favourite ECF82 the triode section first oscillator tuning 2265 to 2465kHz to provide an i.f. of 465kHz.

The output of the mixer feeds the i.f. amplifier

PART ONE

'Trojan' Top band

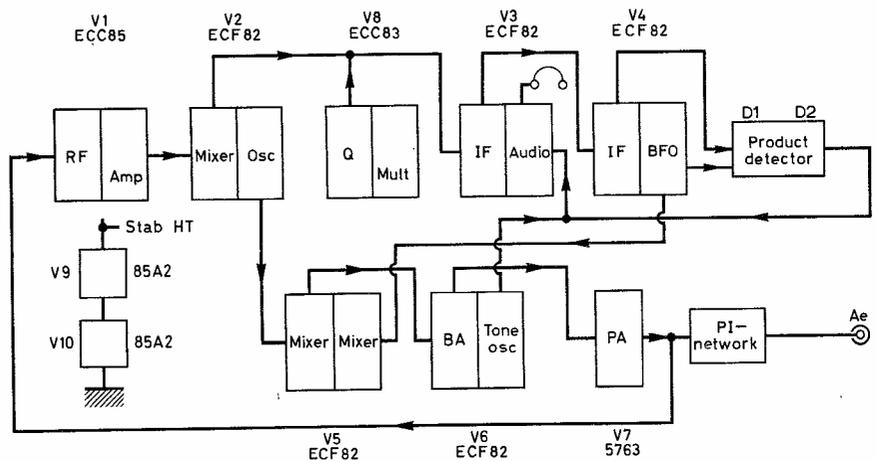
ERIC DOWDES
G4



stages V3 and V4 both using ECF82's, with conventional i.f.t.'s, their gain being controlled by the manual gain control VR2.

Since the bandwidth of the i.f. stages at 3dB down with the i.f.t.'s alone is of the order of 4kHz at best the selectivity is quite inadequate for c.w. operation and so a Q multiplier was included in the design which when properly adjusted gives excellent selectivity.

The Q multiplier circuit used has appeared quite frequently and has been used by the author on several receivers with very satisfactory results. The Q multiplier valve, V8, an ECC83 double triode, is connected to the anode of the receiver mixer stage V2 thus providing the necessary selectivity early on in the process of amplifying the signal and



▲ Fig. 1: Block diagram to illustrate the function of the various stages of the 'Trojan' transceiver.

detector circuit D1 and D2, the triode section of V4 functioning as the b.f.o. on a fixed frequency of 465kHz also. After filtering, the audio signal from the p.d. is routed back to the triode section of V3, an audio amplifier, feeding the headphones via the matching transformer T1. As already mentioned the audio signal is also fed to a small speaker, located in the power supply unit, which is very useful for monitoring purposes while working in the shack. A switch is fitted to disconnect the speaker when using the headphones.

The audio output is adequate for the headphones but not enough to warrant the use of a volume control so this was omitted.

On Transmit As stated previously the transmitted signal is always on the same frequency as that to which the receiver is tuned, to permit single channel working, so to understand how this is achieved the following example may help.

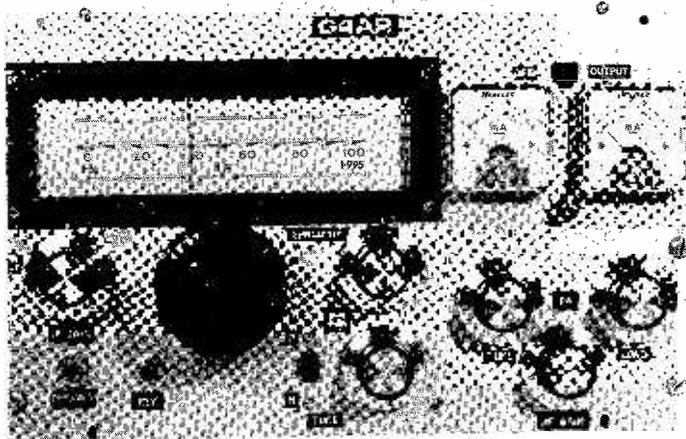
With an incoming signal of, say, 1900kHz the first oscillator is on 2365kHz the difference frequency of 465kHz being amplified and detected as already explained, the b.f.o. also being on 465kHz. If these two frequencies, 2365 and 465kHz are now fed to a separate mixer valve the difference of 1900kHz can be selected and amplified and used to drive the p.a. stage of the transmitter. A little consideration will show that this condition obtains whatever the input signal frequency.

In Fig. 3 the outputs of the two oscillators are fed to the transmitter mixer stage V5, another ECF82, the output circuit of which is fixed tuned to the centre of the band at 1900kHz by L4 and C30. This drives the buffer amplifier V6, an ECF82, which is also tuned to 1900kHz by L5 and C35, this stage driving the p.a., a 5763, to 10 watts input.

The p.a. grid current of 3mA is constant across the band and is shown on the 5mA meter M1. This meter can be switched by the slide switch S1 to give an indication of the transmitter output level using the diode D7 across the low impedance output circuit.

The p.a. anode circuit is a conventional pi-network with component values chosen to permit loading into a coaxial feeder. The anode end of the network is coupled to the grid of the r.f. stage by C44 so acting as the input circuit on receive.

Note that the pi-network tuning capacitor VC1b and the receiver mixer grid circuit tuning capacitor VC1a are ganged so that peaking signals with this control also peaks the transmitter r.f. circuits. The



Transceiver

VELL thus reducing the risk of cross-modulation in later stages.

AR The gain of the Q multiplier stage and hence the selectivity is controlled by VR3 and switch S2 allows the Q multiplier to peak a wanted signal or to null out an interfering signal. A big advantage of the circuit used here is that the b.f.o. remains on a fixed frequency while the desirable feature of "incremental tuning" on receive is obtained by tuning the Q multiplier across the i.f. pass-band with panel control VC4.

Normally the b.f.o. is tunable a few kHz either side of its nominal frequency but in a transceiver this would mean that the transmitted and received frequencies would be offset which defeats the whole object unless complicated switching is employed to return the b.f.o. to its nominal frequency on transmit.

The signal from V4 at 465kHz goes to the product

main tuning control VC2 tunes only the first oscillator. Adjustment of trimmer TC1 and the core of L2 enables full coverage of the band, 1.8 to 2.0MHz to be obtained.

On transmit the triode part of V6 acts as an audio oscillator using the centre-tapped primary of a transistor output transformer T2 which with the capacitor C38 gives a pleasant tone of about 800Hz.

In the interests of stability both oscillators are fed from a stabilised supply of 170V using two 85A2's, V9 and V10. As a matter of interest the main h.t. of 270V varies by only 8V between the receive and the transmit modes.

Receive/Transmit Switching The change-over involves muting the receiver part of the transceiver and activating the transmitter portion in the proper sequence as well as providing for a keyed audio tone to permit proper monitoring.

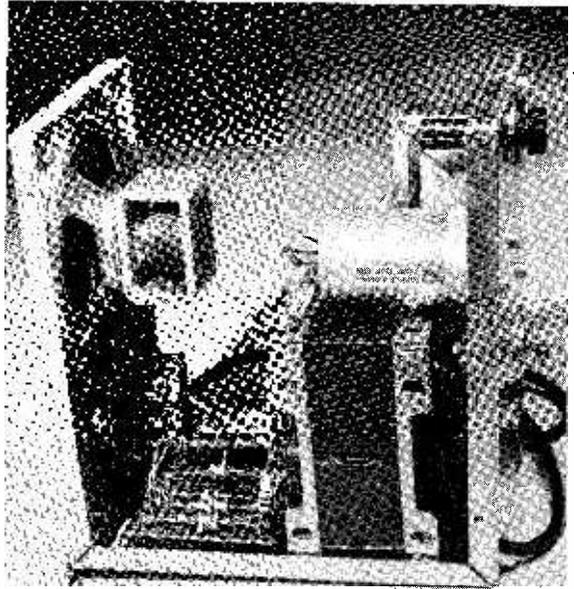
Operation of the key at jack J1, Fig. 3, energises the relay RL1 which is a simple single pole change-over relay on a B7G base. However any relay capable of following the keying will do if the correct operating voltage is applied. If true "break-in" is not required, then the capacitor C27, 200 μ F, can be connected across the relay coil which will cause the relay to stay "on" after the key is lifted thus providing a short delay of a second or two before the receiver becomes operative again.

The relay now does not have to be able to follow the keying and an inexpensive type may be used.

The functions initiated by the relay are as follows: with the key up, cathode return circuits of the r.f. and i.f. stages are at earth potential via diodes D3 and D5 and relay contact R and the receiver functions normally.

The transmitter mixer V5, p.a. stage V7 and the audio oscillator (triode part of V6) are biased off by the negative bias line via R43. With the key down the relay operates and opens the r.f. and i.f. cathode circuits and contact R rendering the receiver inoperative.

The grid return circuits of the transmitter mixer, p.a. and audio oscillator are earthed through relay contact T, diode D4 and the key and the transmitter operates. The keyed audio tone is fed to the grid of the audio output stage and heard in the headphones.



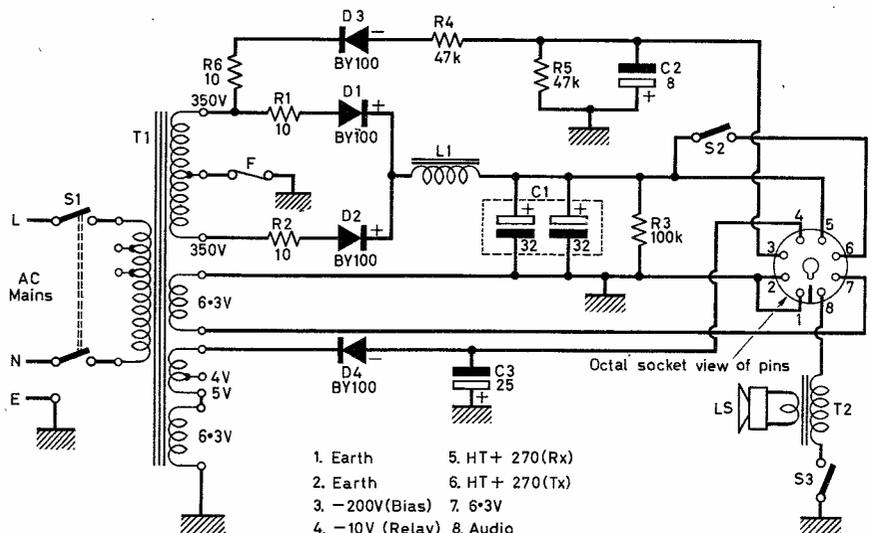
A view of the power supply unit.

POWER SUPPLY

A separate power supply unit is used to provide the h.t., heaters, bias voltage and relay operating voltage from a single transformer, T1, Fig. 2. Rectifier diodes are all silicon BY100's similar to those used in the switching circuits of the transceiver. Choke input smoothing is used to assist in obtaining good output voltage regulation. Switch S2 cuts the h.t. to the p.a. to allow the transmitter driver stages to be aligned using the p.a. grid current meter as an indication of the drive level.

Transformer T2 in the power supply unit matches the speaker to the output winding of the receiver audio stage, but the choice of transformer will depend upon the impedance of the headphones and speaker chosen.

Fig. 2: Complete circuit of the transceiver power supply unit. Capacitor C1, smoothing choke L1, fuse holder and h.t. switch S2 are all mounted on the rear face of the one-piece chassis. See photograph above.



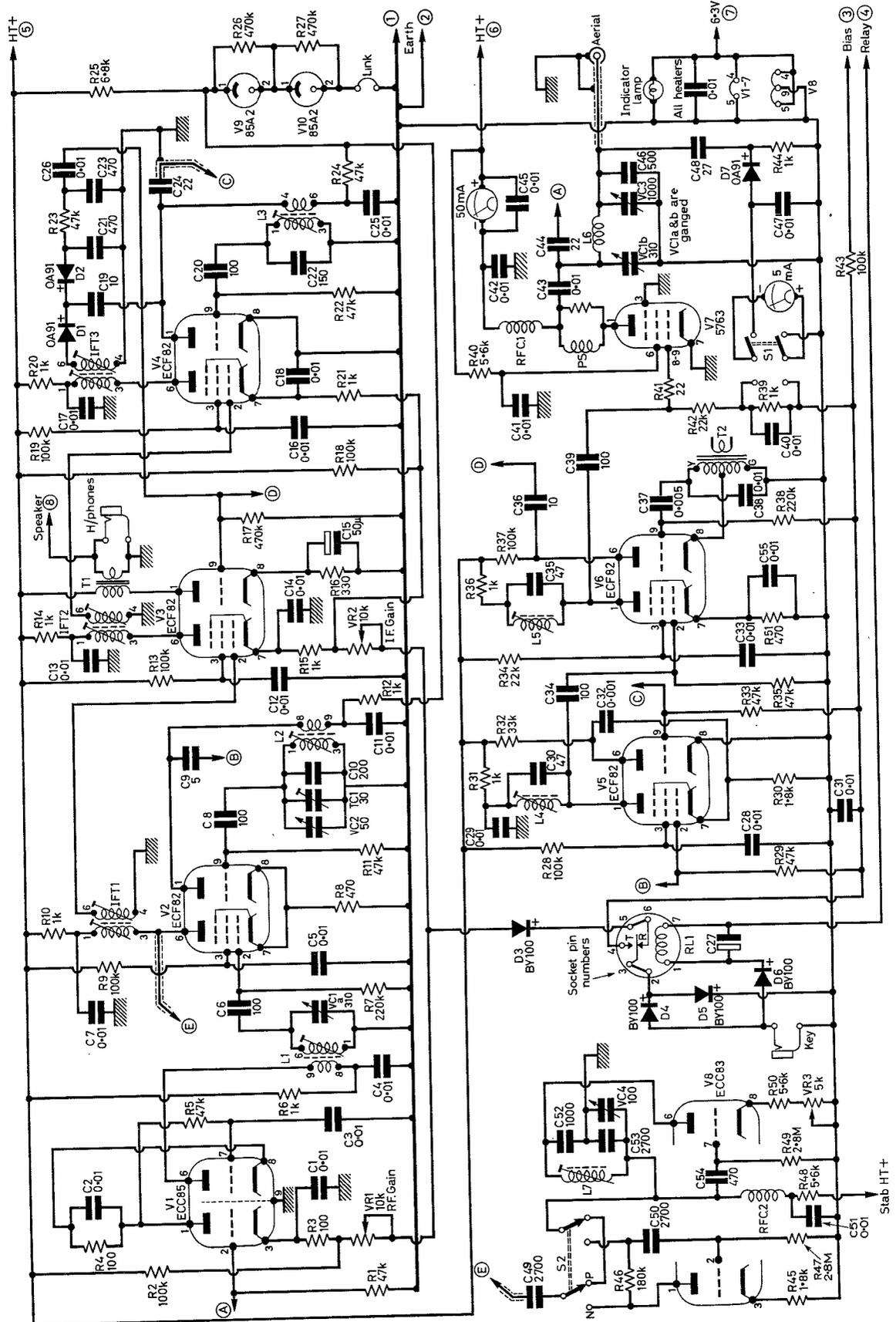


Fig. 3.: Circuit of the 'Trojan' transceiver. The value of C27 across the relay coil is discussed in the text. A capacitor 0.01μF should be shown between the junction of R36/L5 and earth.

CONSTRUCTION

The form of construction used combines the advantages of the solidarity of the usual aluminium chassis with the accessibility of the flat circuit board. Two pieces of 6 x 6in. copperclad s.r.b.p. board are trimmed to 6 x 5 $\frac{7}{8}$ in. and later fitted to an aluminium framework to form a chassis.

The majority of the wiring of the boards is done before they are fitted to the framework the layout of the boards being shown in Fig. 4, the copper side being underneath. The holes for the valveholders can be easily cut with a chassis cutter care being taken to ensure that the cutter itself goes through the board from the copper-clad side to avoid the possibility of lifting the copper. Similarly, holes should be drilled from the copperclad side.

The B9A valveholders and skirts are fixed with nuts and bolts but the B7G ones can be soldered to the copper, without skirts. Very few nuts and bolts are needed in this form of construction, connections to the boards being soldered wherever possible, thus saving a lot of time. No difficulty will be experienced soldering to the copper with a 25W iron although the author used a Weller dual-heat gun for most of the time.

Since the screening cans for the i.f.t.'s, b.f.o. and other inductors are on top of the board care must be taken to ensure that they are properly earthed. This was done by taking a thin copper wire from a lug on each screening can, passing it through the core adjustment hole and soldering it to the board underneath. A check for earthing should be made between each screening can and earth. Details of the fixing holes for the various i.f.t.'s etc. are supplied by the manufacturer.

The Denco r.f. and mixer coils plug into B9A valveholders and the aluminium containers in which they are supplied are used as screening cans as suggested by the makers. However, there is no objection to inverting the coils and using the single hole fixing taking the coil leads through holes in the boards. A small hole is drilled in each can to permit adjustment of the core.

The p.a. coil former is mounted on lin. pillars and the coil ends taken through clearance holes in the board to the pi-network capacitors below. When winding this coil leave several inches of wire at each end for this purpose. The r.f. output indicator components, D7, C47, C48 and R44 are mounted on a small piece of Veroboard and wired directly to the associated tags on the slide switch S1.

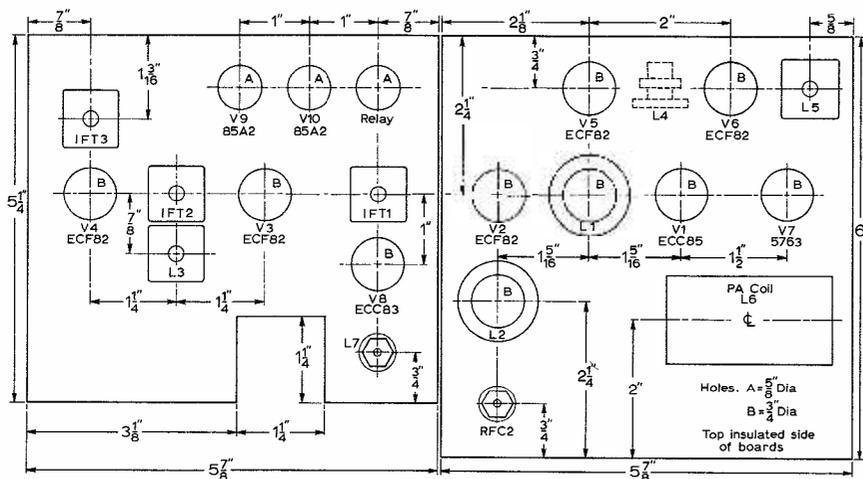
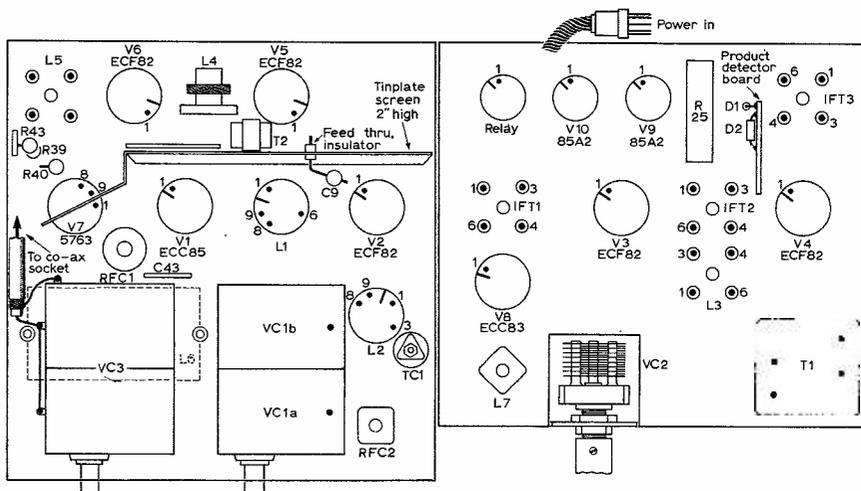


Fig. 4: Layout of the major components on the two copper-clad boards. Care must be taken to ensure that valve and coil screens are properly earthed. See text.

Fig. 5. Reverse view of boards. The interconnections between the boards are completed after the boards are assembled on the chassis. The screen on the lefthand board may be soldered in position after completing the wiring of V1 and V2 and V7.



★ components list

Resistors:

R1 47kΩ	R14 1kΩ	R27 470kΩ	R40 5.6kΩ 1W
R2 100kΩ	R15 1kΩ	R28 100kΩ	R41 22Ω
R3 100Ω	R16 330Ω	R29 47kΩ	R42 22kΩ
R4 100Ω	R17 470kΩ	R30 1.8kΩ	R43 100kΩ ½W
R5 47kΩ	R18 100kΩ	R31 1kΩ	R44 1kΩ
R6 1kΩ	R19 100kΩ	R32 33kΩ ½W	R45 1.8kΩ
R7 220kΩ	R20 1kΩ	R33 47kΩ	R46 180kΩ
R8 470Ω	R21 1kΩ	R34 22kΩ	R47 2.8MΩ
R9 100kΩ	R22 47kΩ	R35 47kΩ	R48 5.6kΩ
R10 1kΩ	R23 47kΩ	R36 1kΩ	R49 2.8MΩ
R11 47kΩ	R24 47kΩ	R37 100kΩ	R50 5.6kΩ
R12 1kΩ	R25 6.8kΩ	R38 220kΩ	R51 470Ω
R13 100kΩ	R26 470kΩ	R39 1kΩ	

All ½W 10% except as indicated. R25 is 5W

VR1 10kΩ linear	VR3 5kΩ linear
VR2 10kΩ linear	

Capacitors:

C1 0.01μF	C19 10pF poly	C37 0.005μF mica
C2 0.01μF	C20 100pF SM	C38 0.01μF
C3 0.01μF	C21 470pF mica	C39 100pF SM
C4 0.01μF	C22 150pF SM	C40 0.01μF
C5 0.01μF	C23 470pF mica	C41 0.01μF
C6 100pF SM	C24 22pF poly	C42 0.01μF
C7 0.01μF	C25 0.1μF	C43 0.01μF
C8 100pF SM	C26 0.01μF	C44 22pF SM
C9 5pF poly	C27 see text	C45 0.01μF
C10 200pF SM	C28 0.01μF	C46 500pF SM
C11 0.01μF	C29 0.01μF	C47 0.01μF
C12 0.01μF	C30 47pF SM	C48 27pF SM
C13 0.01μF	C31 0.01μF	C49 2700pF disc
C14 0.01μF	C32 1000pF SM	C50 2700pF disc
C15 50μF 12V	C33 0.01μF	C51 0.01μF
C16 0.01μF	C34 100pF SM	C52 1000pF SM
C17 0.01μF	C35 47pF SM	C53 2700pF SM
C18 0.01μF	C36 10pF poly	C54 470pF SM
		C55 0.01μF

All 0.01μF are ceramic disc 500VW

VC1a-b 310+310pF variable ganged (Jackson Type E2)
VC2 50pF variable (Jackson Type C804)
VC3 500+500pF variable (Jackson Type 0)
VC4 100pF variable (Jackson Type C804)
TC1 3-30pF Philips trimmer

Valves and Diodes:

V1 ECC85	V5 ECF82	V9 85A2
V2 ECF82	V6 ECF82	V10 85A2
V3 ECF82	V7 5763	
V4 ECF82	V8 ECC83	
D1 OA91	D4 BY100	D7 OA91
D2 OA91	D5 BY100	
D3 BY100	D6 BY100	

Inductors:

L1 Range 3 Yellow (Denco)
L2 Range 3 Red (Denco)
L3 BFO (Denco BFO2/465)
L4 QA11D (Osmor) see text
L5 QA11D (Osmor) see text
L6 45 turns 20 s.w.g. 1½" dia closewound enamel
L7 HQ4 (Electronics Techniques (Anglia) Ltd. Viking Works, Kirton, Ipswich, Suffolk 10/-+ 1/- p.p.)
IFT 1, 2, 3 (Denco IFT11/465)
RFC 1,2 2.5 mH
PS Parasitic suppressor: 10 turns 18 s.w.g. wound on 47Ω ½W resistor

Miscellaneous:

Tuning dial (Jackson Type SL16). Meters 5mA and 50mA f.s.d. (Henrys MRA-38). Valve holders B9A (10) with skirt and screens (7), B7G (3). Slide switches 2 pole 2 way (2). Jack sockets (2). Knobs NK2 (6) Indicator lamp holder and lamp 6.3V. Relay, single pole 2 way, 600Ω, on B7G base (Henrys Type 10). T1, output transformer to suit headphones Octal plug. P.A. coil former 1½in. dia. (G. W. Smith). Instrument case and panel, 12 x 7 x 7in. (H. L. Smith, Type W).

POWER SUPPLY

Resistors:

R1 10Ω ½W	R3 100kΩ 2W	R5 47kΩ 1W
R2 10Ω ½W	R4 47kΩ 1W	R6 10Ω ½W

Capacitors:

C1 32+32μF 350V	C2 8μF 350V	C3 25μF 25V
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Miscellaneous:

D1-4 BY100, S1 2 pole on/off toggle. S2 Single pole on/off toggle. S3 Slide switch. L1 Smoothing choke 10H 100mA. Transformer 350-0-350V 80mA, 6.3V 3.5A, 6V1A, 5V tapped at 4V (Henrys Type MT2AT). T2 Matching transformer (see text). Fuse 500mA and holder. Octal socket. Speaker 4in. Chassis 7 x 7 x 4in. wide (H. L. Smith, Type P) Cover 7 x 7 x 4in. wide (H. L. Smith, Type A)

Before beginning the wiring of the boards it is a good idea to identify each valveholder and coilholder with a small sticky label marked V1, V2, L1, etc., to prevent confusion. The boards are wired separately, only being brought together when fitted to the framework. A single 18 s.w.g. insulated wire is run round the valveholders for the heater wiring the other side of all heaters being soldered to the board at the valveholder. Capacitors of 0.01μF are wired between each live heater and earth.

Little need be said on the rest of the wiring which is quite conventional, the location of the major components under the boards being shown in Fig. 5. Component earth returns are soldered direct to the board with long leads being left on items that are later wired to panel-mounted components. Certain leads are screened as shown in Fig. 3.

The small screen shown alongside the transmitter

mixer and buffer stage is fabricated from thin tinplate and soldered to the board. Miniature tag strips are soldered to the screen to accommodate various feed resistors from these stages. The transformer T2 is likewise soldered to the screen.

The two-ganged capacitors VC1a-b and VC3 are bolted to the board, the spindles passing through clearing holes in the panel. The buffer anode coil L5 is mounted in an old i.f.t. screening can but the mixer anode coil L4 is unscreened. Both these coils are Osmor l.w./m.w. tuning coils with the l.w. and aerial coupling windings removed by sliding them off the formers. On L4 the two unused pins are soldered to the board, acting as supports for the coil.

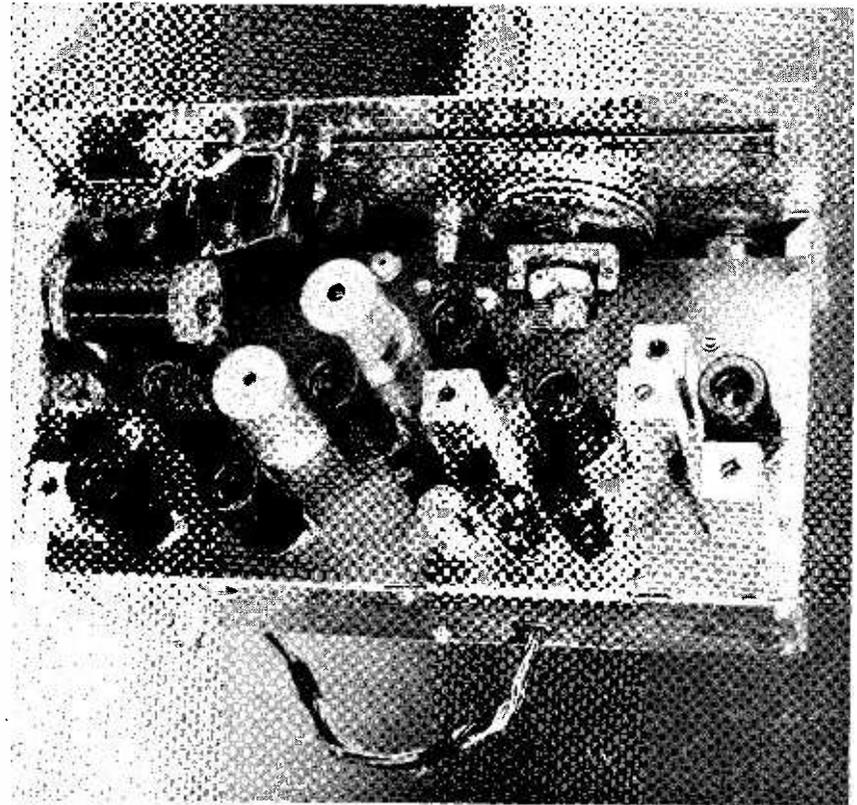
In the Q multiplier circuit the two leads from R46 to the peak-null switch must be kept well apart or the nulling will not be very effective. The usual circuit has been slightly modified to allow one side

of the Q multiplier tuning capacitor VC4 to be earthed.

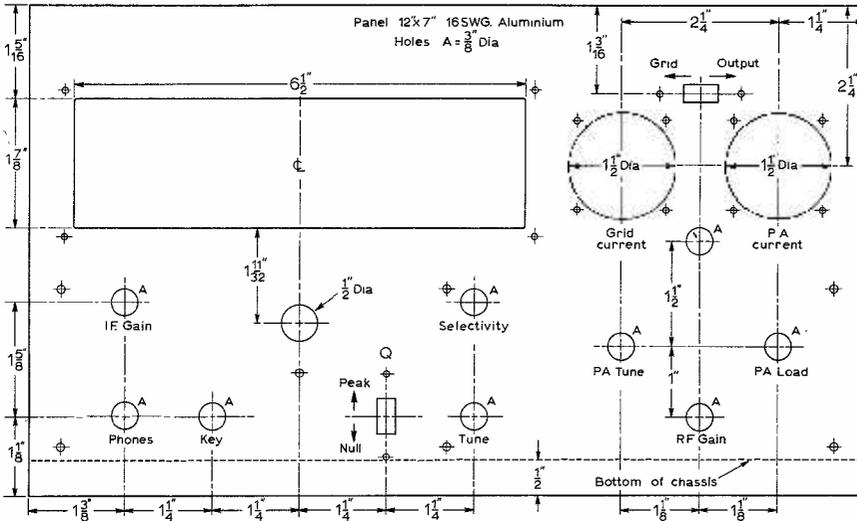
A short flexible link is used at the earthy end of the voltage stabiliser chain to permit the stabiliser current to be measured and adjusted to about 8mA after the preliminary alignment has been carried out.

Panel Assembly The panel is part of the instrument case Type W obtainable from H. L. Smith Ltd. and the layout is shown in Fig. 6. It is advisable to fit the two meters and the complete tuning mechanism to the panel before it is joined to the framework and circuit boards otherwise certain screws become inaccessible.

The bottom corners of the dial itself are cut away, as is shown in the photograph, in order to provide



▲ Top-of-chassis components shown in this view of the transceiver can be readily identified by reference to Fig. 4.



◀ Fig. 6: Drilling and layout data for the panel. Full information for fitting is supplied with the dial. The indicator lamp is mounted centrally below the meters.

clearance for the i.f. gain and Q multiplier selectivity potentiometers. The tuning dial is bolted to the panel with 6BA bolts with nuts used as spacers behind the panel but care must be taken not to overtighten the nuts as the escutcheon is very flexible and the glass easily broken, (it was!). Since the original dial pointer was several "kHz" wide it was unsoldered and replaced with one fashioned from a short piece of 20 s.w.g. copper wire hammered flat and painted white.

NEXT MONTH :- FINAL ASSEMBLY AND ALIGNMENT INFORMATION FOR THE 'TROJAN' TRANSCEIVER



TO BE CONTINUED

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents

Sound Only

Being a typical know-all spoilsport I wish to dispel certain readers' visions of magic at work in their circuits. Several letters reporting mysterious phenomena were printed in January's edition, but I remain, as always, unimpressed.

What's this? Transistors acting as loudspeakers? They *could* be made, if manufacturers felt so inclined, but Mullard would tear their hair out if they thought their p-n-p junctions really *were* rattling about. I suspect that transformer lamination chatter is responsible, or else loose magnetic objects in the vicinity of the transformer. Mind you, it has occurred to me that some gold-plated transistor leads are *magnetic*, surprising though it may seem. They might emit some curious twanging noises if placed near a transformer—an electronic harp, perhaps?

I am surprised that Mr. C. Pearce of Hampton has not previously discovered the remarkable ability of audio amplifiers to detect all sorts of 'oh-nasties'. A transistor is but two diodes, and diodes detect don't they...? He should try stopping his base! Incidentally, when receiving Franklin Englemann, it is essential to use armour-plated transistors to avoid damage, and also, in the interests of safety, the listener should wear ear muffs.—**R. Sterry** G8DVS (Leeds 6).

Belfast Club

I am writing on behalf of the Radio Club's Committee to inform you of our activities.

The club meets every Wednesday evening, the meeting commencing at 8 p.m. There is a Special Events Night on the first Wednesday of each month when there is a lecture, film show or demonstrational talk on a wide variety of topics.

The club is operational on all bands between 1.8 and 70MHz. The equipment includes a KW Viceroy, KW77 and a Pye Reporter. We are on the air during most Club Nights and have obtained a large number of operating awards during our many years of activity.

The club room is soon to be redecorated and refurbished and it is hoped to replace the main equipment in the not-too-distant future.

The club members are always ready to welcome visitors and it is hoped to attract new members as the winter season gets under way. In the last few years the Club has not gained many new members and it is thought that this is due to the fact that too few people know of our existence.

B. D. Humphries (City of Belfast Y.M.C.A. Radio Club, G16YM, Y.M.C.A., Wellington Place, Belfast).

Controversial Ground

Oh come on PW readers, the 20's and 30's were indeed very exciting as Radio began to make an impression on the world, but the 50's and 60's form the real romantic age. The semiconductor revolution, the appearance of the "professional type amateur", the mathematical wonder of what was just a black box built like a jigsaw puzzle.

Experimentation has never been practised by amateurs on the scale it is today, the scope is inexhaustible. From the souped up crystal set to the 'HAL 9000' Radio and Electronics takes its rightful place on the throne of the Technology Kingdom. How any readers can believe that the great days of the amateur are over beats me, they're only just beginning. So wake up you "those were the days" men, you can't see wood for trees.—**Robert C. J. Clay** (Newcastle-upon-Tyne 1).

Tape Recorder Repair

I have a Japanese tape recorder called Golden Eagle which needs attention. I have tried from Swansea to Cardiff without any luck to find a repairer—can you or any readers help me please?—**M. O'Brien** (Glamorgan, S. Wales).

[We passed your letter to our Query Service Tape Expert and he replies as follows: "As Technical Director of a tape recorder and Hi-Fi establishment to whose Cardiff branch you have probably applied already. I can perhaps explain the reason for the difficulty in getting such machines as

this repaired. We have several times in the past undertaken this kind of repair and run into trouble on two accounts. (1) Spare parts even when obtainable always take a long time to arrive. Customers inevitably blame the service engineer for this delay, which causes a lot of bad feeling even when the job is done successfully. (2) The cost of repairing any tape recorder is inevitably raised by the labour time, and service engineers have to be fairly well paid nowadays in order to retain their labour. This means that the odd tape recorder for which service information may not be available, and which is unfamiliar to the engineer and takes a little longer to be repaired, will always result in a costlier job. Once again, the customer gets rather annoyed and the service engineer even when he has done a satisfactory job is not regarded very favourably. As most businesses are existing primarily to sell and secondarily to service, it is understandable that they only want to service the machines they sell and those similar to them. This makes for economic service and enables them to give their own customers a better deal.

I am sorry to go on like this but it really needs saying. When you buy something like a tape recorder it certainly does pay to make sure that after-sales service is available". The Query Service expert then goes on to tell the reader one or two possible repair depots.—Editor.

Good Leader

Your lead article on BBC Local Radio (P.W. January, 1971) was first class. I am sure that with a bit more publicity, these stations could become very popular, but because the BBC is a semi-State corporation they seem to feel that advertising their wares is beneath their dignity.

Radio 4 being regional is the ideal medium for publicising the local radio stations but scarcely a word is heard from them.

The radio retailers can't escape blame either—I have yet to see a retailer helping local radio with publicity and the retail shop is surely one of the best mediums.—**P. Singh** (Southall).

THE RF Detector to be described consists basically of an absorption wavemeter circuit with a detector diode and an indicating meter. Several special features have been included to increase the versatility of the instrument.

It can be used as a field strength meter to check the radiation from a transmitting aerial from 1.6 MHz to 146 MHz. A remote meter socket is provided, as well as an audio output socket for the monitoring of amplitude modulated transmissions.

In conjunction with a "saddle" coupling loop it can be used to check the alignment of frequency multiplier stages in a transmitter or converter and to identify parasitic oscillation.

The frequency range is covered in 5 overlapping bands using switched coils.

A diode is connected in parallel with the meter circuit to provide a semi-logarithmic indication of field strength. This obviates the need for a sensitivity switch and protects the meter against accidental overloading and consequential damage.

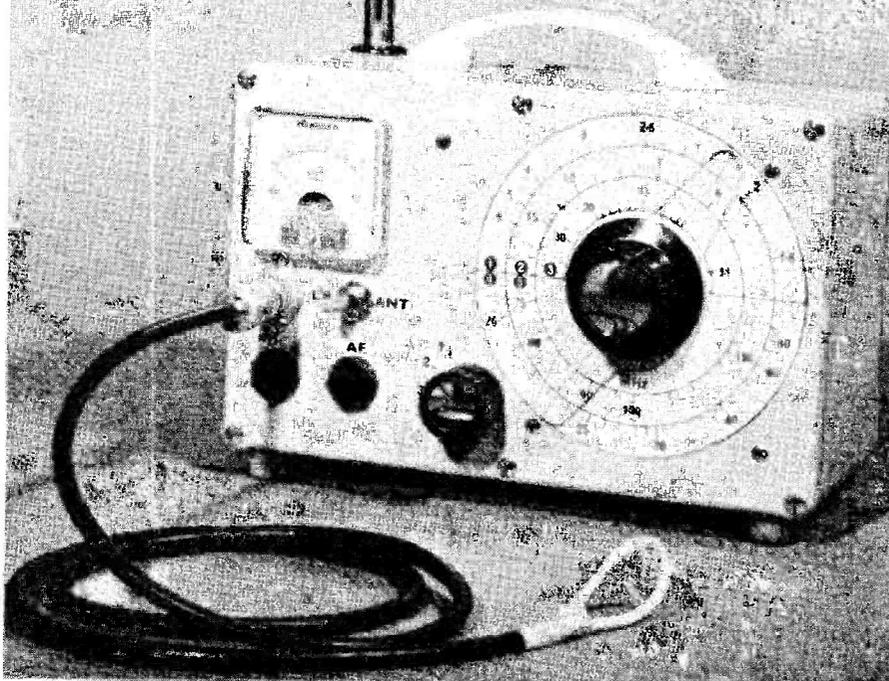
Circuit

The complete circuit is shown in Fig. 1. The input signal may be obtained from the telescopic whip aerial or from a pick-up loop connected to the coax input socket. The desired input is selected by S1.

The input signal is routed through S2a to the appropriate coupling coil on ranges 1 to 4 and to a tap on the tuning coil on range 5. The secondary winding of the Denco miniature dual purpose coils, which are used on ranges 1 to 4, are switched by S2b to the tuning capacitor VC1. On range 5, to avoid switching losses, etc., the tuning coil L9, is permanently connected across its tuning capacitor VC2.

VC1 and VC2 are the two sections of a 2-gang tuning capacitor having a swing of 300pF and 48pF respectively, the 300pF section being at the front. This special type is available direct from Jackson, as detailed in the components list.

Two separate detector circuits are used, comprising D1, C1 on ranges 1 to 4 and D2, C2 on range 5. The output for each detector is switched through SC2 to the meter circuit. The circuit formed by R1 and D3 cause the meter M1 to have a semi-logarithmic



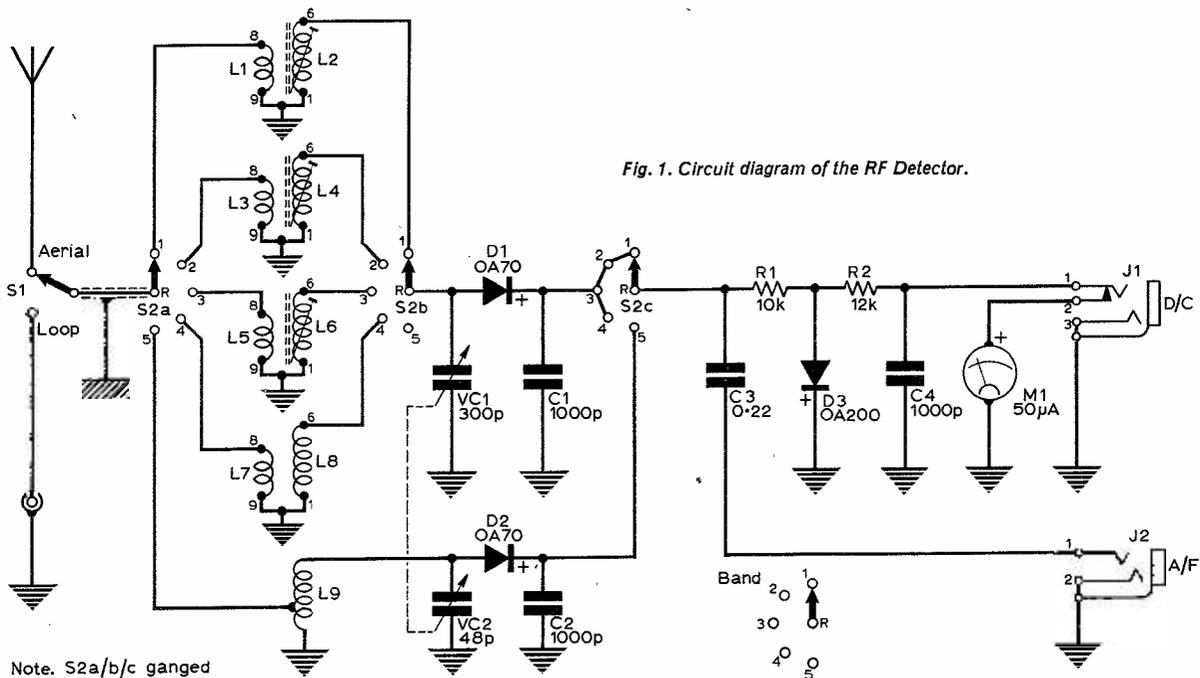


Fig. 1. Circuit diagram of the RF Detector.

scale. The operating range is about 50 dB. (Voltage 300:1). R2 sets the sensitivity of the meter and C4 is included to filter out r.f. pickup when a remote meter is being used in J1.

The a.f. coupling capacitor, C3, feeds demodulated a.f. signals to J2 for headphone monitoring. The headphones should be high impedance types.

Range 1	1.7	—	6MHz
Range 2	5	—	15MHz
Range 3	11	—	30MHz
Range 4	20	—	80MHz
Range 5	75	—	160MHz

Construction

The heart of the RF Detector is the tuner unit and this is built on a flat sub-chassis of 16 s.w.g. aluminium. The drilling for this is shown in Fig. 2. The fixing of the 2-gang capacitor is by three very short 4BA x $\frac{3}{16}$ in. screws. It is essential to check that the screws do not protrude through the gang capacitor frame sufficiently to short circuit or damage the stator and rotor plates.

The three fixing holes on the sub-chassis are spaced 120 degrees on a 1in. diameter circle, and a $\frac{5}{16}$ in. diameter hole is required to clear the spindle bearing. The tuning capacitor spindle is of insufficient length to allow a knob to be fitted directly and so an exten-

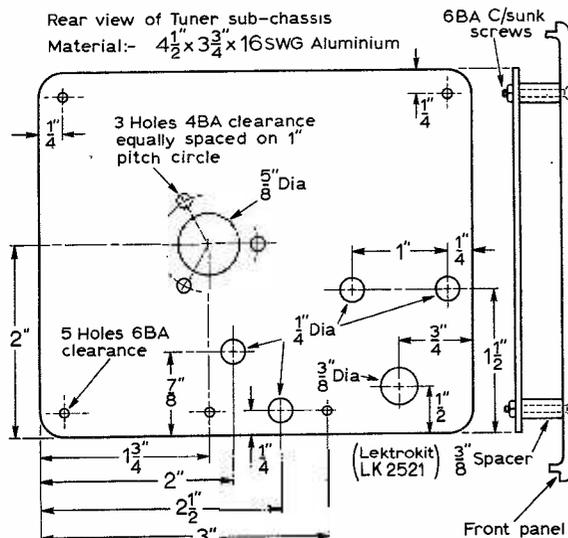


Fig. 2. Drilling details for the sub-chassis.

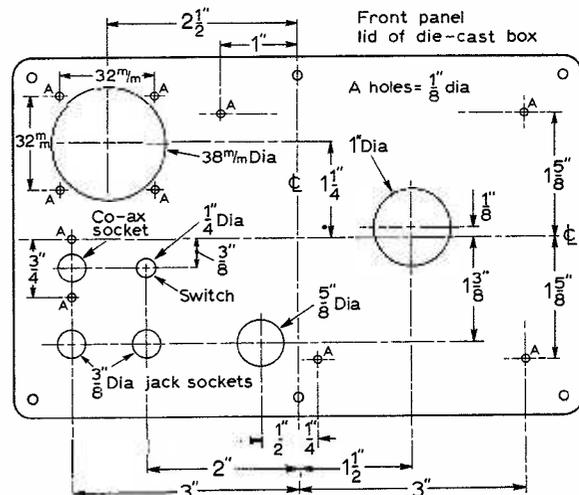


Fig. 3. Layout of the front panel.

sion spindle, Denco type SP2, is required. The tuning capacitor spindle is cut down to length $\frac{5}{16}$ in. before fitting the extension.

The case of the instrument consists of the 6357P Eddystone die-cast box, with the lid forming the front panel. The case is sprayed with car touch-up aerosol spray and lettered with 'Letraset'.

The sub-chassis is fastened to the front panel by four 6BA screws and spaced from it by $4 \times \frac{3}{8}$ in. long spacing sleeves, fitted on the screws. Lektrokit spacers type LK2521 are suitable, but extra nuts could be fitted to the 6BA screws to do the same job.

The front panel (lid) drilling is shown in Fig. 3. It is a good plan, after drilling the sub-chassis, to use this as a template for marking out the exact positions of the fixing screw holes on the front panel.

The type A61 telescopic aerial is supplied complete with an adaptor bush which has an internal 4BA thread. It is mounted in the case by fixing the bottom end to a nylon 4BA screw and nut, fixed through the bottom edge of the box, and at the top by means of a suitable plastic grommet. This arrangement is shown in Fig. 4.

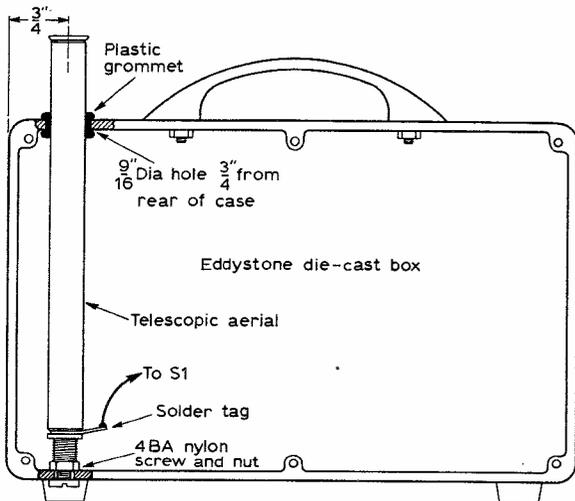


Fig. 4. Details of the fitting of the telescopic aerial.

The placement of the tuning components on the sub-chassis is shown in Fig. 6. L9 is made from 18 s.w.g. tinned copper wire and is bent to the dimensions shown. The shorter side is soldered directly to the ends of the rotor contacts, where these are soldered to the centre of the frame of the capacitor, and the longer side is soldered directly to the stator tag of the rear section of the capacitor.

It is important to orientate the coils correctly as this provides the shortest length of leads. On the higher frequency ranges excessive lead length could affect the calibration. All the wiring to S2 and the coils is done in 20 s.w.g. t.c. wire. The wiring of the components on the front panel is shown in Fig. 5.

A 'sniffer' loop may be constructed from a piece of coax cable by stripping off the braid and covering, for about 4 inches, and bending over and attaching the end of the centre conductor to the braid. The loop, so formed, should have the connection to the braid insulated with tape and a suitable coax plug may be fitted to the other end, for plugging into the front panel socket.

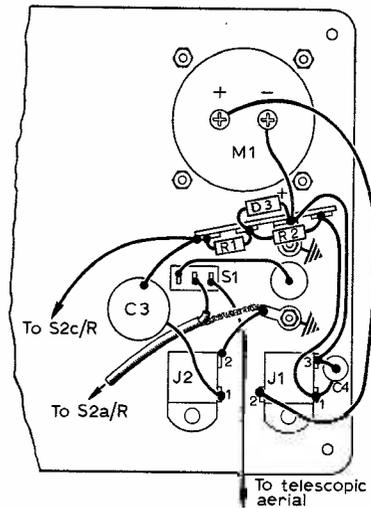


Fig. 5. Wiring guide for components on the front panel.

Calibration

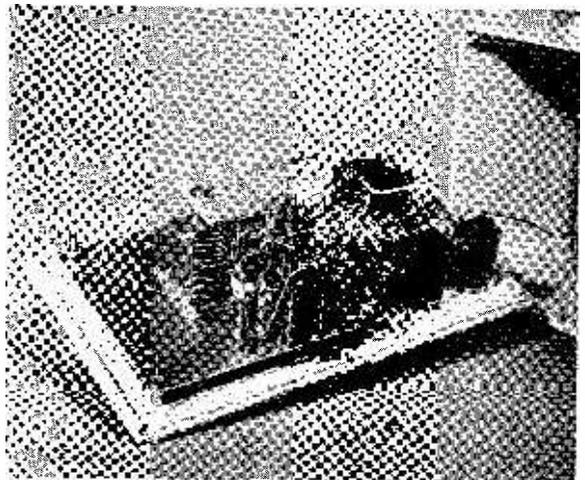
Calibration of the tuner unit is carried out with the sub-chassis removed from the front panel.

1. Connect the full r.f. output from a calibrated signal generator to the coax input socket and switch S1 to LOOP.
2. Set VC1/VC2 to maximum capacity, fully clockwise.
3. Adjust as follows:—

S2 set to	Sig. Gen.	Adjust for max.
Range 1	1.7 MHz	L2
" 2	5.0 "	L4
" 3	10.5 "	L6
" 4 & 5	No adjustment	

Lock the cores in position with a touch of polystyrene cement and assemble the sub-chassis on the front panel. It may be necessary to reduce the length of the tuning slug screws if these are protruding too far and are fouling the back of the front panel.

When assembled the overall calibration may be checked if suitable equipment is available. Details of the dial pointer are given in Fig. 6.



General view of back of the RF Detector.

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2N3904 35p	2N1711 28p	AC126 20p	BC154 35p	BFY51 20p
2N3906 35p	2N1895 54p	AC127 20p	BC157 19p	BFY52 23p
2N4053 30p	2N2147 95p	AC128 25p	BC158 17p	BSX20 18p
2N4059 30p	2N2218 33p	AC153 25p	BC159 18p	C407 17p
2N4060 30p	2N2218A 45p	AC176 27p	BC167 13p	MC140 25p
2N4061 30p	2N2219 38p	ACY20 20p	BC168 11p	MP86531 35p
2N4062 30p	2N2219A 58p	ACY22 18p	BC169 15p	MTS6634 30p
2N4124 18p	2N2270 62p	AD140 56p	BC177 31p	NKT211 25p
2N4126 27p	2N2368A 19p	AD142 43p	BC178 28p	NKT212 25p
2N4284 15p	2N2483 35p	AD149 62p	BC179 30p	NKT214 23p
2N4286 15p	2N2484 45p	AD161 40p	BC182L 13p	NKT274 18p
2N4289 15p	2N2904 38p	AD162 40p	BC183L 11p	NKT403 65p
2N4291 15p	2N2904A 42p	AF114 30p	BC184L 15p	NKT405 75p
2N4292 15p	2N2905 44p	AF115 30p	BC212L 25p	OC71N 25p
40361 65p	2N2905A 47p	AF117 25p	BC218L 25p	OC81DN 25p
40362 65p	2N2924 47p	AF124 30p	BC214L 25p	OC81N 25p
2N696 20p	2N2925 22p	AF127 28p	BCY70 19p	ZTX300 17p
2N697 22p	2N2926 11p	AF139 48p	BCY71 33p	ZTX301 17p
2N706 12p	2N3053 27p	AF239 48p	BCY72 15p	ZTX302 22p
2N930 29p	2N3325 54p	AS Y28 27p	BF115 35p	ZTX303 22p
2N1131 38p	2N3702 18p	AS Y28 27p	BF167 43p	ZTX304 33p
2N1132 40p	2N3703 18p	BC107 14p	BF173 50p	ZTX500 25p
2N1302 17p	2N3704 13p	BC108 12p	BF194 17p	ZTX501 25p
2N1303 19p	2N3705 13p	BC109 14p	BF195 18p	ZTX502 30p
2N1304 23p	2N3706 13p	BC125 55p	BFX29 31p	ZTX503 28p
2N1305 33p	2N3707 13p	BC126 55p	BFX84 25p	ZTX504 60p
2N1306 33p	2N3708 13p	BC127 15p	BFX85 34p	
2N1307 36p	2N3709 13p	BC148 14p	BFX87 29p	

RESISTORS

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99	100 up
C	1/20W	5%	82 Ω-220K Ω	E12			6
C	1/8W	5%	4.7 Ω-380K Ω	E24	1	0-8	0-7
C	1/4W	10%	4.7 Ω-10M Ω	E12	1	0-8	0-7
C	1/2W	5%	4.7 Ω-10M Ω	E24	1-2	1	0-9
C	1W	10%	4.7 Ω-10M Ω	E12	2-5	2	1-8
MO	1/2W	2%	10 Ω-1M Ω	E24	4	3-5	3
WW	1W	10% ±1/20 Ω	0-92 Ω-3-9 Ω	E12			12p all quantities
WW	3W	5%	12 Ω-10K Ω	E12			12p all quantities
WW	7W	5%	12 Ω-10K Ω	E12			14p all quantities

Codes: C = carbon film high stability low noise
MO = metal oxide ElectroSil TR5 ultra low noise
WW = wire wound Plessey.

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

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MULLARD SUB-MIN ELECTROLYTIC

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Values (μF/V): 0-64/64; 1/40; 1-6/25; 2-5/16; 2-0/64; 4/10; 4/40; 5/64; 6-4/6-4; 6-4/28; 8/4; 8/40; 10/2-5; 10/16; 10/64; 12-5/25; 16/40; 20/16; 20/64; 25/8-4; 25/25; 32/4; 32/10; 32/40; 32/64; 40/16; 40/2-5; 50/6-4; 50/25; 50/40; 64/4; 64/10; 80/2-5; 80/16; 80/25; 100/8-4; 125/4; 125/10; 125/16; 160/2-5; 200/6-4; 200/10; 250/4; 320/2-5; 320/6-4; 400/4; 500/2-5.

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MEDIUM RANGE ELECTROLYTICS

Axial leads: 50/50 9p; 100/25 9p; 100/50 13p; 250/25 13p; 320/25 13p; 250/50 13p; 500/25 19p; 500/50 21p; 1000/25 20p; 1000/50 20p; 2000/25 30p.

SMALL ELECTROLYTICS

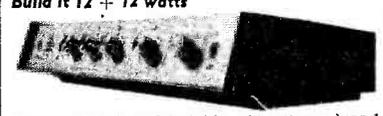
Axial leads: 4-7/10; 4-7/25; 5/50 5p ea. 10/10; 10/25; 10/50; 33/10; 50/10 5p ea. 22/25; 25/50; 47/25; 100/10; 220/10 6p ea.

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1N5GT	-38	30C15	-63	DL96	-36	EM81	-41	PCL85	-45	UBR89	-33
1R5	-21	30C17	-60	DT87	-28	EM84	-33	PCL86	-41	UC084	-35
1T4	-16	30F5	-78	EABC80	-32	EY51	-36	PCL88	-72	UC085	-36
384	-28	30FL1	-63	EAF42	-50	EY86	-32	PENA4	-42	UCH42	-62
3V4	-37	30FL12	-72	EB91	-11	EZ40	-43	PEN36C	-70	UCH81	-32
5Y3GT	-30	30FL14	-72	EBC33	-40	EZ41	-43	PFL200	-58	UCL82	-35
Z24G	-37	30L1	-32	EB041	-52	EZ80	-23	PL36	-48	UCL83	-55
6/80L2	-56	30L15	-65	EBC90	-22	EZ81	-24	PL81	-46	UF41	-62
6AL5	-11	30L17	-73	EBF80	-33	EZ92	-48	PL81A	-51	UF89	-33
6AM6	-13	30P4	-65	EBF89	-31	EZ94	-42	PL82	-30	UL41	-60
6AQ5	-26	30P12	-77	ECC81	-18	KT41	-77	PL83	-35	UL44	£1-00
6AT6	-22	30P19	-65	ECC82	-23	KT61	-48	PL84	-32	UL84	-25
6AU6	-22	30PL1	-63	ECC83	-35	KT66	-33	PL600	-65	UM80	-25
6BA6	-22	30PL13	-35	ECC85	-23	LN319	-63	PL504	-67	UM84	-22
6BE6	-23	30PL14	-70	ECC804	-60	LN329	-72	PL608	£1-17	UY41	-41
6BJ6	-42	30PL15	-72	ECF80	-30	LN339	-63	FMS4	-37	UY85	-22
6BW7	-60	35L6GT	-43	ECH30	-30	N75	-87	PX25	£1-17	VP8	-77
6CD6G	£1-10	35W4	-22	ECH35	-30	P61	-50	PY32	-55	W119	-35
6F14	-45	35Z4GT	-25	ECH42	-63	PAB080	-35	PY33	-55	Z77	-22
6F23	-73	807	-45	ECH81	-28	PC86	-51	PY81	-26	Transistors	
6F25	-68	9063	-62	ECH83	-41	PC88	-51	PY82	-26	AC107	-17
6K7G	-12	ACVYP2	-77	ECH84	-37	PC96	-42	PY83	-23	AC127	-18
6K8G	-17	AZ31	-47	ECL80	-35	PC97	-40	PY85	-34	AD140	-37
6SL7GT	-27	B349	-65	ECL82	-33	PC900	-37	PY800	-37	AF115	-20
6V6G	-17	B729	-62	ECL86	-40	PCC84	-32	PY801	-37	AF116	-20
6V6GT	-32	CCH35	-67	EF39	-23	PCC85	-30	R19	-32	AF117	-20
6X4	-23	CL33	-92	EF41	-58	PCC88	-45	R20	-65	AF118	-48
6X7GT	-23	CV31	-32	EF80	-24	PCC89	-47	U25	-58	AF125	-17
10F18	-35	DAC32	-36	EF85	-31	PCC189	-51	U36	-25	AF127	-17
10P13	-60	DAF91	-21	EF86	-21	PCC805	-65	U47	-68	OC96	-25
12AHS	22-25	DAF96	-36	EF89	-26	PCF80	-32	U49	-65	OC44	-12
12AT7	-18	DF33	-38	EF91	-13	PCF82	-32	U78	-24	OC45	-12
12AU6	-23	DF91	-16	EF183	-28	PCF86	-47	U191	-62	OC71	-12
12AU7	-23	DF95	-36	EF184	-32	PCF800	-67	U193	-42	OC72	-12
12AX7	-23	DF97	-22	EF90	-42	PCF801	-33	U251	-72	OC75	-12
19B6GG	-87	DK32	-37	EL33	-48	PCF802	-45	U301	-52	OC81	-12
20F2	-67	DK91	-28	EL34	-47	PCF805	-67	U329	-72	OC81D	-12
20P3	-85	DK92	-42	EL41	-55	PCF806	-60	U801	-98	OC82	-12
20P4	-92	DK96	-38	EL84	-24	PCF808	-72	UABC80	-32	OC82D	-12
25L6GT	-25	DL35	-25	EL90	-26	PCL82	-36	UAF42	-51	OC170	-22

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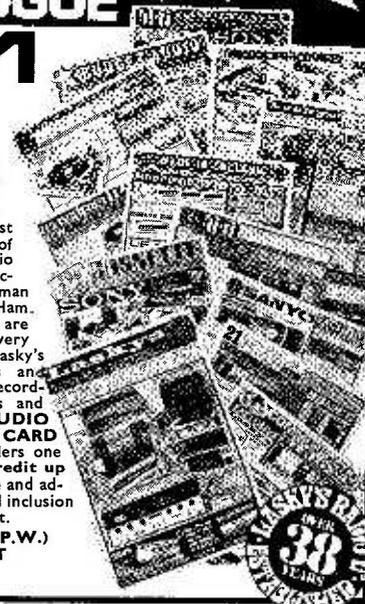
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Operation

When used as a field strength meter, the telescopic aerial should be extended as required to give a satisfactory reading on the meter. The tuning may appear to be rather broad, but this is mainly due to the semi-logarithmic operation of the meter.

With the aerial extended, the Detector may be useful in adjusting whip and other aerials for maximum efficiency and for checking radiation patterns. Where detection is required at a remote point, a $50\mu\text{A}$ meter on a long lead may be plugged into J1.

The Detector can also be used for monitoring the output from an a.m. transmitter by connecting headphones or an audio monitor or signal tracer, to J2.

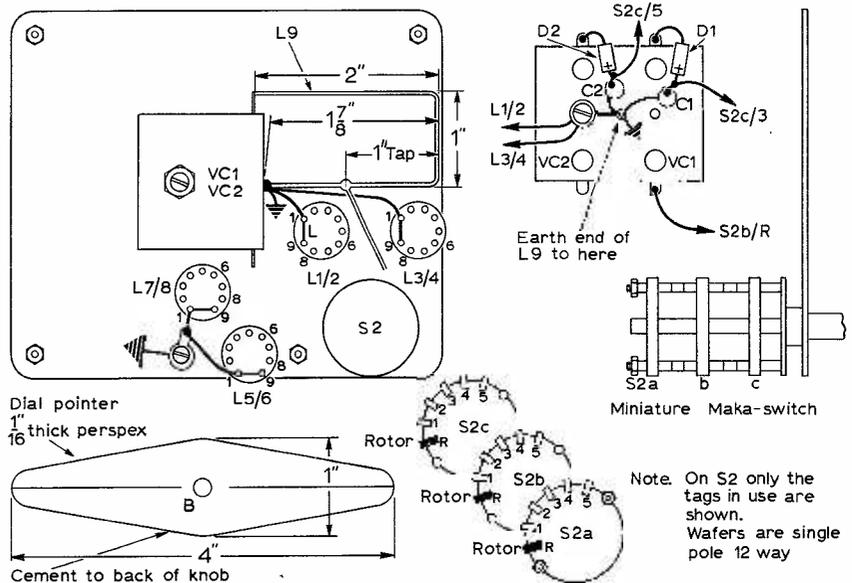
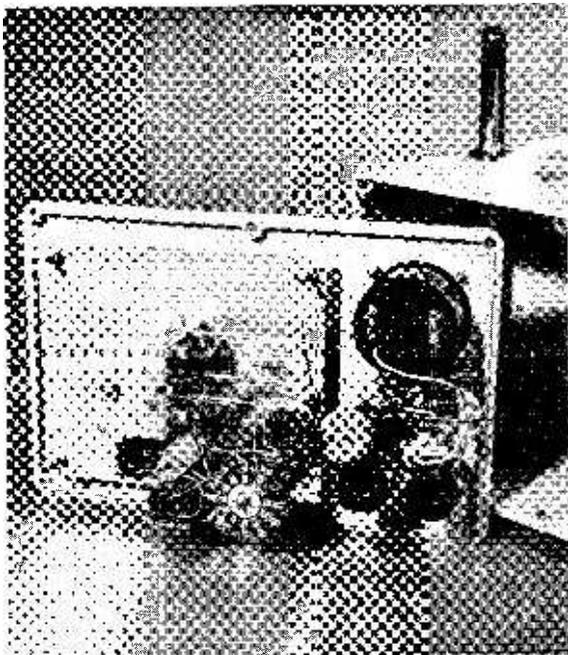


Fig. 6. Location of components on the sub-chassis.



This view clearly shows L9 mounted on the gang capacitor.

With the 'sniffer' loop connected, the frequency of each stage of a frequency multiplier chain may be checked. This is done by holding the loop near to the coil of the multiplier stage and searching through each range on the tuning dial for an indication of the frequency of operation.

Where the r.f. power level is reasonably high, as in a transmitter, it is possible to check for leakage of r.f. signals through screens and along cables by 'sniffing' it out with the loop. Parasitic oscillations in equipment can also be traced using the loop, and the effect of grid stoppers etc. can be observed.

★ components list

Resistors :

R1 10k Ω $\frac{1}{2}$ W 5% R2 12k Ω $\frac{1}{2}$ W 5%

Capacitors :

C1 1000pF disc C3 0.22 μF Poly or disc
C2 1000pF disc C4 1000pF disc
VC1/VC2 300+48pF variable (Jackson Bros.
Type 5250/2/300/48)

Inductors :

L1, L2 Range 3 Blue Miniature Dual Purpose
(Denco)
L3, L4 Range 4 Blue " "
L5, L6 Range 5 Blue " "
L7, L8 Range 7 Blue " "
L9 See text

Semi-conductors :

D1 OA70 (CG63 etc.) D2 OA70 (CG63 etc.)
D3 OA200 (1S921 etc.)

Miscellaneous :

Meter 50 μA f.s.d. (Henelec MRA38, Henrys).
S1, Single pole changeover, miniature.
S2, Miniature "Maka-switch" shaft assembly with 3
single pole 12-way wafers and pack of miniature
spacers (Home Radio).
Jack sockets, 1 open, 1 closed circuit. Eddystone
die-cast box type 6357P (Home Radio).
Telescopic aerial type A61 (Home Radio).
Knobs, 1 PK $\frac{3}{4}$ in., 1 SK $1\frac{1}{8}$ in. Coax plug and socket
Extension spindle coupler SP1 (Denco), Grommet,
4BA nylon screw and nut, plastic feet, handle etc.

For the guidance of readers the following list shows the instruments which have already been described in this series:—

October 70. Transistor and Diode Tester.
November 70. Capacitance and Resistance Bridge.
January 71. Signal Tracer.
February 71. Multi-range EHT Voltmeter.

Writing for 'Practical Wireless'

AS promised in the leader last month, we have collected together some pointers which we hope will be of use to readers interested in writing for Practical Wireless. Long before an issue goes to press the Editor must decide on the contents of that issue and endeavour to maintain a fair balance of interest for all the various sections of the readership. It needs only a quick glance through several consecutive issues to illustrate just how wide the editorial arm must reach—beginners and advanced constructors (and various grades in between), valve enthusiasts (there are still plenty about) must not be ruled out, short wave listeners, test gear enthusiasts, receiver builders (and all the permutations in this group!), gadget lovers, audio fans, and so on. An overloading on one sector will instantly bring complaints from other enthusiasts, but a neglect of one particular aspect will similarly fill the postbag.

To a large extent, of course, the selection of articles is the province of the editor and his team and can be controlled to conform to what we think is right, judging not only from our own opinions but on the response from readers as gauged from the mail and personal contacts. However, it is not always possible to flavour the cake *exactly* as we would like from the ingredients to hand.

Quite often, our main feature articles have been specially commissioned from authors whose names are well known, not only in this magazine but in other technical journals. They have earned a reputation for being able to produce an article which is correctly presented, technically reliable and compiled in such a way that editorial work can proceed with the minimum of trouble and worry. The balance of articles are mainly "unsolicited"—that is, material sent along by readers without prior consultation, out of the blue.

There are several important points to note here. One or two of our regular contributors rose in the ranks, as it were, from the unsolicited group. They have done this, not only for the quality of their work, but principally because they have taken the trouble to work out exactly what our requirements are. In other words they have placed themselves in the editor's position and thought about what *he* would like to see.

The regulars also stand more chance of their work being accepted because in most cases they will approach the editor *before* starting work on a project to ensure such an article would be welcome; that is, except where an article is specially commissioned. Readers wishing to submit an unsolicited article should think hard before putting pen to paper—to ensure a greater chance of acceptance it is well worthwhile to write first, giving a brief run-down of the equipment to be described or a brief synopsis if

the article is of a theoretical nature. This will at least establish that the editor is looking for such an article, for it sometimes happens that perfectly good material has to be returned to an author simply because we already have similar articles in the files.

Although it is understandable that most articles from new authors describe pieces of equipment they have already built for their own personal use, many of such articles *could* be suitable for publication. Occasionally we receive articles of intrinsic merit but with various blemishes, but others defy even the best efforts of the editorial team to lick them into shape. Much of this material could be salvaged if the prospective author notes the general requirements as outlined in the previous paragraphs and then studies the practical notes which follow.

PLANNING

It is important that an article is planned before starting work. Break the text up into definite sections, for instance: Introduction, The Circuit, What the Equipment will do, Advantages, Notes on Construction, How to Use it, etc. Having thought out mentally how the article is to be constructed then, the actual writing will not only be easier, but it will flow logically and make interesting reading. There is nothing worse than an article which jumps from one aspect to another, then back again, causing great confusion.

Another factor to be determined right at the beginning is the technical level to aim at. This should, basically, depend on the type of article being prepared. If the project is a simple 2-transistor radio for the beginner then a great deal of information is required, including fool-proof constructional details. If the equipment is, say, a communications receiver, then the ideal approach is to explain unusual circuit features in detail, describe construction only where a particular aspect is of critical importance in the resultant performance, and generally to treat the material at the assumed technical level of the reader with sufficient practical knowledge and experience to embark on such a comparatively complex piece of equipment.

The lesson here is similar to that to be learned when deciding to submit an article in the first place. Don't think of yourself! In the first place, think what the editor might need. In the second place, think what the reader might need.

WRITING AN ARTICLE

Let us be frank. We *prefer* typewritten manuscripts! Hand-written articles will have to be retyped in the office and errors can occur in the transcript. Such articles are also harder to evaluate initially. And it takes up more time. We *do* accept written texts *but* ask prospective authors to make the effort to get them typed if they are not equipped themselves!

Manuscripts should be typed with double-line spacing, leaving wide margins top, bottom and sides. It helps us if the text is typed to an average line of 55 characters as this gives a quick conversion for casting off the size when the material is type set. Each page should be numbered.

Where logical, side headings should be inserted; we can do this, of course, but again it makes it simpler to check through initially.

It is also advisable to take a carbon copy of anything submitted for publication. Apart from the

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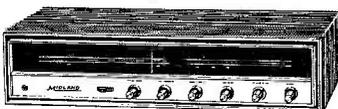
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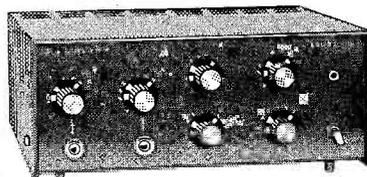
MODEL 19-520



MODEL 19-542

Specifications	MODEL 19-520	MODEL 19-542
Semi conductors	19 transistors, 12 diodes, 2 varistors	22 transistors, 12 diodes
Tuning range	FM 88-108 MHz FM Stereo Multiplex AM 535-1635 kHz	FM 88-108 MHz FM Stereo Multiplex AM 535-1605 kHz
Aerial	Internal AM and external FM	Internal AM and external FM
Frequency response	50-17,000 Hz	35-20,000 Hz
Power output	2½ watts rms per channel (3 watts music power)	4 watts rms per channel (8 watts music power)
Inputs	Ceramic phono	Magnetic/Ceramic phono and aux.
Speaker impedance	4-8 ohm	8 ohm
Controls	Power on/off, Volume, tone, balance, tuning, AFC. Stereo indicator	On/off, Volume, bass, treble, balance, tuning, AFC. Stereo indicator
Function selector	AM, FM, FM Stereo, Phono (Stereo indicator light)	AM, FM, FM Stereo, Ceramic, Magnetic, Aux.
Size	15" x 8½" x 3½"	16½" x 9½" x 3½"
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safeguard against accidental loss, it is handy to have a copy should the need arise at a later date for consultation between the editorial department and the author to clear up any doubtful points.

Where a components list is required, this should be typed on a separate sheet of paper. Full ratings of components should be given, if this is important from the performance viewpoint. Sources of supply (i.e., distributors or manufacturers) should be given where a product is "exclusive", that is cannot be obtained generally in component retail shops.

ILLUSTRATIONS

Drawings and sketches accompanying an article need not be artistic masterpieces, for all are redrawn by our own illustrators. They should, however, be neat and clear avoiding ambiguity. Make them as large as you like, or as small as you like—but remember, you are familiar with what they represent and we are not! All drawings should be on separate sheets of paper and should never be incorporated among the typescript. All drawings should be identified by their figure numbers and captions provided.

Photographs of the equipment, taken from various angles, are highly desirable and should preferably be of half-plate size, black and white and of good definition. However, the cost of retouching a poor photograph, with perhaps inferior end results, often means that authors are requested to send along the equipment so that we can take the necessary photographs

in our own studios. Loan of equipment is also sometimes requested for examination.

PAYMENT

A very quick publication date is not always possible for an accepted article, although every effort is made to process the material without undue delay. After publication, the author may expect to receive a cheque in payment for his efforts, usually about a week after the issue concerned is on the bookstalls.

FINAL POINTS

Remember that, although the staff have a wide range of knowledge of most fields of the hobby, they may not have a deep knowledge of some highly specialised subject. It is, therefore, important that articles are clear and where possible references should be quoted if some unusual technique is being described. Also, when describing even a simple circuit, be absolutely sure you are right; it is amazing how many explanations, even by experienced writers, are quite wrong! So, please check everything before posting it off to P.W. as this will save time and temper of those who are doing their best to help you.

It is obvious from our very voluminous correspondence that there are tens of thousands of enthusiastic constructors around the country who not only build from the designs in P.W. but who must, in the very nature of things, construct and design their own equipment. So, all of you out there who are busily building away—let's hear from you! ■



ISSUES WANTED

- ... August 1961 issue of P.W.—C. Smith, 96 Sumner Lane, Royston, Nr. Barnsley.
- ... the issues containing the "Imperial" transmitter (June, July and August 1966).—A. Pierson, 1 Belle Vue, Chilcompton, Nr. Bath, Somerset.
- ... the issues of P.W. dealing with mods to the 19 set.—John McCall, 45 Coxton Place, Garthamlock, Glasgow, E.3.
- ... Practical Wireless for February, March and November 1968 and February 1969.—M. Nicholls, 14 Munster Square, Regents Park, London, N.W.1.
- ... P.W. December 1967, February 1968 and Practical Electronics for February 1968.—D. R. Pitcaithley, 13 King Street, Londonderry.
- ... February 1967 issue of Practical Wireless.—John Ellis, 10 Coxhill Gardens, River, Dover, Kent.
- ... March 1967 issue of Practical Wireless. Also contact anyone who has built the Top Band Transceiver.—I. R. Munro, 47 Green Drive, Craigshill, Larne, Co. Antrim, N. Ireland.
- ... to complete my father's set from 1946 I need the following issues: December 1948, September and October 1949, November 1950, August 1952, November and December 1954, August 1955, February, April and May 1956, July and August 1957, April and December 1958, August 1959, April, May and June 1960.—Pamela Imberg, 85 Luscombe Close, Lower Henley Road, Caversham, Nr. Reading, Berks.
- ... the February 1969 issue of Practical Wireless.—F. Adams, 17 Westheath Villas, Bodmin, Cornwall.
- ... loan or buy the March 1969 issue of P.W.—Patrick Cassidy, 9 Irishaven Gardens, Creggan Estate, Londonderry, N. Ireland.
- ... the October and November 1966 issues of Practical Wireless.—R. Perryman, 26 Cranbrook Road, London, S.E.8.
- ... March and April 1966 issues of Practical Wireless containing the 19 set mods.—Roger Manners, 165 Mayfield Road, Edinburgh, EH9 3AY.
- ... the issue of P.W. containing the details for the 10 metre converter for the 1155.—K. Hardy, 180 Southcroft Road, Tooting, S.W.17.
- ... September 1967 issue of Practical Wireless for part 2 of the Switched f.m. Tuner.—R. Goodship, 128 Green End, Comberton, Cambridge, CB3 7DY.
- ... March, April and June 1970 issues of Practical Television. Also, has anybody a reprint of the 625-line receiver article (including the September i.f. strip)—R. A. Wheeler, Burnt Norton, Chipping Campden, Evesham, Worcs.

ISSUES FOR DISPOSAL

- ... many back numbers of P.W. January 1961 to April 1968. S.A.E. for details.—Peter Seddon, 11 Sunway Grove, Coventry.
- ... 80 issues of P.W. from 1957 to 1964 any reasonable offer accepted. R. A. Greenhaigh, 1 Wilmot Street, Bolton, Lancashire.
- ... a number of issues of P.W. and P.E. For complete list of issues send S.A.E. to: J. Brailsford Oakley, 26 South Knighton Road, Leicester, LE2 3LP.
- ... many issues of P.W. from January 1951 to April 1970. Some are partially bound in twelves up to December 1958. They contain blueprints that were issued.—A. King, 10 David House, Roehampton Lane, London, S.W.15.

- ... Practical Wireless February 1966 to September 1968; Practical Electronics August 1966 to October 1968; W.W. five copies 1967-1968 and four volumes of Television Servicing by G. N. Patchett (for C. & G. and R.T.E.B.) all four volumes.—R. James, 47 Hobblack Road, Norwich, Norfolk.
- ... 130 copies of Practical Wireless from 1941 to 1964. S.A.E. for details.—R. G. Palmer, Peterhouse, Cambridge.
- ... 48 back issues of P.W. from 1960-1969. Postage and packing 1s. each.—J. Brown, Tiptree Hall Annex, Tiptree, Nr. Colchester, Essex.
- ... many issues of P.W., P.T.V., S.W. Mag., R.C. and S.W. Listener. S.A.E. for details.—A. G. W. Thompson, Thursley Cottage, Church Road, East Molesey, Surrey.
- ... many issues of P.W., P.E. and R.C. Send s.a.e. for details.—G. Cheyney, 33 Vale Road, Parkstone, Poole, Dorset.
- ... 1967, 68, 69 volumes of P.W. and P.E. all good condition. Offers with s.a.e. please.—D. Hartley, 19 Fairacre Road, Liverpool, 19, Lancs., L19 9DP.
- ... many issues of P.W. from 1949 to 1967. Please send s.a.e. for details.—Mrs. G. Custance, 43 New Street, Honiton, Devon.

INFORMATION REQUIRED

- ... circuit, manual or other notes on Nova Tech R/x "Air.o.Ear model 711 W.N.—F. Eland, 20 Woodcot Avenue, Baildon, Shipley, Yorks.
- ... manual or circuit of Indicator type 221.—A. Woodridge, 38 Stannard Road, Norwich, NOR 44G.
- ... circuit or any details on tuning unit for an R.A.F. receiver type R1125A.—J. B. Nash, 5 Moorfield Road, Peterborough, Northants.
- ... circuit or manual on Philips oscilloscope type GM 3152-15 (a Mitcham instrument).—G. Wade, Knowle Orchard, Churchill, Nr. Bristol.
- ... any gen on the Canadian 58 Mk. 1 transmitter/receiver.—G. Whitwell, 90 Milverton Road, Erdington, Birmingham, 23.

APPARATUS REQUIRED

- ... anyone have a Murphy V270 which perhaps has only the tube at fault and wishes to dispose of it?—R. P. Jessep, 5 Green Lane, Sonning Common, Nr. Reading, RG4 9NA, Berks.
- ... can anyone say where it is possible to get a permanent magnet speaker remagnetised (preferably London area).—T. F. Callon, 27 Sprules Road, Brockley, London, S.E.4.
- ... tube or equivalent for my scope type Taylor 33A.—E. Corder, 16 Eden Avenue, Portadown, Co. Armagh, N. Ireland.
- ... an X78 valve or direct equivalent.—A. J. Payser, 40 Broadleas Pk., Hartmoor Road, Devises, Wilts. Tel. Devises 3896.

EXCHANGE

- ... valued modules marked Pulse Gate, Amplifier, Squaring Circuit, One Shot, 2 x Flip Flop, 4 x Gate, 2 x Vertical Detectors, 2 x Horizontal Detectors; together with a relay Mk. 2 type 1000 6p.d.t. 26.5V d.c. plastic encased. These modules are very compact and use miniature valves. They are of U.S. make called Electro-Tec Corp. Ormond Beach, Fla. I am a newcomer to electronics and would swap with any piece of equipment.—H. Taylor, 4 Spire Street, Ardwick, Manchester, 12.

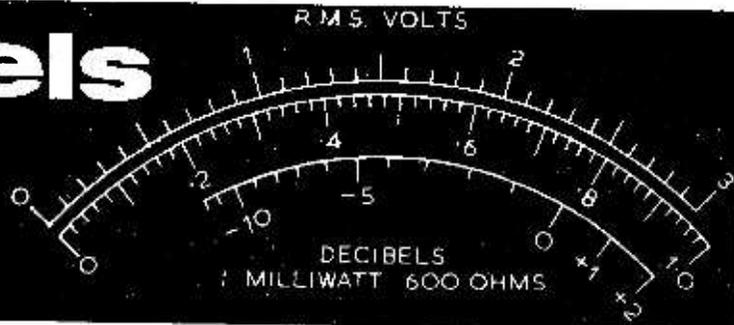
- ... view cards and more than 50 varieties of postage stamps of Pakistan for two ORP12's, two 2N706's, two BC109's and a VA3705 thermister.—S. K. Ghulam Qudus, c/o M.A. Razaque (S.R.O.), Forest Research Institute, P.O. Box No. 273, Dist. Chittagong, East Pakistan.

FOR DISPOSAL

- ... Mullard 5-10 amplifier with preamp. Offers over £6 or w.h.y.—L. Howes, 10 Millers Lane, Stanstead Abbots, Ware, Herts.

Items in this section are carried free of charge as a service to readers. We only ask that those making use of the service answer all correspondence resulting and reimburse postage and all reasonable expenses. We cannot guarantee inclusion and requests for inclusion will not be acknowledged. Material for inclusion should be sent to Practical Wireless Editorial, Fleetway House, Farringdon Street, London, E.C.4.

Decibels and a dB METER A. J. Whittaker



THE name "Decibel" has been with the electro acoustic industry for many years. The same word is now becoming common-place with the police forces throughout the country and even the man in the street is heard to mutter something about decibel noise levels.

What then, may we ask, is it all about and how did it come into being? It all began in 1923 when the American Telephone and Telegraph Company was investigating the properties of the transmission of sound over telephone wires. A number of trained observers were asked to write down their observations on the difference in received intensity of a pure 800Hz tone transmitted over a mile of standard telephone cable. Upon analysis of the results so obtained the relationship in intensity of the note transmitted and received was found to follow a well known law, true for all sensations such as sight, hearing and smell. This states that the intensity produced is proportional to the logarithm of the stimulus. From this the following equation was derived:

$$\text{Sensation Level} = \text{Log } \frac{I}{I_0}$$

Where, I is the intensity of the note transmitted and I_0 is the threshold or received intensity.

From this simple relationship between a note, or musical sound as transmitted, and the actual intensity as perceived by the ear, a unit called a "Bel" was derived (after Alexander Graham Bell inventor of the telegraph sounder). The Bel is a unit for comparing the relative intensities in signal strength transmitted over a telephone line. Thus a Bel is $\text{Log } P_1/P_2$

Where P_1 is the intensity of the signal transmitted;

and P_2 is the intensity of the signal heard.

It was found in practice that the Bel was too large a unit for general measurements and a unit called the Decibel was derived, this being a tenth part of a Bel, thus our equation now takes the form:

$$\text{Decibels} = 10 \text{ Log } \frac{P_1}{P_2}$$

The Decibel is a unit by which one may express power ratios or gain or loss ratios of related quantities such as voltage or current. In 1924 the International Advisory Committee adopted: (a) The "Bel" a unit based on Logs to the Base 10 and is in general use. (b) The Neper (after Napier) based on Logs to the Base "e".

GAIN IN DECIBELS

In general two powers P_1 and P_2 may be compared either by observing the voltage developed across a given resistance or a current passing through it. If

the two resistances are equal in value the power ratio will be proportional to the voltage or current ratio.

Thus the power gain in decibels is given by:

$$10 \text{ Log } \frac{\text{Watts}_1}{\text{Watts}_2}$$

and as watts equal E^2/R we have

$$10 \text{ Log } \frac{\frac{E_1^2}{R}}{\frac{E_2^2}{R}} = 10 \text{ Log } \frac{E_1^2 \times R}{R \times E_2^2}$$

If the two resistances are equal in value the decibel gain is

$$10 \text{ Log } \left(\frac{E_1}{E_2} \right)^2 = 20 \text{ Log } \frac{E_1}{E_2}$$

When the resistances are not equal in value the equation becomes

$$\text{decibels} = 20 \text{ Log } \frac{E_1}{E_2} + 10 \text{ Log } \frac{R_1}{R_2}$$

When applied to current measurements the equation becomes

$$\text{decibels} = 10 \text{ Log } \frac{\text{Watts}_1}{\text{Watts}_2} \text{ and, since watts also equal } I^2R.$$

$$\text{decibels} = 10 \text{ Log } \left(\frac{I_1}{I_2} \right)^2 = 20 \text{ Log } \frac{I_1}{I_2}$$

As in the voltage relationship, when the resistances are not equal in value, the equation becomes

$$\text{decibels} = 20 \text{ Log } \frac{I_1}{I_2} + 10 \text{ Log } \frac{R_1}{R_2}$$

In alternating current circuits involving impedances Z_1 and Z_2 across which the voltage or current measurements may be taken, allowance must be made for the quadrature components. Where the impedances (which are the quadrature components) are not equal the decibel gain or loss is given by:

$$20 \text{ Log } \frac{E_1}{E_2} + 10 \text{ Log } \frac{Z_1}{Z_2} + \frac{\cos \theta_1}{\cos \theta_2}$$

Where $\cos \theta_1$ and $\cos \theta_2$ are the power factors of the impedances involved.

In the decibel specification of electronic amplifiers, be they valve or solid state types it is necessary to state,

- 1 The input and output impedance values.
- 2 Voltage input and voltage or wattage output.
- 3 Decibel reference level.

The Decibel is defined as the least ratio of sound intensity that can be appreciated by the human ear.

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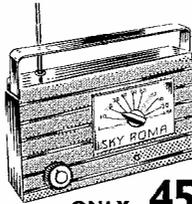
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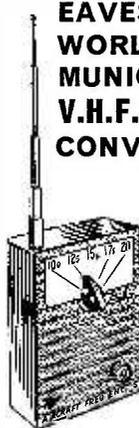
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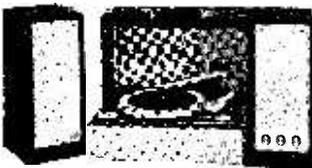
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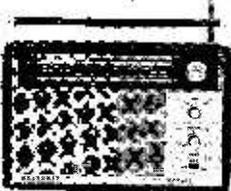
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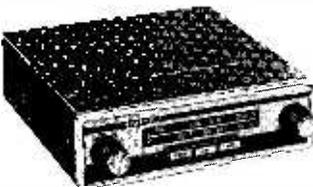
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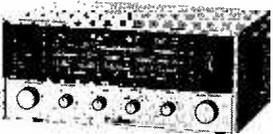
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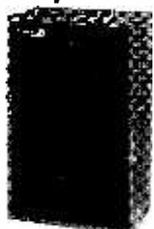
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PRACTICAL APPLICATION OF DECIBELS

A transistor amplifier having an input impedance of 1000 ohms requires an input of 5mV for an output of 3 watts into a load impedance of 3 ohms. Calculate the overall gain in decibels.

$$\begin{aligned} \text{decibel gain} &= 20 \text{ Log } \frac{V_1}{V_2} + 10 \text{ Log } \frac{Z_1}{Z_2} \\ &= 20 \text{ Log } \frac{3}{5 \times 10^{-3}} + 10 \text{ Log } \frac{1000}{3} \\ &= 80.8 \text{ dB} \end{aligned}$$

A DECIBEL METER

A practical decibel meter may be constructed with a 0-1mA meter so calibrated and arranged to read alternating voltages and decibels. The meter has a system of four diodes arranged as a bridge so as to enable the meter to read a.c. in four ranges, 0-1 volt, 0-3 volts, 0-10 volts and 0-30 volts (i.e. approx 10 dB between ranges). Each of the ranges has its own adjustable series resistance to facilitate the calibration (Fig. 1).

Included in this design is a switch and the necessary input sockets enabling the instrument to be used on stereo equipment to check the output of either channel.

This instrument is essentially an a.c. voltmeter which must be connected across an external load such as a loudspeaker or a resistor simulating the loudspeaker, whence it will read the output voltage, and as the meter scale is also calibrated in dB with a zero reference level of 1mW in 600 ohms, i.e. corresponding to 0.775 volt, one may observe the dB loss or gain at various frequencies.

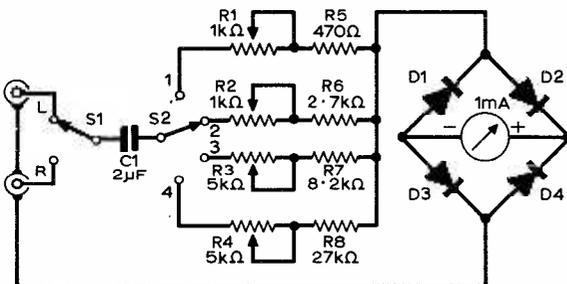


Fig. 1: Circuit of a practical dB meter.

A 0-1mA meter was selected because these instruments are readily available or are reasonably cheap to purchase. The meter series resistors required are as follows:

Range	Scale	Series Resistor
1	0-1V	1kΩ—1kΩ wirewound slider resistor with 470Ω fixed resistor.
2	0-3V	3kΩ—1kΩ wirewound slider resistor with 2.7kΩ fixed resistor.
3	0-10V	10kΩ—5kΩ wirewound slider resistor with 8.2kΩ fixed resistor.
4	0-30V	30kΩ—5kΩ wirewound slider resistor with 27kΩ fixed resistor.

The block schematic diagram (Fig. 2) shows the equipment required for purposes of calibration.

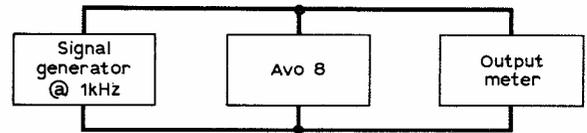


Fig. 2: Calibration set-up for the dB meter.

CONSTRUCTION

Figure 3 is a sketch of the construction of the instrument, which may be mounted in a metal or wooden box, and shows the wiring to the meter and calibrating resistors.

Terminals 1 to 4 are wired to the fixed tags on the wafer switch. The moving tag of this switch goes to the blocking capacitor C1 in Fig. 1. The other side of the blocking capacitor goes to the moving tag on the channel selector wafer switch S1. Dimensions of the panel have purposely been omitted, leaving the constructor to make his own arrangements.

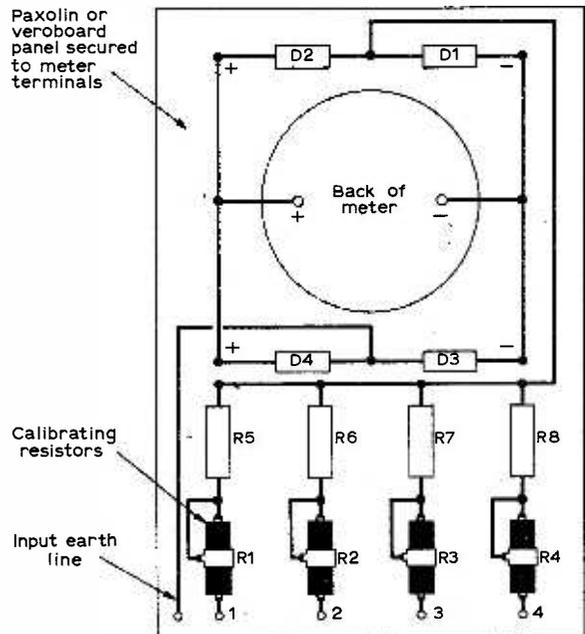


Fig. 3: Layout of the major components.

CALIBRATION PROCEDURE

Having assembled the instrument and checked the wiring, etc, connect the instrument as shown (Fig 2). Set the range switch of the meter to range one, and the channel switch to the side on test, i.e. left or right. Switch on signal generator and set output to one volt, as registered on the Avo on the appropriate scale, adjusting the calibrating resistor R1 for full-scale deflection, i.e. 1 volt.

Reduce the signal generator output by 0.1 volt i.e. 0.8, 0.7, 0.6, etc., checking against the Avo and making appropriate marks on the meter scale.

Switch to range 2, 0-3 volts, and repeat the above. Fig. 4 is of the completed scale. Examination of this shows the form it should take. Note that the decibel scale zero level is opposite 0.775 volt on the 0-1 volt scale.

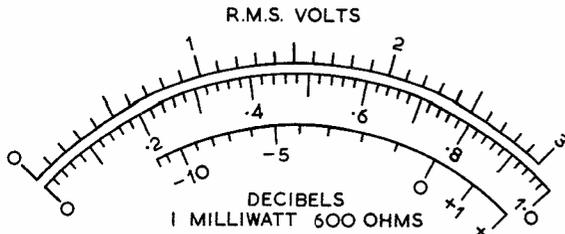


Fig. 4: Typical scale showing voltage and dB calibration.

★ components list

Resistors	
R1	1kΩ Wirewound preset (Radiospares 'Slider')
R2	1kΩ " " " " "
R3	5kΩ " " " " "
R4	5kΩ " " " " "
R5	470kΩ ½W 10% Morganite Type S
R6	2.7kΩ " " " " "
R7	8.2kΩ " " " " "
R8	2.7kΩ " " " " "

Capacitors	
C1	2μF 150V (Increase to 10μF for frequencies down to 20Hz. Non-polarised electrolytic)

Diodes	
D1, 2, 3, 4	Type D914 (Newmarket) or similar.

Miscellaneous	
Meter, 0-1mA, moving coil:	water switch SP4W:
Toggle switch SPDT:	Input sockets: paxolin or Veroboard about 4 x 5in: Metal or wood case.

TABLE 1

Decibels Power (Watts)	Ratio	Decibels Voltage or Current
0	1	0
3	2	6
4.8	3	10
6.0	4	12
7.0	5	14
7.8	6	15.6
8.5	7	17
9.0	8	18
9.5	9	19
10	10	20
20	10 ²	40
30	10 ³	60
40	10 ⁴	80
50	10 ⁵	100
60	10 ⁶	120

One final note. If it is desired to read watts on this instrument this may be done by observing the voltage across a given load resistance (or loudspeaker). Assuming for the sake of this example the load resistor to be 3 ohms, switch meter to appropriate scale and then connect across load. If the reading on the meter showed say 3 volts the power in watts would be:

$$\text{Watts} = \frac{V^2}{R} = \frac{3 \times 3}{3} = 3 \text{ Watts (r.m.s.)}$$

The table gives some decibel ratios in common use.

THE MW COLUMN

DURING the winter months North American medium wave stations are often audible at 2300hrs GMT which is the time when a number of Europeans close down for the night. Propagation on this path is rather variable and fadeouts are frequent, so DXers will find it useful to look for stations that are among the first to appear, before deciding to stay up late. Those which can be used as a guide to conditions are CJON in St John's Newfoundland on 930kHz; Radio St Pierre 1375kHz in the French colony of St Pierre et Miquelon near Newfoundland; CBA 1070kHz a 50 K-watter in Moncton New Brunswick. CJON can be found between Brussels 926kHz and AFN 935kHz as early as 2200hrs. R St Pierre causes a 1kHz heterodyne on Lille 1376kHz before the latter closes down at 2300hrs. CBA is the easiest North American and when conditions are favourable it will be audible as soon as Paris 2 signs off at 2300hrs. On a good night North Americans start to peak up before midnight and they can be picked up easily on a communications receiver and a short outdoor antenna—even a TV aerial will do.

North Americans logged by the writer on the 13th December between 2300hrs and midnight GMT include CBNA 600kHz St Anthony Nfld; CBN 640 St John's Nfld; CBH 860 in Halifax Nova Scotia; CJCH 920 in Halifax; CJON 930 St John's; CHER 950 Sydney N.S.; CHNS 960 Halifax; CBA 1070 Moncton. From the United States; WNBC 660 New York City; WABC 770 also in NYC; WHDH 850 in Boston; WABI 910 in Bangor Maine; WINS 1010 NYC; WBZ 1030 Boston; WHB 1050 NYC; WBAL 1090 in Baltimore; WBT 1110 in Charlotte, North Carolina; WNEW 1130 NYC; WPOW 1330 NYC. These stations were heard in Lancashire on a CR100 and a standard medium wave loop. North Americans have call signs which are used frequently followed by the name of the town or city in which the studios are located, which makes identification easy.

For the DXer who stays up late there are also Latin Americans, many of them sharing a frequency with stations further north. A MW loop will easily separate the two when the directions are different e.g. CBA and Radio el Mundo Buenos Aires on 1070kHz; CHER and LR3 Radio Belgrano Buenos Aires on 950kHz; KDKA Pittsburg and YVRS Radio Margarita in Venezuela 1020kHz; Godhavn Greenland and YVLH Radio Giradot in Maracay Venezuela on 650kHz; CBH and PRA3 Radio Mundial in Rio de Janeiro 860kHz; WHAM in Rochester NY and PRE3 Radio Globo in Rio on 1180kHz. No serious MW DXer should be without a loop. This type of antenna is based on the frame aerial used in the early days of radio. It is rotatable and directional and is used to null out co-channel interference.

Further news of MW DXing between Australia and Europe comes with a report of a DXer in Finland who logged Emerald, Queensland on the 27th of October as it was signing off at 1402hrs GMT. Also from Sweden Calling DXers, comes news of reception in Australia of Rennes France on 710kHz.

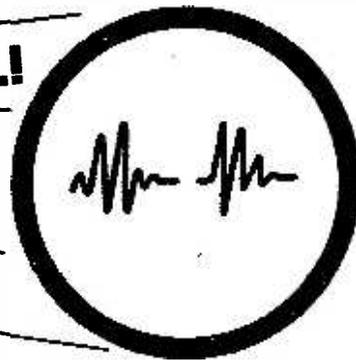
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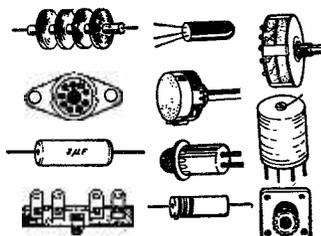
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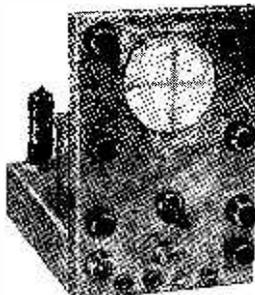
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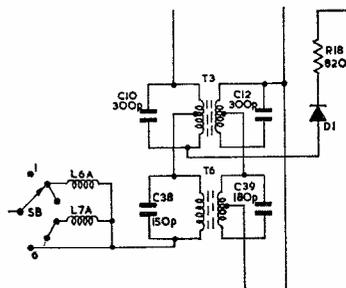
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1HG5T	.35	6P24	.68	12AD6	.40	30L1	.32	DK92	.47	ECC86	EM81	.42	UP44	.30	AC128	.20	BF173	.25	OC22	.38	
1L4	.13	6P25	.65	12AD8	.48	30L15	.64	DK96	.37	ECC8042.10	EM84	.34	UP45	.30	AC128	.20	BF180	.25	OC23	.38	
1R5	.29	6H9GT	.70	12AT7	.19	30L17	.78	DL96	.37	ECC821	EM87	.38	UP46	.30	AC128	.20	BF185	.40	OC25	.38	
1S4	.24	6A5G	.19	12AV6	.28	30P4M	.98	DM70	.30	ECC835	EM87	.38	UP47	.30	AC128	.20	BF185	.40	OC26	.25	
1S5	.22	6J6	.18	12AV7	.24	30P12	.69	DM71	.38	ECC84	EM81	.35	UP48	.30	AC128	.20	BF185	.40	OC28	.60	
1U4	.29	6J7G	.24	12AV6	.28	30P4	.60	350	.38	ECC81	EM81	.35	UP49	.30	AC128	.20	BF185	.40	OC29	.60	
1U5	.48	6J7GT	.38	12AX7	.23	30PL1	.69	DW4/	.38	ECC84	EM81	.35	UP50	.30	AC128	.20	BF185	.40	OC32	.38	
2D21	.35	6K7G	.10	12BA6	.30	30PL2	.37	600	.38	ECC80	EM81	.35	UP51	.30	AC128	.20	BF185	.40	OC34	.1.18	
3D5	.19	6K7GT	.23	12BA6	.30	30PL3	.75	DY867/	.29	ECC82	EM81	.35	UP52	.30	AC128	.20	BF185	.40	OC4	.1.18	
3Q4	.38	6K8G	.20	12B7H	.40	30PL4	.78	DY802	.48	ECC83	EM81	.35	UP53	.30	AC128	.20	BF185	.40	OC4	.1.18	
3Q5GT	.35	6L6GT	.39	12C1	.85	30PL5	.98	EB0F	1.20	ECC84	EM81	.35	UP54	.30	AC128	.20	BF185	.40	OC4	.1.18	
3S4	.29	6L7GT	.48	12C7GT	.38	30PL6	.44	ES3F	1.20	ECC85	EM81	.35	UP55	.30	AC128	.20	BF185	.40	OC4	.1.18	
3V4	.32	6L18	.45	12E5	.50	35W4	.23	ES8CC	.60	ECC86	EM81	.35	UP56	.30	AC128	.20	BF185	.40	OC4	.1.18	
5V4G	.38	6LD20	.48	12K7GT	.34	35Z4GT	.24	ER0F	.95	ECC87	EM81	.35	UP57	.30	AC128	.20	BF185	.40	OC4	.1.18	
5Y3GT	.28	6N7GT	.40	12Q7GT	.38	35Z6GT	.20	E182CC1.13	EF36	.33	FW4/500.75	.35	UP58	.30	AC128	.20	BF185	.40	OC4	.1.18	
6B0L2	.58	6Q47	.40	12SA7GT	.50	50L6GT	.45	E1148	.58	EF37A	.35	FW4/800.75	.35	UP59	.30	AC128	.20	BF185	.40	OC4	.1.18
6A8G	.38	6R7	.55	12SCT	.40	72	.35	EA50	.18	EF39	.40	G230	.35	UP60	.30	AC128	.20	BF185	.40	OC4	.1.18
6AC7	.15	6R7G	.35	12SG7	.23	807	.48	EA76	.98	EF40	.50	G232	.45	UP61	.30	AC128	.20	BF185	.40	OC4	.1.18
6AG5	.25	6SA7GT	.35	12SH7	.15	5763	.50	EACB80	.38	EF41	.50	G233	.45	UP62	.30	AC128	.20	BF185	.40	OC4	.1.18
6AK5	.25	6SA7GT	.35	12S7	.23	AC2/PEN	EAFAZ	.50	EF54	.98	G237	.58	UP63	.30	AC128	.20	BF185	.40	OC4	.1.18	
6AL5	.12	6S7GT	.38	12SK7	.24			EB34	.20	EF73	.38	HABC80	.45	UP64	.30	AC128	.20	BF185	.40	OC4	.1.18
6AQ5	.25	6S7GT	.38	12SQ7GT		AC2/PEN/	EB41	.50	EF80	.28	HL2DD.40		UP65	.30	AC128	.20	BF185	.40	OC4	.1.18	
6AT6	.20	6T6	.30	12TD	.50		EB41	.50	EF83	.48	HL4DD.98		UP66	.30	AC128	.20	BF185	.40	OC4	.1.18	
6AU6	.25	6U7	.35	14S7	1.15	AC2/PEN	EB41	.50	EF83	.48	HL4DD.98		UP67	.30	AC128	.20	BF185	.40	OC4	.1.18	
6AV6	.30	6SK7GT	.23	18AQ5	.24	AC/PEN/7	EB41	.50	EF83	.48	HL4DD.98		UP68	.30	AC128	.20	BF185	.40	OC4	.1.18	
6B8G	.13	6S7GT	.38	20P2	.70		EB41	.50	EF83	.48	HL4DD.98		UP69	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BA6	.23	6V6G	.18	20L1	.98	AC/TH1	EB41	.50	EF83	.48	HL4DD.98		UP70	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BE6	.24	6V6GT	.33	20P1	.98	AC/TP	EB41	.50	EF83	.48	HL4DD.98		UP71	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BH6	.43	6X4	.52	20P3	.90	AL50	EB41	.50	EF83	.48	HL4DD.98		UP72	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BJ6	.43	6X5GT	.52	20P4	.90	ATP4	EB41	.50	EF83	.48	HL4DD.98		UP73	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BQ7A	.38	7B6	.35	20P5	1.00	AZ1	EB41	.50	EF83	.48	HL4DD.98		UP74	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BR7	.78	7B7	.35	25A6G	.20	AZ31	EB41	.50	EF83	.48	HL4DD.98		UP75	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BR8	.63	7C6	.30	25L6G	.20	AZ41	EB41	.50	EF83	.48	HL4DD.98		UP76	.30	AC128	.20	BF185	.40	OC4	.1.18	
6RW6	.72	7H7	.28	25Y5	.38	B36	EB41	.50	EF83	.48	HL4DD.98		UP77	.30	AC128	.20	BF185	.40	OC4	.1.18	
6RW7	.65	7R7	.65	25Y5G	.43	CY1C	EB41	.50	EF83	.48	HL4DD.98		UP78	.30	AC128	.20	BF185	.40	OC4	.1.18	
6BZ6	.33	8D7	.78	28Z4G	.30	CY31	EB41	.50	EF83	.48	HL4DD.98		UP79	.30	AC128	.20	BF185	.40	OC4	.1.18	
6C9	.73	10C1	1.52	25Z5	.40	DAC92	EB41	.50	EF83	.48	HL4DD.98		UP80	.30	AC128	.20	BF185	.40	OC4	.1.18	
6CD6G	1.15	10C2	1.50	25Z6G	.43	DAF91	EB41	.50	EF83	.48	HL4DD.98		UP81	.30	AC128	.20	BF185	.40	OC4	.1.18	
6CH6	.38	10P1	.75	30C1	.30	DAF96	EB41	.50	EF83	.48	HL4DD.98		UP82	.30	AC128	.20	BF185	.40	OC4	.1.18	
6CL6	.43	10P9	.45	30C15	.65	DF33	EB41	.50	EF83	.48	HL4DD.98		UP83	.30	AC128	.20	BF185	.40	OC4	.1.18	
6CW4	.63	10P18	.35	30C17	.80	DF91	EB41	.50	EF83	.48	HL4DD.98		UP84	.30	AC128	.20	BF185	.40	OC4	.1.18	
6E1	.68	10LD11	.53	30C18	.84	DF96	EB41	.50	EF83	.48	HL4DD.98		UP85	.30	AC128	.20	BF185	.40	OC4	.1.18	
6F6	.63	10P13	.85	30P3	.80	DF97	EB41	.50	EF83	.48	HL4DD.98		UP86	.30	AC128	.20	BF185	.40	OC4	.1.18	
6FG6	.25	10P14	1.10	30FL1	.64	DE63	EB41	.50	EF83	.48	HL4DD.98		UP87	.30	AC128	.20	BF185	.40	OC4	.1.18	

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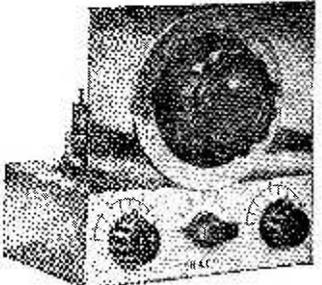
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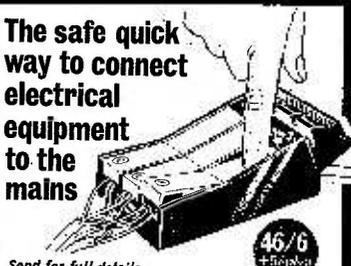
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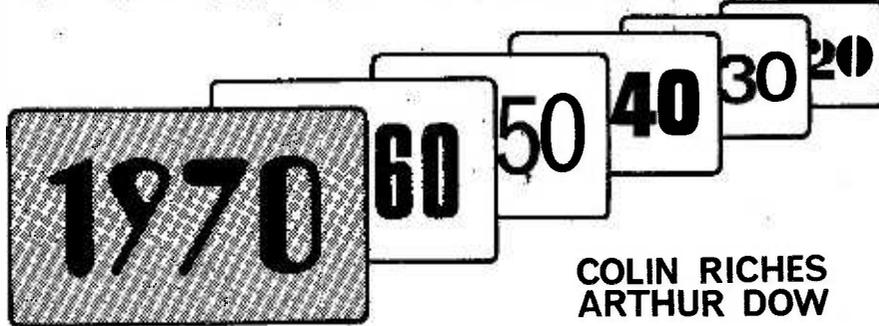
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GOING BACK...



COLIN RICHES
ARTHUR DOW



IN "Going Back" of August of last year we suggested that those readers interested in the collection and preservation of vintage radio equipment should write to Mr. K. Lancaster of 40 Great Gardens Road, Hornchurch, Essex, with a view to forming a Vintage Radio Society for that purpose.

To date only a handful of readers have bothered to respond although we are sure that the number of those interested must run into hundreds. Every month advertisements can be seen in various radio magazines by those wanting to obtain old radios, periodicals and such like and we would like to think that the advertisers have altruistic rather than pecuniary motives in the preservation of these relics.

In the United States the Antique Wireless Association caters for those interested in the history of radio and ancient radio equipment. A most useful adjunct for such devotees is the publication "Album of Wireless and Radio" by Greenwood, a paperback with a pictorial presentation of radios and components from way back in 1896 until 1927.

Incidentally, we don't know whether 1927 is regarded by the Americans as the "deadline" for vintage equipment but the date ties in very well with our own suggestion (Going Back, August 1970).

The time must surely come when we on this side of the Atlantic will have to produce a similar publication with a comprehensive photographic record of the history and development of radio in this country. Such a book would enable one more easily identify the odd bits and pieces of gear that come to the surface from time to time.

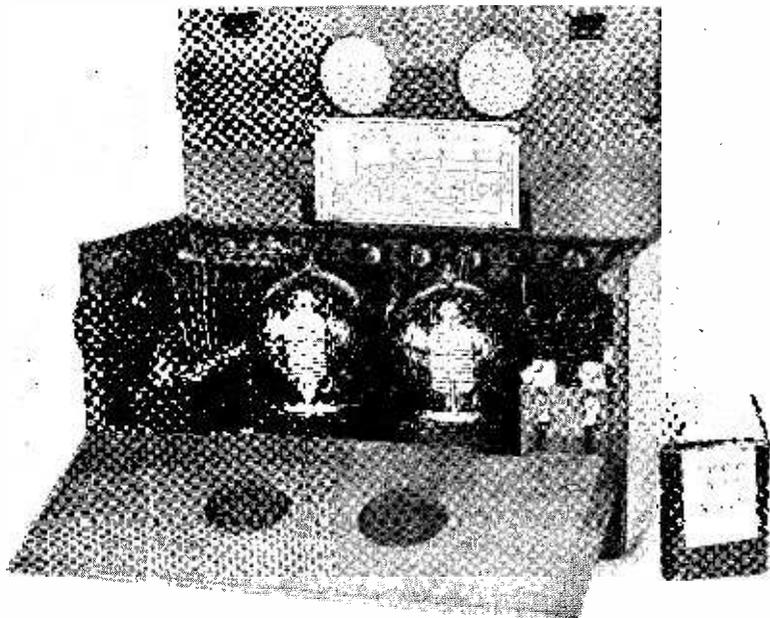
Once again it is necessary to stress the importance of ensuring that all the really old radios and accessories that must still be hibernating in attics, garages and workshops be safeguarded and entrusted to those best able to preserve them.

A Useful Find

As if to highlight the above reflections we are pleased to record an incident in which one reader of "Going Back" was able to rescue an old piece of equipment from almost certain death.

Mr. David Henson of Bothwell, Lanarkshire, is a lecturer in Electrical and Telecommunication subjects at the Langside Further Education College in Glasgow and he was delighted when one of his students came along with a Western Electric "Loud Speaking Amplifier", circa 1923.

It had been found in the attic of a house which the student had been helping to rewire. With the amplifier was a bundle of notes and diagrams but perhaps



A view of the "Loudspeaking Amplifier" of 1923 and its original grid-bias battery.

the most interesting find was the original Ever-Ready bias battery, still in perfect condition after some 47 years!!

The date of manufacture of the amplifier was fixed precisely thanks to the still clear imprint of an inspection stamp, 5th. February 1923.

Mr. Henson was able to get the amplifier working again although he states that the gain seemed a trifle low but the Type 216A valves, at least, are still serviceable.

While this find is not, in itself, of any great importance it does underline the need to keep one's eyes and ears open for information on the whereabouts of similar old equipment. In most cases the discoverers of such treasures display little interest and are only too happy to hand them over to some enthusiast rather than consign them to the dustbin.

The Type 216A valve had its counterpart in the Mullard "ORA" valve which in 1922 was being virtually mass-produced and sold for 15s. A bright emitter, the ORA was only slightly more expensive than similar imported types but it was considerably more reliable.

It filled a triple need being advertised as an Oscillator, Rectifier and Amplifier, hence the name ORA and it proved a boon to the experimenter in the early twenties who had had to fiddle long enough with cat's-whisker detectors.

Listeners were soon reporting the reception of signals from stations over 9000 miles away while using just a single ORA valve. Considering that these signals were on a frequency of about 33kHz (yes, thirty-three kilocycles!) or a wavelength of 9000 metres these results must have been thought stupendous as indeed they were.

The SWL of today would be hard pushed to put up a matching performance even on the medium wave band. It is a pity that there is such a paucity of information on these early achievements particularly in respect of the types of emissions employed and styles of aerials used at the transmitters.

Certainly the SWL had nothing more than a long wire or perhaps a cage aerial but he would have paid more attention to getting a good earth system than does the SWL of today. This factor must have played an important part in receiving DX signals on 9000 metres.

"Luxembourg Effect"

In the early thirties one heard a lot about the "Heaviside Cross-modulation Effect". A signal would appear to be cross-modulated by another signal even when one station was on the long-wave band and the other on medium waves.

The effect only seemed to occur with high power stations and only when their respective paths to the receiving station via the ionosphere roughly coincided.

As the symptoms apparently got worse with increasing power levels it was hoped that this might lead to a relaxation in the race for more and more powerful transmitters. With current individual stations running powers of 1500kW it looks as if these hopes have come to nought!

The effect was first noticed with the Hilversum long-wave transmitter and later between Athlone and other stations. It was not long before Luxembourg, then on long-wave 1304m and the best signal on the band, became involved as listeners to the

Swiss station Beromünster on 540m reported hearing the Luxembourg programme in the background. As before these listeners tended to be located on a line passing through Luxembourg and Beromünster. These transmitters were using powers of 100kW and 60kW respectively.

By late 1934 the "Luxembourg Effect" as it inevitably became known here was reckoned to take place with any long-wave station and any medium-wave station which were roughly in line with the receiving aerial.

Investigations by Dr. van de Pol in Holland found that a station with a wavelength in excess of 450m could appear as a background to another station using a shorter wavelength. This point was confirmed by several observers hearing Cologne on 456m as a background to Leipzig on 382m.

Dr. van de Pol and Professor Appleton both thought that the Heaviside Layer was being disturbed by the high-power long-wave transmissions and that medium-wave signals travelling through the same part of the layer were being cross-modulated by the long-wave station.

While the "Luxembourg Effect" was accepted as a fact the other reports which did not seem to quite fit in with the theory were soon discounted when someone did a bit of arithmetic with receiver oscillator harmonics and intermediate frequencies!! It had been noted that the observers had all been using superhets!

Band Plans

Presumably if every broadcast station on the medium waves adhered to its allocated frequency there would not be a heterodyne whistle from end to end of the band. In practice this is far from the case as a quick listen around any evening will confirm.

However, in 1934 things seemed to have been much the same to judge from the following comments.

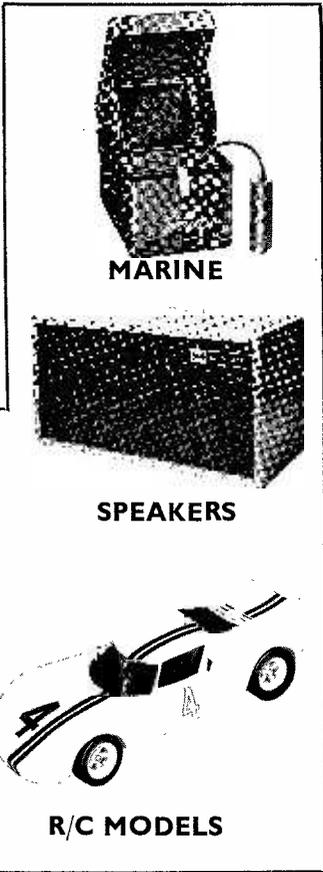
"Radio LL which has been a nuisance for years, now, is, I suppose, a pirate station, since no individual wavelength is available for it. Recently it has wandered all over the place between 357 and 362 metres heterodyning Bucharest, Moscow IV and Berlin. Limoge has strayed between 239 and 335 metres seemingly unable to keep to any wavelength.

"Toulouse has used anything between 324 and 335 metres and Rennes has wobbled badly around 288 metres."

At that time the Lucerne Plan was in operation and all the governments concerned had agreed to keep their stations in order but in spite of that many stations seemed to do as they liked. Things haven't changed much, have they?

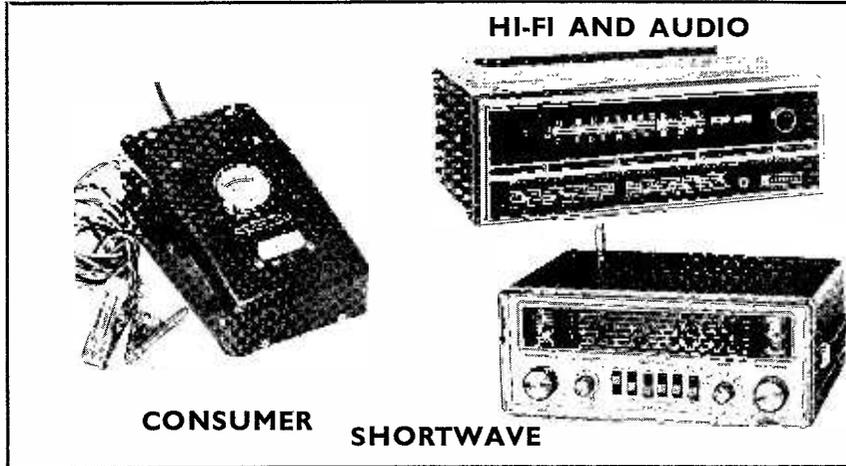
In addition to adjacent channel problems one other serious form of interference was prevalent in those days. This was due to the radiation of harmonics from broadcast transmitters. Scottish Regional was heterodyned by Moscow's second harmonic, Luxembourg interfered with the London and West Regional services and the seventh (yes, the 7th!) harmonic of Radio Paris made a mess of the Nurnburg transmissions. We wonder what mischief was caused by the other harmonics of RP!

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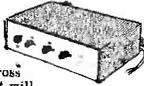
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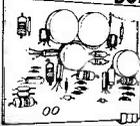
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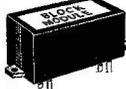
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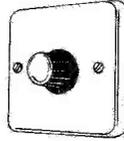
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LIGHT DIMMER

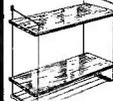
The unit comes complete with MK Ivory Front Plate and Control Knob, when used in place of Light Switch it will control your room lighting from, off to full brightness. Power—up to 300 watts in interference suppressed

£2.75 + P. & P. 7 1/2p.



SHELF UNIT

Two teak finish shelves on a black frame (overall size 28" x 25" x 12" deep). This unit is wall mounting. **250p.** Postage Free



DWELL TIME UNIT

These small units contain the following components:
700 ohm DPDT relay with base, 1µF 250v. paper, 0.01µF 400v. paper, 50µF 35v. electrolytic, 3 diodes OC200 transistor, a 2N2926 type transistor unmarked, a skeleton pre-set pot, 4 pin din plug & skt., 4 foot of 4 core screen. All housed in a small neat metal box. Can be made into many timing devices.
-P. & P. **42 1/2p** 7p



IMPORTED PANEL METERS

KA-38C 1 1/2" x 1 1/2" 50µA, 100µA, 500µA, 1mA, 5mA. S meter 1mA, 300v. All at **£1.47 1/2** Plus 5p P. & P.
KA-65C 3 1/4" x 3 1/4" 300v., S meter 500µA, 1mA. All at **£1.97 1/2** Plus 7 1/2p P. & P.



COMPONENT CENTRE

8" x 6" one aided printed circuit board 10p each
1Y100 type rectifier 800 pvt 750mA 10p each
4-pin transistor holders 2p each
2 1/2" 80 ohm loudspeaker 27p each
2 1/2" 8 ohm loudspeaker 27p each
2 1/2" 25 ohm loudspeaker 27p each
U2 battery holders (blue plastic) 5p each
10 ohm w/w pots 12p each
OC81 double heat clips 2p each
Tape recorder rev. counters 25p each
Transistors, Diodes, S.C.R.s etc. Send for list now
Please include P. & P.

LOOK FOR OUR NEW SHOP TO OPEN SOON IN ED-MONTON CARRY-ING A WIDER RANGE OF COMPONENTS, HI-FI AND SURPLUS STOCK.

G.E.C. RATCHET RELAY No RELIA/008/07 Coil—375 Ω 3-make break contacts, 1-changeover. All New and Boxed. **30p.** each. Post 5p.

FLICK SWITCHES



250 volt 3A. Single Pole on-off. 1 1/2" nylon Toggle. **17 1/2p** Plus Postage 5p



2 1/2 kW FAN HEATER
Three position switching to suit changes in the weather. Switch up for full heater (2 1/2 kW), switch down for half heat (1 1/4 kW), switch central blows cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit **£3.75.** Post and ins. 38p.



12 VOLT BATTERY CHARGER
Made in Japan, this is very small and neat. Regular use will keep your car battery in good trip throughout the winter. Silly price **£1.25** plus 23p postage and insurance.

QUICK CUPPA

Mini Immersion Heater, 350w. 200/240v. Boils full cup in about two minutes. Use any socket or lamp holder. Have at bedside for tea, baby's food, etc. **£1.25**, post and insurance 14p. 12v. car model also available **£1.**



PLINTH AND COVER

Suitable for most auto changers, teak base with tinted perspex cover **£4.25** plus 33p postage.



THRISTOR LIGHT DIMMERS

Will dim incandescent lighting up to 500 watts from full brilliance to out. Assembled and wired ready to install **35p.**



AUTO ELECTRIC CAR AERIAL

With dash board control switch—fully extendable to 40" or fully retracted. Suitable for 12V positive or Neg. earth supplied complete with fitting instructions and ready wired dash board switch **£5.95** plus 5/- p. & p.



COMPUTER TAPE

2,400 ft. of the best magnetic tape money can buy. Made by E.M.I., 1in. wide almost unbreakable and on a 10 1/2in metal computer spool. Users have claimed successful results with video as well as sound recordings **£1** plus 33p post. Cassette to hold spool 50p extra.

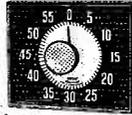


HORSTMANN "TIME AND SET" SWITCH

(A 15 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost period of up to 3 hours. Equally suitable to control processing. Regular price probably around **£5.** Special snip price **£1.50**, p. & ins. 23p.

1 HOUR MINUTE TIMER

Made by famous Smiths company, these have a large clear dial, size 4 1/2 x 3 1/2, which can be set in minutes up to 1 hour. After preset period the bell rings. Ideal for processing, a memory jogger or, by adding simple lever, would operate micro-switch **£1.15.**



THE FULL-FI STEREO SIX



The amplifier sensation of the year You will be amazed at the fullness of reproduction and at the added qualities your records or tuner will reproduce. Built into metal cabinet elegantly styled in simulated teak finished to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts R.M.S. split over the two channels. The amplifier is ideal for use with normal pick-ups and tuners, it has a double wound mains transformer and ganged volume and tone controls—also switching for Mono to Stereo, tuner or pick-up. Other controls include "treble lift and cut", "balance" and separate mains on/off switch. UNREPEATABLE PRICE is **£9** plus 33p post and insurance.

STANDARD WAFER SWITCHES

Standard Size 1 1/2" wafer—silver-plated 5 amp contact, standard 1 1/2" spindle 2", long—with locking washer and nut.

No. of Poles	2		4		6		8		9		10		12	
	way													
1 pole	33p													
2 poles	33p													
3 poles	33p													
4 poles	33p													
5 poles	33p													
6 poles	33p													
7 poles	55p													
8 poles	55p													
9 poles	55p													
10 poles	55p													
11 poles	55p													
12 poles	55p													

Where postage is not stated then orders over **£5** are post free. Below **£5** add 14p Semi-conductors add 5p post. Over **£1** post free. S.A.E. with enquiries please.

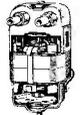
SPARTAN Portable RADIO

Long and medium wave, 7 transistor, size 6in. x 4in. x 1 1/2in. with larger than usual speaker giving very good tone. Built-in ferrite aerial and telescopic aerial for distant stations. A real bargain complete with leather case, carry sling, earplug and case **£3.75** plus 25p post and ins.



MULTI-SPEED MOTOR

Replacement in many well known food mixers. Six speeds are available. 500, 850 and 1100 r.p.m. from either or both of the nylon sockets (Where the heaters of the food mixers normally go) and 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) from the main drive shaft. Very powerful and useful motor size approx. 2in. diameter, 5in. long. Price **90p** plus 23p, p. & ins. 12 or more post free.



MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2 1/2" x 2" x 2in. **£1** each.



DOUBLE ENDED MAINS MOTOR

On feet with holes for screw-down fixing. To drive models, oven, blower heater, etc. 50p each, plus 15p post and insurance, 6 or more post free.



0.005mFd TUNING CONDENSER

Proved design, ideal for straight or reflex circuits 13p each, **£1.20** doz.



ELECTRONICS (CROYDON) LTD
Dept PW 266 London Road, Croydon CRO-2TH
Also 102/3 Tamworth Road, Croydon

an engineers 'PIPE DREAM'

John Chapman

MORE than three hundred and fifty engineers—many from overseas—assembled in London recently to hear about the latest developments in the use of waveguides for long distance communications.* Britain is among the leading nations in this advanced technology and is about to lay an experimental waveguide link with a capacity of 400,000 telephone circuits or equivalent—say, 250 television channels in either direction.

This work is being undertaken by the Post Office and holds much promise for the future. Talking at the conference, W. J. Bray, Research Director of the British Post Office, said that the research and advanced development on guided-wave transmission systems in the United Kingdom during the last few years could provide the answer for economically accommodating the anticipated large and increasing volumes of telecommunications traffic foreseen on the main trunk routes during the next thirty years.

New services will account for a large part of this growth. It is almost certain that we shall see the introduction of the picture telephone (Viewphone), conference television (Confravision) and a variety of high-speed data transmission links before the end of the century and possibly very much sooner. These new services will, of course, require a much greater bandwidth than the present telephone and data services and, to be practicable, new transmission techniques have to be found.

Two types of guided-wave transmission systems are being studied by the British Post Office, in co-operation with industry and universities. One of these is based on 50 millimetre diameter helix and dielectric guides (referred to as TE_{01} -mode waveguides); the other on an optical system featuring a mono-mode fibre guide.

Work on TE_{01} -mode systems is at an advanced stage and major field trials are now scheduled. It is proposed to lay an experimental waveguide linking the Post Office's research station at Martlesham Heath to the country's microwave radio-relay network. The nearest point is at Mendlesham, Suffolk, a distance of nearly twenty miles. This project will allow engineers to prove the design of the waveguides and associated equipment under realistic conditions.

The application of fibre optics to long distance communications is still at an early stage of development. Engineers are confident that this method has a future, for the inherent flexibility of optical fibres may avoid the need for special laying techniques associated with helix and dielectric waveguides, such as limited numbers of specially designed corners, the need to use long straight sections and having to use very gradual bends.



Model of Martlesham

Optical fibre systems may also solve another problem—that of providing broadband local distribution between exchange and subscriber. If proved feasible, they may be used to provide a cheap way of bringing broadcast television, the "viewphone," access to video tape film libraries, computer memory banks and so on right into the home or office. The unique properties fibre optics have in offering many space-divided broadband channels which can be separated with simple equipment at the receiving end, their flexibility and compactness make them very attractive for future applications.

Looking towards the future, Mr. Bray suggested that it would be natural to consider that solid-state technology would continue to open up even higher frequencies—say, in the range 80 to 275GHz. This would allow engineers to think of using 20mm helix or dielectric lined guides which could carry a million telephone circuits—about 2.5 times as many as now possible with a 50mm guide operating in the frequency range 32 to 110GHz.

Mr. Bray also spoke of the vast area between the upper limit of some 300GHz for helix and dielectric lined guides and the near infra-red end of the spectrum (300,000GHz) in which optical fibre systems work. A study of this region, he suggests, might reveal new guided-wave structures with bandwidth capabilities exceeding even those of the systems now being developed.

It seems likely that we are to see many changes in the telecommunications field before the end of the century which must affect people connected with the electronics industry. There are all the signs that waveguide technology will be as important as the implementation of satellite communications. There is no doubt that new means of telecommunication are needed, it is just a question of which method best suits our needs. We in Britain are not the only ones to think that waveguides offer the best solution. Certainly, they are complementary to satellite communications and it is almost certain that they will provide the answer to the ever increasing congestion of our internal communications network. Also it is unlikely that we will see the introduction of super quality television pictures, the "videophone" and other such services until guided-wave lines (or some other form offering comparable bandwidth) are introduced. ■

* Trunk Telecommunications by Guided Waves Conference, 29 September-2 October, 1970, at Institute of Electrical Engineers, Savoy Place, London.

NEWS FROM ABROAD

ARE YOU SHOBER?

Flashing numbers on the dashboard of a car may help to reduce the number of accidents caused by drunken drivers in the U.S. The device will baffle anyone whose driving ability is impaired by alcohol, drugs or toxic gases and so prevent them driving off. Sober and alert drivers will have no difficulty in starting their cars.

This is the way it works. When a driver turns the ignition key, a random number of up to five digits flashes onto a miniature screen. The driver must punch this number into a keyboard within a few seconds. If he does so correctly, the car starts automatically. If he fails, he gets two more chances with different numbers. If he misses out on these the car will not start for a long time. This device—still in the experimental stage—has been developed by the electronics division of General Motors.

HI-JACKING THE HI-JACKER

A company called Brovac Electronics appear to have perfected a Hi-Jacker Hi-Jacker. The system comprises three metal-detecting sensors and a set of revolving doors. The sensors detect the quality and surface of a metal object like a gun and when a person boarding a 'plane and carrying a gun or other suspicious article passes, the doors snap shut. The hi-jacker is then asked to put his gun in a chute and if he refuses, sleeping gas is pumped in rendering him unconscious.

INDUSTRIAL ELECTRONICS

Electronics in the service of Industry is the theme to be used at the International Electronics Week in Lille, France from June 14th to 19th. Research and development, management communication and training, together with manufacture, will be the three main topics. Visits will be arranged to many plants in the Pas-de-Calais and Nord regions.

DECCA RADAR

Decca Radar's 40,000th order is among a dozen recently received from the Belgian Administration de la Marine, through International Electronics Service, one of Decca's oldest agents. A variety of harbour craft, including pilot boats and customs launches, are all to have Decca's solid-state RR 914's.

The Belgian order was only just ahead of one for a fishery protection vessel in S. Ireland. The new solid-state radars are in particular demand there, nearly eighty per cent of all fishing vessels of 65ft. and above, now under construction or on order, being due to fit the RM 914.

QUERY COUPON

This coupon is available until 5th March 1971 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, MARCH 1971

JAP COLOUR

It looks as though we will soon be able to get Japanese colour TV sets in England. The Hitachi Company have been given the go-ahead by the Japanese Government on their recent licence agreement with AEG-Telefunken to manufacture TV sets using the PAL system. The first sets should be reaching dealers any time now and the company claim that they will be of high quality and at competitive prices.

OVER THE AIR

Residents in Tampa, Florida, can telephone their local radio station to report on examples of pollution in the area. Staff members check the allegations and refer valid complaints to the State Pollution Control Board. Reports of action are announced over the air.

In the first two months of the programme, the station received about three calls a day. Twenty violations were confirmed and reported to the Board.

STAMP ON IT

Some weeks ago, the Portuguese Post Office issued a set of postage stamps commemorating the centenary of the laying of the first submarine cable to Portugal. There are four stamps in the set and two of them—the 1 escudo and 2 escudos 50 cents, show the old Cable Ship *Great Eastern* laying the cable. The two stamps of the same design are in different colours. The other two, of 2 escudos 80 cents and 4 escudos show a cross-section of a submarine cable.

VIDEO MEDICS

A news service by video-cassette under the name Mediscope is being received by hospitals and clinics in France. About 6,000 students and specialists are receiving programmes on TV sets supplied by the Compagnie Europeene de Video-Information.

PRACTICAL WIRELESS

QUERY SERVICE

Before using the query service it is important to read the following notes:

The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard textbooks. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(a) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(b) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

(c) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(d) We regret we are unable to answer technical queries over the telephone.

(e) It helps us if queries are clear and concise.

(f) We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.

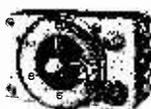
ELECTRIC CLOCK WITH 25 AMP SWITCH

Made by Smith's, these units are as fitted to many top quality cookers to control the oven. The clock is mains driven and frequency controlled so it is extremely accurate. The two small dials enable switch on and off times to be accurately set. Ideal for switching on tape recorders. Offered at only a fraction of the regular price—new and unused only £2, less than the value of the clock alone—post and insurance 14p.



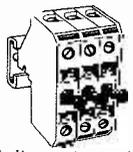
20 AMP ELECTRICAL PROGRAMMER

Learn in your sleep: Have Radio playing and kettle boiling as you awake—switch-on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an Electrical Programmer. Made by the famous Smiths Instrument Company. This is essentially a 230/240 volt mains operated Clock and a 20 amp Switch, the switch-off time of which can be delayed up to 12 hours (continuously variable not stepped). Similarly the switch-on time can be delayed. This is a beautiful unit, size 5 1/2 x 3 1/2 x 2 1/2 in. deep. Metal encased, glass fronted with chrome surround. Offered at £2.40 plus 23p postage and insurance.



Mains Connector

A quick way to connect equipment to the mains safely and firmly—L, N, and E. coded to new colour scheme; disconnection by plugs prevents accidental switching on; has sockets which allow insertion of meter without disconnection; cable inlets firmly hold one hair wire on up to four 7.029 cables. 65p each.



FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15-20 w. £1. Kit B—30-40 w. £1. Kit C—50 w. £1.20. Kit D—65 w. £1.20. Kit E for 8ft. 125 w. tube £1.75. Kit MF1 is for 6in., 9in. and 12in. miniature tubes £1. Kit MF2 for 21in. 13 w. miniature tube £1. Postage on Kits A and B 23p for one or two kits then 23p for each two kits ordered. Kits C, D and E 23p on first kit then 18p for each kit ordered. Kit F 35p then 23p for each kit ordered. Kit MF1 18p on first kit then 15p on each two kits ordered.

BLANKET SWITCH

Double pole with neon let into side so luminous in dark, ideal for dark room light or for use with waterproof element, new plastic case 30p each. 3 heat model 40p



BLANKET SIMMERSTAP

Although looking like, and fitted as an ordinary blanket switch, in fact a device for switching on for varying time periods, thus giving a complete control from off to full heat. Although suitable for controlling the temperature of any other appliances using up to 1 amp. Listed at £1.40 each we offer these while our stocks last at only 65p. each.

REED SWITCHES

Glass enclosed, switches operated by external magnet—gold welded contacts. We can now offer 5 types: Miniature. 1in. long x approximately 1/4 in. diameter. Will make and break up to 1A up to 300 volts. Price 13p each. £1.20 dozen. Standard. 2in long x 3/16in. diameter. This will break currents of up to 1A, voltages up to 250 volts. Price 10p each. 90p per dozen. Flat. Flat type, 2in. long, just over 1/16in. thick, approximately 1/4 in. wide. The Standard Type flattened out, and can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1 amp 200 volts. Price 30p each. £3 per dozen. Small ceramic magnets to operate these reed switches 8p each. 90p per dozen.

HIGH CAPACITY ELECTROLYTICS

Brand new, not ex-equipment.
100 mfd. 25v., 6p each. 60p doz.
250 mfd. 50v., 10p each. 1.65 doz.
400 mfd. 40v., 25p each. £2-30 doz.
500 mfd. 12v., 19p each. £1-05 doz.
500 mfd. 25v., 18p each. £1-80 doz.
300 mfd. 50v., 28p each. £2-40 doz.
500 mfd. 350v., 43p each. £4-50 doz.
1000 mfd. 12v., 15p each. £1-50 doz.
1000 mfd. 18v., 17p each. £1-70 doz.
1000 mfd. 64v., 27p each. £4 doz.
2000 mfd. 25v., 34p each. £3-85 doz.
5000 mfd. 12v., 24p each. £2-40 doz.
10,000 mfd. 6v., 29p each. £3 doz.
10,000 mfd. 18v., 43p each. £4-50 doz.
10,000 mfd. 100v., 10p each. £1-50 doz.
60,000 mfd. 8v., £1-10 each. £10 doz.
70,000 mfd. 18v., £2 each. £20 doz.

3 amp 12v Battery Charger Kit—comprising 230/40 mains transformer with 3 amp secondary and 3 amp rectifier £1.15 plus 23p post.

12 volt 1 1/2 amp Power Pack. This comprises double-wound 230/240v mains transformer with full wave rectifier and 2000 mfd/50 smoothing. Price £1-40.

Sonotone Stereo Cartridge. Turnover type, ref. No. 19 T1. This fits most British pick-ups and is a really excellent reproducer. Limited quantity, £1. 5 amp 3 pin Sockets. These are always good stock, you never know when you will need some. Famous make, brown bakelite, standard size, 12 for 65p plus 23p post.

Ditto but with switch. 12 for £1 plus 23p post. 15 amp sockets, flush mounting. Bakelite, cream-les switch. 6 for £1.

Bakelite Panels, many thicknesses. We have just taken delivery of approximately 10 tons of bakelite in varying thicknesses from 2in. to a few thou. If you have a need for any of this then we would be glad to supply. The thickest is very heavy and could be used, for instance, as a bed for a motorised unit. Medium thickness is useful for front panels of instrument, etc., etc. Cut to your size price is 30p per lb. plus 30p cutting charge plus carriage. 2 amp 3 pin Switched sockets for surface mounting, brown bakelite. Made by famous maker. 13p each or £1-20 dozen.

100 Assorted Silicon Rectifiers G.P. and switching diodes. Smallhand very small sizes. A real snip for experimenters. 65p per 100.

40 WATT 1 1/2 in. HI-FI SPEAKER

Is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi and public address. Handling 40 watts R.M.S.—Cone moulded fibre—Freq. response 30-10,000 c.p.s.—specify 3 or 15 ohms. Chassis diam. 1 1/2 in.—1 1/2 in. over mounting lug. Over 115 1/4 in. height. A £10 speaker offered this month for £7 plus 86p post and ins.



INTEGRATED CIRCUIT BARGAIN

A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. 4 of the ICs are single silicon chip GP amplifiers. The 5th is a monolithic NFM matched pair. Regular price of parcel well over £5. Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices 5/- upwards with circuits and technical data of each. Complete parcel only £1 post paid. DON'T MISS THIS TERRIFIC BARGAIN.

THIS MONTH'S SNIP 24-HOUR ELECTRIC TIME SWITCH

Made by Smith's, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours, 5 amp changeover contacts will switch circuit on or off during these periods. £2-60 post and ins. 23p. Additional time contacts 50p pair

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work, £2 less plus £2-25 with fitted 13 amp plug; £2-40 with fitted 15 amp plug, plus 23p P. & I.

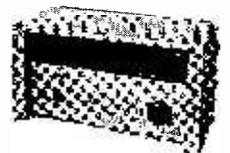
BARGAIN OF THE YEAR MICROSONIC KEYPCHAIN RADIO

7 transistor Keychain Radio in very pretty case, size 2 1/2 x 2 1/4 x 1 1/4 in.—complete with soft leather zippered bag. Specification—Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kcs. Sensitivity: 5 mv/in. Intermediate frequency: 465 Kcs or 455 Kcs. Power output: 40mW. Antenna: ferrite rod. Loudspeaker: Permanent magnet type. In transit from the East these sets suffered slight corrosion as the batteries were left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new. Price only £1-25 less batteries plus 13p. post 6 for £7 post free. Pair of rechargeable batteries and charger 85p.



ERGOTROL UNITS

These units made by the Mullard Group are for operating and controlling d.c. Motors and equipment from A.C. mains. Thyristors are used and these supply a variable d.c. resulting in motor speed control and operating efficiency far superior to most other methods. The units are contained in wall mounting cabinets with front control panel on which are fuses—push buttons for on/off and the variable thyristor firing control.



4 models are available—all are brand new in makers cases:
Model 2410 for up to 5 amps £17.50
Model 2411 for up to 10 amps £27.50
Model 2413 for up to 45 amps £47.50
Model 2415 for up to 80 amps £95.00
Note: 2415 is a floor mounting unit.

19 PIECE SOCKET SETS

Complete with wall or bench rack. Most useful size— from 1/2 to 3/4" 80p plus 23p post and insurance.



HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting, anti-theft and signs, Signalling, etc. Price from makers probably over £10 each. Special snip price £5-75 plus 25p. post and insurance. Don't miss this terrific bargain.



Where postage is not stated then orders over 25 are post free. Below 25 add 14p. Semi-conductors add 5p post. Over £1 post free. S.A.E. with enquiries please.

CONTROL DRILL SPEEDS

Electronically changes speed from approximately 10 revs to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1-50 plus 13p post and insurance. Made up model also available, £1-90 plus 13p post & p.

BALANCED ARMATURE UNIT

300 ohm. operates speaker or microphone, so useful in intercom or similar circuits. 33p ea. 55.30 doz.



PROTECT VALUABLE DEVICES FROM THERMAL RUNAWAY OR OVER HEATING

Thyristors, rectifiers, transistors, etc., which use heat-sinks can easily be protected. Simply make the contact with the sensor, also part of the heat sink. Motors and equipment generally, can also be adequately protected by having thermostats in strategic spots on the casing. Our contact thermostat has a calibrated dial for setting between 90deg. to 190 deg. F. or with the dial removed range setting is between 80 to 800deg. F. Price: 50p.



THERMOSTAT WITH PROBE

This has a sensor attached to a 15A switch by a 14in. length of flexible capillary tubing—control range is 20°F to 160°F so it is suitable to control soil heating and liquid heating especially when in buckets or portable vessels as the sensor can be raised out and lowered into the vessel. This thermostat could also be used to sound a bell or other alarm when critical temp. is reached in stack or heap subject to spontaneous combustion or if liquid is being heated by gas or other means not controllable by the switch. Made by the famous Teddington Co., we offer these at 65p each. Postage and insurance 14p.



MAINS MOTOR

Precision made—as usually in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip 10p. Postage 15p for first one then 5p for each one ordered.



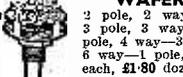
NEED A SPECIAL SWITCH?

Double Leaf Contact. Very slight pressure closes both contacts. 6p each, 60p doz. Plastic push-rod suitable for operating. 5p each, 45p doz.



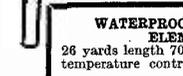
MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 4 way—1 pole, 12 way. All at 15p each, £1-80 dozen, your assortment.



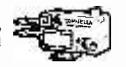
WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 50p post free.



MICRO SWITCH

5 amp. changeover contacts, 8p each, £1 doz. 15 amp. Model 10p each or £1-05 doz.



ELECTRONICS (CROYDON) LTD
Dept. PW, 266 London Rd., Croydon CR0 2TH
Also 102/3 Tamworth Road, Croydon

Sinclair Project 60



the world's most advanced high fidelity modules

Sinclair Project 60 presents high fidelity in such a way that it meets every requirement of performance, design, quality and value and now that the remarkable phase lock loop stereo FM tuner is available, it becomes the most versatile of high fidelity systems. With Project 60, it is possible to start with a

modest mono record reproducer and expand it to a sophisticated stereophonic radio and record reproducing system of fantastically good quality to hold its own with any other equipment, no matter how expensive. Project 60 is a unique high fidelity module system where compactness and ease of assembly are combined with

circuitry that is far in advance of any other manufacturer in the world. Thus it is extraordinarily easy to assemble any combination of modules using nothing more complicated than the simplest of tools, and you certainly do not have to be experienced to build with complete confidence. The 48 page manual free with Project 60 equipment makes everything easy and you can house your assembly in an existing cabinet, motor plinth, free standing cabinet or virtually any arrangement you wish. Once you have completed your assembly you will have superlatively good equipment to give you years of service and enjoyment. You will have obtained superb value for money because Project 60 is the best selling modular system in Europe and can therefore be produced at extremely competitive prices and with excellent quality control.

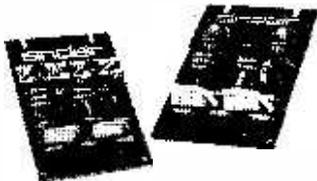
Sinclair Radionics Ltd., London Road, St. Ives, Huntingdonshire PE17 4HJ.
Tel: St. Ives (048 06) 4311

sinclair

System	The Units to use	together with	Cost of Units
A Simple battery record player	Z.30	Crystal P.U., 1.2V battery volume control	89/6 (£4.47½)
B Mains powered record player	Z.30, PZ.5	Crystal or ceramic P.U. volume control etc.	£9.9.0 (£9.45)
C 20+20 W. R.M.S. stereo amplifier for most needs	2 x Z.30s, Stereo 60, PZ.5	Crystal, ceramic or mag. P.U., most dynamic speakers, F.M. tuner etc.	£23.18.0 (£23.90)
D 20+20 W. R.M.S. stereo amplifier with high performance spkrs.	2 x Z.30s, Stereo 60, PZ.6	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	£26.18.0 (£26.90)
E 40+40 W. R.M.S. de-luxe stereo amplifier	2 x Z.50s, Stereo 60 PZ.8, mains trsfrmr	As for D	£32.17.6 (£32.87½)
F Outdoor P.A. system	Z.50	Mic., up to 4 P.A. speakers controls, etc.	£5.9.6 (£5.47½)
G Indoor P.A.	Z.50, PZ.8, mains transformer	Mic., guitar, speakers, etc., controls	£17.8.6 (£17.42½)
H High pass and low pass filters	A.F.U.	C, D or E	£5.19.6 (£5.97½)
J Radio	Stereo F.M. Tuner	C, D or E	£25.0.0

Sinclair Project 60

Z.30 & Z.50 power amplifiers



The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and may be used with other units in the Project 60 range equally well.

SPECIFICATIONS (Z.50 units are interchangeable with Z.30s in all applications).

Power Outputs

Z.30 15 watts R.M.S. into 8 ohms using 35 volts; 20 watts R.M.S. into 3 ohms using 30 volts.

Z.50 40 watts R.M.S. into 3 ohms using 40 volts; 30 watts R.M.S. into 8 ohms, using 50 volts

Frequency response: 30 to 300,000 Hz \pm 1dB

Distortion: 0.02% into 8 ohms

Signal to noise ratio: better than 70dB unweighted.

Input sensitivity: 250mV into 100 Kohms.

For speakers from 3 to 15 ohms impedance.

Size $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ in.

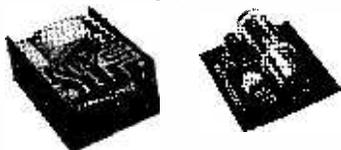
Z.30

Built, tested and guaranteed with circuits and instructions manual **89/6** (£4.47 $\frac{1}{2}$)

Z.50

Built, tested and guaranteed with circuits and instructions manual **109/6** (£5.47 $\frac{1}{2}$)

Power Supply Units



Designed specially for use with the Project 60 system of your choice.

Illustration shows PZ.5 to left and PZ.8 (for use with Z.50s) to the right. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.

PZ-5 30 volts stabilised **£4.19.6** (£4.97 $\frac{1}{2}$)

PZ-6 35 volts stabilised **£7.19.6** (£7.97 $\frac{1}{2}$)

PZ-8 45 volts stabilised

(less mains transformer) **£5.19.6** (£5.97 $\frac{1}{2}$)

PZ-8 mains transformer **£5.19.6** (£5.97 $\frac{1}{2}$)

Guarantee

If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost

Stereo 60 pre-amp/control unit



Designed for the Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalisation is provided for all the usual inputs.

SPECIFICATIONS

Input sensitivities: Radio—up to 3mV. Mag. p.u. 3mV; correct to R.I.A.A. curve \pm 1dB; 20 to 25,000 Hz. Ceramic p.u.—up to 3mV; Aux—up to 3mV.

Output: 250mV.

Signal-to-noise ratio: better than 70dB.

Channel matching: within 1dB.

Tone controls: TREBLE \pm 15 to $-$ 15dB at 10KHz; BASS \pm 15 to $-$ 15dB at 100Hz.

Front panel: brushed aluminium with black knobs and controls.

Size: $8\frac{1}{2} \times 1\frac{1}{2} \times 4$ ins.

Built, tested

and guaranteed.

£9.19.6 (£9.97 $\frac{1}{2}$)

Active Filter Unit

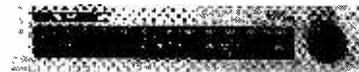


For use between Stereo 60 unit and two Z.30s or Z.50s, and is easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The A.F.U. is suitable for use with any other amplifier system. Two stages of filtering are incorporated—rumble (high pass) and scratch (low pass). Supply voltage $-$ 15 to 35V. Current $-$ 3mA. H.F. cut-off ($-$ 3dB) variable from 28k Hz to 5kHz. L.F. cut-off ($-$ 3dB) variable from 25Hz to 100Hz. Distortion at 1kHz (35V. supply) 0.02% at rated output.

Built, tested and guaranteed

£5.19.6 (£5.97 $\frac{1}{2}$)

Stereo FM Tuner



first in the world to use the phase lock loop principle

Before production of this tuner, the phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio over other systems. Now, for the first time, the principle has been applied to an FM tuner with fantastically good results. Other original features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and squelch circuit for silent tuning between stations. Sensitivity is such that good reception becomes possible in difficult areas. Foreign stations can be tuned in suitable conditions and often a few inches of wire are enough for an aerial. In terms of a high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with any other high fidelity system.

SPECIFICATIONS:

Number of transistors: 16 plus 20 in I.C.

Tuning range: 87.5 to 108 MHz.

Capture ratio: 1.5dB

Sensitivity: 2μ V for 30dB quieting; 7μ V for full limiting.

Squelch level: 20μ V.

A. F. C. range: \pm 200 KHz

Signal to noise ratio: $>$ 65dB

Audio frequency response: 10Hz—15KHz (\pm 1dB)

Total harmonic distortion: 0.15% for 30% modulation

Stereo decoder operating level: 2μ V

Pilot tone suppression: 30dB

Cross talk: 40dB

I. F. frequency: 10.7 MHz

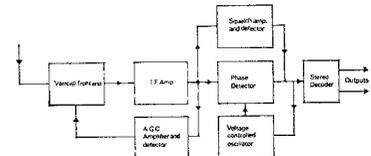
Output voltage: 2×150 mV R.M.S.

Aerial impedance: 75 Ohms

Indicators: Mains on; Stereo on; tuning indicator

Operating voltage: 25-30 VDC

Size: $3.6 \times 1.6 \times 8.15$ inches; $91.5 \times 40 \times 207$ mm



Price: £25 built and tested. Post free

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send

Name

Address

for which I enclose cash/cheque/money order.

PW.371

Sinclair IC10/Q16/Micromatic

IC10



The world's most advanced high fidelity amplifier

This is the world's first monolithic integrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself is a chip of silicon, only a twentieth of an inch square by one hundredth of an inch thick, having 5 watts RMS output (10 watts peak). It contains 13 transistors (including two power types), 2 diodes, 1 zener diode and 18 resistors, and is encapsulated in a solid plastic package which holds the metal heat sink and connecting pins. This exciting device is more rugged and has considerable performance advantages, including complete freedom from thermal runaway and a very low level of distortion. The IC10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which application it only requires the addition of such components as tone and volume controls and a battery or mains power supply. It may also be used in other applications including car radios, electronic organs, servo amplifiers (it is dc coupled throughout) etc.

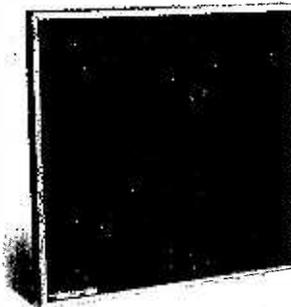
Circuit Description

The first three transistors are used in the pre-amp and the remaining 10 in the power amplifier. Class AB output is used with closely controlled quiescent current which is independent of temperature. There is generous negative feedback round both sections and the amplifier is completely free from crossover distortion at all supply voltages, making battery operation eminently satisfactory. Each IC10 is sold with a comprehensive manual giving circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include oscillators, etc. The pre-amp section can be used as an RF or IF amplifier without any additional transistors.

Specifications:

Output: 10 watts peak, 5 watts RMS continuous.
Frequency response: 5Hz to 100kHz $1 \pm$ dB.
Total harmonic distortion: Less than 1% at full output.
Load impedance: 3 to 15 ohms.
Power gain: 110 dB (100,000,000,000 times) total.
Supply voltage: 8 to 18 volts. (A Sinclair power unit, PZ.7 is available for mains operation).
Size: 1 x 0.4 x 0.2 in. plus heat sink and tags.
Sensitivity: 5 mV.
Input impedance: Adjustable externally up to 2.5 Mohms.
Price (with manual): 59/6 (£2.97 $\frac{1}{2}$) post free.

Q16



High fidelity loudspeaker

The Q16 employs the well proven acoustic principles specially developed by Sinclair in which a special driver assembly is meticulously matched to the characteristics of the uniquely designed cabinet. In reviewing this exclusive Sinclair design, technical journals have justly compared the Q16 with much more expensive loudspeakers. Its shape enables the Q16 to be positioned and matched to its environment to much better effect than is the case with conventionally styled enclosures. A solid teak surround with a special all-over cellular foam front is used as much for appearance as its ability to pass all audio frequencies.

This elegantly designed shelf mounting speaker brings genuine high fidelity within reach of every music lover.

Specifications:

Construction: Special sealed seamless sound or pressure chamber with internal baffle.
Loading: up to 14 watts TMS.
Input impedance: 8 ohms.
Frequency response: From 60 to 16,000 Hz, confirmed by independently plotted B and K curve.
Driver unit: Special high compliance unit having massive ceramic magnet of 11,000 gauss, aluminium speech coil and a special cone suspension for excellent transient response.
Size and styling: 9 $\frac{1}{2}$ in square on face x 4 $\frac{1}{2}$ in. deep with neat pedestal base. Black all-over cellular foam front with natural solid teak surround.
Price £8.19.6. (£8.97 $\frac{1}{2}$).

Micromatic



Britain's smallest radio

Considerably smaller than an ordinary box of matches, this is a multi-stage AM receiver brilliantly designed to provide remarkable standards of selectivity, power and quality for its size. Powerful AGC counteracts fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy. The plug-in magnetic earpiece provided matches the Micromatic's output to give wonderful standards of reproduction. Everything including the special ferrite rod aerial and batteries is contained within the minute and attractively designed case. Whether you build a Micromatic kit or buy this amazing receiver ready built and tested, you will find it as easy to take with you as your wrist watch, and dependable under the severest listening conditions.

Specifications:

Size: 36 x 33 x 13 mm ($1\frac{1}{5}$ x $1\frac{3}{10}$ x $\frac{1}{2}$ in.)
Weight: including batteries, 28.4 gm (1 oz.).
Case: Black plastic with anodised aluminium front panel and spun aluminium dial.
Tuning: medium wave band with bandspread at higher frequencies, (550 to 1,600 Hz).
Earpiece: Magnetic type.
On/off switching: By inserting and withdrawing earpiece plug.
Kit in pack with earpiece, case, instructions and solder 49/6 (£2.47 $\frac{1}{2}$).
Ready built, tested and guaranteed, with earpiece 59/6 (£2.97 $\frac{1}{2}$).
Two Mallory Mercury batteries type RM675 required. From radio shops, chemists, etc.

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send

Name

Address

for which I enclose cash/cheque/money order.

PW 371

Sinclair Radionics Ltd., London Road,
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PAPER CONDENSERS:

TV types, 500V	50	50p
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VOLUME CONTROLS: Double, Mixed

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NUTS AND BOLTS: Mixed lengths/types

8 B.A.	100	50p
6 B.A.	100	50p
4 B.A.	100	50p
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METAL SPEAKER GRILLES: 7 1/2 in x 3 1/2 in

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V.H.F./F.M. TUNERS: Need ECC85

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VEROBOARD: Cutter — 5 2 1/2 in x 1 in Bds.

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OC22 Mullard. 1st grade manufacturers marking	2	50p
OC25 Mullard. 1st grade manufacturers marking	2	50p
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Solid core, insulated	yards	100	50p
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Selenium, large. Produce up to 16ma.	2	50p
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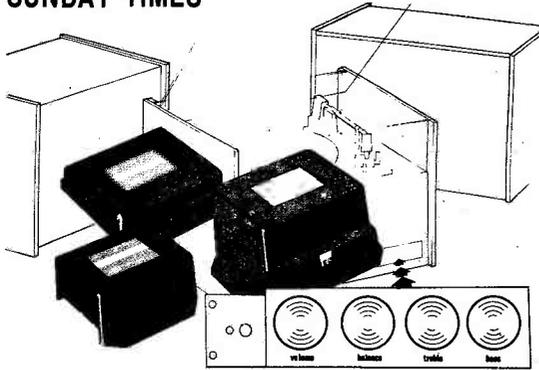
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PACKAGE DEAL

Two EP-9000 Modules **£5.80** • EP9002 Module **£4.60** • EP-9001 Module **£3.10** • Control Units **£3.25** • Instruction Book **25p**. **TOTAL LIST PRICE £17.00**
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FANTAVOX 105

MODEL VHF 105

An item for the radio enthusiast bringing instant reception of the ground-to-air, air-to ground waveband. For use with any standard AM or FM radio covering 535-1600 KHz 88-108 MHz respectively — with no electrical conversion or connection required. The model VHF-105, self powered by one 3V (PP3 type) battery, is merely placed close to the receiving set and then tuned over 110 to 135 MHz which covers the whole aircraft communications band. Volume and reception effectiveness is adjusted by moving both sets to the most favourable position and balancing the vol. controls of each accordingly. The Model VHF-105 has a smartly designed black plastic cabinet with brushed metal front panel and 18in. chrome telescopic antenna, size only 4 x 2 1/4 x 2 1/4 in. (inc. knobs). Complete with battery and full instructions.



LASKY'S PRICE £3.60 Post 10p

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List Price

£19.41

OUR PRICE

£6.95

Post 18p

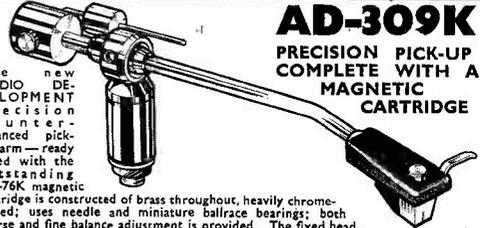


AUDIO DEVELOPMENT

AD-309K

PRECISION PICK-UP ARM COMPLETE WITH AD-76K MAGNETIC CARTRIDGE

The new AUDIO DEVELOPMENT precision counter-balanced pick-up arm — ready fitted with the outstanding



AD-76K magnetic cartridge is constructed of brass throughout, heavily chrome-plated; uses needle and miniature ballrace bearings; both coarse and fine balance adjustment is provided. The fixed head has standard 3/16 in. mounting centres and is finished in black enamel with chrome lifting spur. Completely wired, with all fixing nuts and washers. Arm rest also supplied. Tech. details: Overall length 285mm; needle to pivot length 223mm; offset angle 24°; overhang 10mm. Requires single 7/16 in. dia. mounting hole.

LASKY'S PRICE £8.50 Post Free

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Stereo Magnetic Cartridge. Frequency response 20-20,000Hz. Output: 5mV. Stylus: Diamond LP. Tracking force: 2 gms ± 0.5 gm. Replacement stylus type JS.P1 £2.05 post free.

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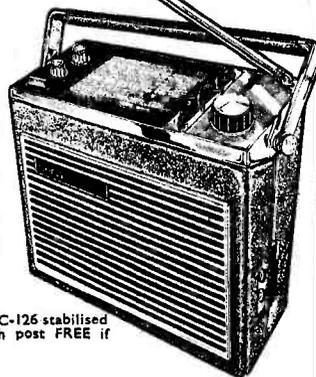
The SONY TFM-8030L will enliven your leisure hours anywhere, anytime with exciting sound, news, sport, music, etc. Technical specification: Freq. range, FM 87-108MHz, LW150-285kHz, MW530-1, 605kHz. Circuit: 11 transistors, 7 diodes and 2 thermistors. Aerial System: Directional telescopic for FM, internal ferrite bar for LW/MW. Power Output: 1.85W max. Speaker: PM Dynamic—4Ωimp. Power Source: 9v power pack battery (Ever-Ready PP9 or equiv.), AC mains with adaptor, Car battery with adaptor. Size: 9½(W) x 8½(H) x 3½(D). Complete with earphone and battery and full instruction manual.

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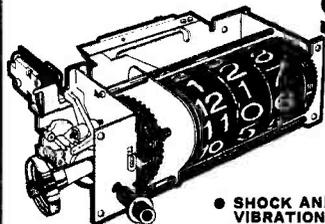
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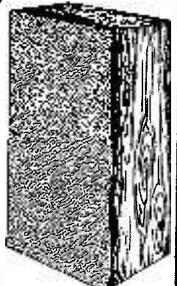
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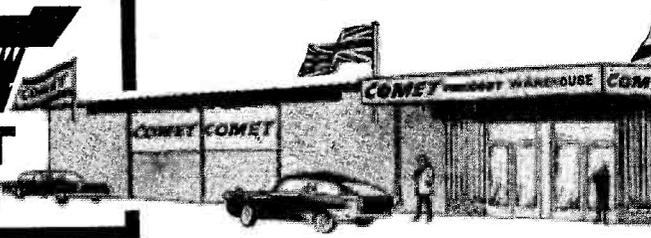


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Rec. Retail Comet
Price Price Price

STEREO AMPLIFIERS

ARMSTRONG 521	56-00	44-50
*DULCI 207	25-00	17-00
FERROGRAPH F307	30-00	21-00
GOODMANS Maxamp	59-00	48-00
LEAK Stereo 30 Plus	54-00	38-00
LEAK Stereo 30 Plus, in teak case	56-50	44-75
LEAK Stereo 70	62-50	49-50
LEAK Stereo 70, in teak case	69-00	55-00
*LEAK LT 66	75-00	59-50
METROSOUND ST20	21-00	17-00
PHILIPS RH 591	36-00	28-00
PHILIPS RH 590	76-75	59-00
PHILIPS RH 590	51-75	39-50
PHILIPS RH 580	28-00	25-00
PIONEER SA500	98-00	70-00
PIONEER SA700	98-00	70-00
PIONEER SA900	134-10	97-00
PIONEER Reverberation	45-50	33-00
ROGERS Ravensbourne	59-50	50-00
ROGERS Ravensbourne (cased)	64-00	50-00
ROGERS Ravensbrook Mk. II	47-50	38-00
ROGERS Ravensbrook (cased)		
Mk. II	52-50	42-00
SINCLAIR 2000	30-45	23-00
SINCLAIR PROJECT 60/2 X Z30/ PZ5	23-90	17-00
SINCLAIR PROJECT 60/2 X Z50/ PZ8/trans.	32-88	23-50
SINCLAIR Nesteric	61-95	48-00
SINCLAIR 3000	45-00	36-00
TELETON 203E	28-75	20-00
TELETON GA 101 30w RMS	37-50	28-50
VOLTEC 100w. Stereo Discotheque, 8 electronically mixed inputs	185-00	139-00

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges.

TUNERS

*ARMSTRONG 523 AM/FM	53-76	45-00
*ARMSTRONG 524 FM	41-89	35-00
*ARMSTRONG M8 Decoder	9-50	8-00
*DULCI FMT. 7 FM	22-05	15-00
DULCI FMT. 75 Stereo	31-00	25-25
GOODMANS Stereomax	82-52	49-95
LEAK Stereofetic Chassis	66-50	52-00
LEAK Stereofetic In teak case	72-50	59-00
PHILIPS RH 690	44-50	35-50
PHILIPS RH 691	89-00	75-50
PIONEER TX75 AM/FM	77-94	64-00
PIONEER TX900 AM/FM	153-69	125-00
ROGERS Ravensbourne	61-89	50-00
ROGERS Ravensbrook	45-01	40-00
ROGERS Ravensbrook (cased)	51-26	43-00
*SINCLAIR Project 60	26-73	19-25
TELETON GT 101	25-00	21-00
TELETON 201X FM	45-50	34-00
TELETON 201X FM	36-00	30-00

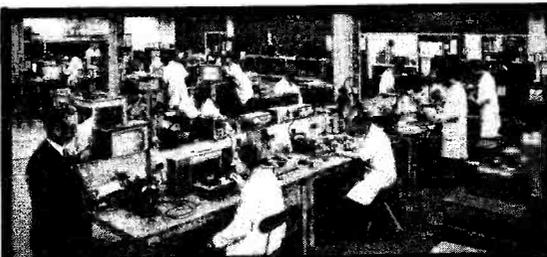
All above Tuners are complete with MPX Stereo Decoder except where starred.

TUNER/AMPLIFIERS

AKAI 6800	142-53	112-00
ARENA R500	82-00	67-00
ARENA 2400	90-30	72-00
ARENA 2600 Stereo AM/FM	111-30	94-00
ARENA 2700	105-00	85-00
ARENA T1500F	72-45	60-00
ARENA T9000	303-45	258-00
ARMSTRONG M8 Decoder	9-50	8-00
ARMSTRONG 525	91-89	77-00
ARMSTRONG 526	104-71	87-00
GOODMANS 3000	77-73	53-00
*PHILIPS RH 781	74-98	55-00
PHILIPS RH 790	135-00	109-00
PIONEER KX330 AM/FM/SW	76-52	59-00
PIONEER SX7000 AM/FM	180-43	126-00
PIONEER SX900 AM/FM	194-74	150-00
*TELETON F2000	51-50	32-00
TELETON 7 AT 20	105-00	80-00
TELETON 10AT1 150w. RMS	160-00	109-00
*TELETON R4200	51-75	32-00
TELETON R2500	75-50	56-00
*TELETON RT 6000 with Speakers	63-25	50-00
TELETON CR55	120-00	95-00
WHARFEDALE 100.1	131-25	105-00

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges.

All the above Tuners and Tuner/Amplifiers include MPX Stereo Decoder with the exception of Armstrong where decoder is extra as listed.



COMET for after-sales service

THROUGHOUT THE U.K.
Pictured, Service Dept at Clough Rd, Hull also at Leeds, Goole, Wakefield, Doncaster, and Bridlington

Rec. Retail Comet
Price Price Price

PICKUP ARMS

GOLDRING Lenco L75	12-33	10-50
GOLDRING Lenco L69	9-29	7-00
SME 3009 with S2 Shell	31-31	26-00
SME 3012 with S2 Shell	33-36	29-00

CARTRIDGES

GOLDRING 800 Cartridge	13-00	7-50
GOLDRING 800H	10-69	8-00
GOLDRING 800E	18-86	12-25
GOLDRING 800 Super E	26-01	20-00
*GOLDRING CS90 Stereo	5-20	4-25
*GOLDRING CS91/E	7-81	6-25
GOLDRING G850	6-50	5-25
ORBIT Magnetic NM 22	Special Price	
PICKERING V15 AC2	8-40	7-00
ORTOFON SL15E	29-65	23-75
ORTOFON 2X15K Transformer	7-00	5-25
SHURE M3DM	7-41	5-25
SHURE M31E	12-05	9-50
SHURE M32E	11-10	8-75
SHURE M32-3	10-20	8-00
SHURE M44-7	11-10	8-50
SHURE M44-7	10-20	8-00
SHURE M-44C	10-20	8-00
SHURE M44E	12-05	9-50
SHURE M55E	12-95	10-25
SHURE M75G	17-60	14-00
SHURE M75E-6	16-70	13-00
SHURE M75EJ	19-45	16-00
SHURE M75E-95G	23-15	18-00
SHURE M75E	21-30	16-00
SHURE M75E/D19	23-15	19-00
SHURE V15-11	40-75	30-00
SHURE V15-11-7	38-90	29-00

Starred cartridges above are ceramic. All others are magnetic.

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GARRARD SP25, fully wired with Goldring G800 Magnetic Cartridge. Complete with base, plinth and cover—Special.	20.98	
DUAL 1218 transcription	60-40	50-00
DUAL 1209 transcription	42-62	35-00
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GARRARD SL65 B	21-25	15-90
GARRARD SL95 B	38-25	28-50
GARRARD 401	53-27	38-50
GARRARD SL72 B	38-01	29-50
GARRARD 3500, with GKS Cartridge	32-77	26-90
Base and Cover to fit GARRARD SP25, SL65, SL85 and 3500	17-23	12-90
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GARRARD AP 76	13-84	10-97
GOLDRING 705P with 850 Cartridge and Cover	28-88	21-50
GOLDRING GL69 Mk. II	26-00	23-90
GOLDRING GL69 P Mk. II	26-63	22-50
GOLDRING GL75	35-14	29-50
GOLDRING GL75 P	36-41	33-90
GOLDRING GL75 P	46-94	41-90
GOLDRING Covers for 69P and 75P	4-21	3-50
GOLDRING C99—plinth and cover for G99	11-45	9-90
GOLDRING G99	25-00	23-90
GOODMANS 3025	37-74	26-90
McDONALD MP 80	15-75	12-25
McDONALD 610	20-00	15-90
Base and Cover for McDONALD MP 80 and 610	Special Price	4-50
PHILIPS 228	20-00	17-00

Rec. Retail Comet
Price Price Price

PHILIPS GA 146	31-50	25-00
PHILIPS 217	33-00	27-00
PHILIPS 202 Electronic	35-00	31-50
PIONEER PL11	67-00	57-50
THORENS TX 25 cover	8-22	6-53
THORENS TD125	75-89	62-00
THORENS TD150A Mk. II	43-63	33-00
THORENS TD125AB	120-20	100-00
THORENS TD150AB Mk. II	47-43	41-00
THORENS TX11 Cover	4-11	3-75

SPEAKERS

ARENA HT 16	13-00	10-95
B & W Model 70	139-50	115-00
B & W DM1	63-00	53-00
CELESTION Ditton 120	32-00	25-50
CELESTION Ditton 15	24-00	18-00
CELESTION Ditton 25	29-00	23-00
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GOODMANS Magister	22-45	19-00
GOODMANS Maxim	57-00	45-00
GOODMANS Mezzo 3	20-39	16-75
GOODMANS Mezzo 3	30-90	23-90
GOODMANS Magnum K2	40-10	29-90
KEF Celeste	29-00	21-50
KEF Concord	43-50	33-00
KEF Concerto	53-50	42-00
KEF Cresta	22-17	18-00
KELETRON KN 654/3 3 speaker system (pair)	19-00	14-97
KELETRON KN 824/3 3 speaker system (pair)	23-00	18-97
KELETRON KN 104/3 3 speaker system	16-75	12-97
KELETRON KN 123/3 3 speaker system	18-75	15-97
KELETRON KN 120/4 4 speaker system	24-50	18-97
LEAK 200	24-95	17-90
LEAK 300	32-50	23-50
LEAK 600	49-50	36-90
LOWTHER Acousta (with PM6)	45-50	38-50
LOWTHER Acousta (with PM7)	53-00	46-00
LOWTHER Ideal Baffle	35-50	30-00
METROSOUND HFS 20	18-50	13-50
PHILIPS RH481	11-00	9-25
PHILIPS RH482	18-00	15-00
SINCLAIR Q16	8-98	8-00
STE-MA 275 3 speaker system	23-10	15-00
WHARFEDALE Speakers		
Airedale	69-50	56-00
Denton	19-95	15-90
Super Linton	24-95	20-50
Dovedale 3	32-50	25-50
Rosedale	42-50	32-50
Triton (pair)	65-00	52-50
Unit 3 Speaker Kit	59-90	48-90
Unit 4 Speaker Kit	13-90	10-50
Unit 5 Speaker Kit	18-00	14-25
Unit 5 Speaker Kit	26-00	20-50

CHASSIS SPEAKERS

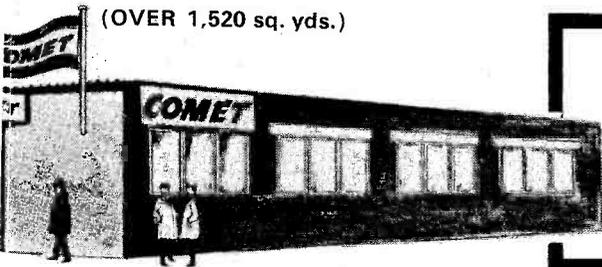
GOODMANS Axlette 8	7-48	6-00
GOODMANS Twinaxlette 8	8-44	7-00
GOODMANS Axlom 10	8-84	7-00
GOODMANS Axlom 8	26-07	21-75
GOODMANS Axlom 201	13-45	10-00
GOODMANS Axlom 301	19-25	14-50
GOODMANS Axlom 501	12-15	9-50
GOODMANS Audiom 51	17-60	13-00
GOODMANS Audiom 61	12-87	10-00
GOODMANS 12P		

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GOODMANS ASU 172	3.59	3.00
GOODMANS Trebax 100	7.45	5.50
GOODMANS Trebax 5K/20XL	8.40	6.50
GOODMANS Midax	11.20	8.50
GOODMANS Attenuator	3.07	2.25
GOODMANS Crossover Networks XO/950/5000	8.43	6.25
GOODMANS Crossover Networks XO/950	6.39	4.75
GOODMANS Crossover Networks XO/5000	2.30	1.75
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WHARFEDALE Super 8/RS/DD	8.50	7.00
WHARFEDALE Super 10/RS/DD	14.00	11.50
WHARFEDALE WMT 1 Matching Transformer	0.84	0.75

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ALBA UA662	59.75	50.00
ALBA 1552	45.50	38.00
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DECCA Sound 604	72.50	61.00
DECCA Sound 1203	97.50	80.00
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FERGUSON 2065	117.00	80.00
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KB KA1250/651	80.00	62.00
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TELETON 8-track Stereo	102.50	70.00
TELETON CMS400	102.50	70.00
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AKAI X-330D	312.56	245.00
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AKAI X-360 D-deck	318.92	243.00
AKAI 1800SD	199.42	167.00
AKAI 1710L	89.85	68.90
AKAI 4000 4-track Stereo	124.90	100.00
AKAI 4000 D 4-track Stereo deck	89.95	70.00
BUSH TP 60 Cassette Tape Re- corder	29.40	25.00
BUSH TP 70 Cassette Battery/ Mains Tape Recorder	29.95	24.00
FERGUSON 3244 Stereo 4-track	97.90	80.00
FERGUSON 3245 Twin track	37.05	30.00
FERGUSON 3246 4-track	43.00	34.00
FERGUSON 3247 4-track	48.45	39.00
FERGUSON 3248 4-track	54.30	42.00

	Rec. Retail Price	Comet Price
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FERROGRAPH 722	242.54	199.00
FERROGRAPH 724	242.54	199.00
FERROGRAPH 702/W 2 track tape deck	207.35	175.00
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GRUNDIG C200 Cassette	37.99	30.00
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PHILIPS 4500 4-Track Stereo Tape Deck	126.00	99.00
PHILIPS 4408 4-Track Stereo	139.00	109.00
PHILIPS N404 4-Track Stereo	85.00	70.00
PHILIPS N4308	60.50	50.00
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TOSHIBA GT 840 S	38.50	25.00
TOSHIBA GT 601v Twin Track	110.00	80.00
TOSHIBA 850 SA	45.15	30.00
TOSHIBA 850 SA	94.00	60.00

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GARRARD WB4 Base	5.69	4.75
GARRARD SPC 1 Cover	3.74	3.00
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THORENS TX11 Cover	4.11	3.75
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GOLDRING GL 69P Mk. 11 mounted in base with hinged lid, GOLD- RING G800 Cartridge, Rogers Ravensbrook Amplifier in Teak case. Two Wharfedale Super Linton Speakers	151.25	115.95
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GOLDRING GL 75P mounted in teak base with hinged perspex cover complete with GOLDRING G800E Cartridge, Leak Stereo 30 Plus Amplifier in Teak case. 2 GOODMANS Mezzo 3 Speakers	194.30	149.00
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THORENS TD 150AB Mk. II with TX11 dust cover, SHURE M55E Cartridge, LEAK Stereo 70 Amplifier in Teak case. 2 Wharfe- dale Dovedale 3 Speakers	224.50	175.00
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THORENS TD 125AB Electronic Turntable complete with cover. SHURE V15-11 Cartridge, GOOD- MANS Maxamp, GOODMANS Steromax AM/FM Tuner. 2 GOODMANS Magister Speakers	419.65	319.00
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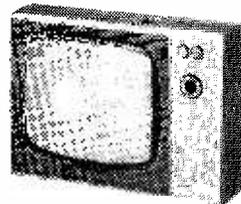
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10½"	7½"	1	14	6	2	2	6 2 6 0
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6F23	-71	D Y87	-26	KT61	-48	PY33	-54
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30C18	-63	EBF89	-30	PC88	-49	PY801	-35
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30FL1	-62	EOC32	-20	PC900	-35	U25	-65
30LL5	-63	ECC83	-23	PC84	-81	U26	-63
30L17	-71	ECF80	-28	PC89	-46	U191	-60
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30P19	-60	EOH36	-27	PCF80	-29	U329	-70
30PL1	-61	ECH61	-28	PCF86	-45	UABC30	-30
30PL14	-67	ECL80	-23	PCF901	-32	UB F99	-31
COH35	-65	ECL82	-31	PCF902	-44	UOC85	-86
DAC32	-23	ECL86	-37	PCF905	-64	UCH81	-32
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DAF96	-35	EF80	-24	PCL82	-35	UCL83	-49
DF33	-37	EF85	-28	PCL84	-35	UB F89	-30
DF91	-16	EF86	-31	PCL85	-42	UL84	-32
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OAB2	0.45	6AR6	0.40	6EW6	0.85	9YW6	0.50
OAC2	0.35	6AS5	0.35	6F1	0.70	10C2	0.50
OAB3	0.40	6AT6	0.30	6F2	0.80	10D1	0.60
OCC3	0.38	6AT7	0.30	6F6G	0.30	10D2	0.40
OD3	0.35	6AU6	0.25	6F11	0.38	10P1	0.90
IB3GT	0.38	6AV6	0.30	6F13	0.38	10P9	0.50
IL4	0.20	6AW8A	0.55	6F14	0.55	10P18	0.45
IR4	0.35	6BA6	0.25	6F15	0.25	10L1	0.45
IR5	0.35	6BE9	0.30	6F18	0.45	10L1D1	0.80
IR4	0.27	6BE9	0.30	6F23	0.30	10P13	0.55
IS5	0.25	6BF6	0.50	6F24	0.75	10P14	1.10
IT4	0.25	6BH6	0.45	6F25	0.75	12AB5	0.40
IU4	0.27	6BJ6	0.45	6F26	0.85	12AC6	0.40
IU5	0.50	6BK7A	0.55	6F28	0.80	12AL5	0.45
IV2	0.45	6BL7GTA	0.34	0.50	12AQ5	0.45	
IX2B	0.40	0.65	6BG6T	0.50	12AT8	0.30	
2D21	0.35	6BN5	0.45	6J7	0.45	12AT7	0.38
3A4	0.35	6BN6	0.40	6KGGT	0.55	12AU6	0.30
3B23	2.15	6BQ5	0.25	6K7	0.35	12AU7	0.30
3BP1	2.75	6BR8	0.65	6K8G	0.35	12AV6	0.38
3Q4	0.40	6BS7	1.30	6K23	0.55	12AV7	0.50
384	0.35	6BW6	0.85	6K25	0.75	12AX7	0.30
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6U4GY	0.40	6B16	0.25	6LGGT	0.45	12AY7	0.70
6U4G	0.35	6B26	0.35	6L18	0.45	12BA6	0.35
6U4GB	0.42	6C4	0.33	6LD20	0.40	12BA7	0.35
6V4G	0.42	6CG5GT	0.40	6N7GT	0.40	12BE6	0.35
6Y3GT	0.32	6CA4	0.28	6P1	0.60	12BH7	0.40
6Z3	0.50	6CA7	0.50	6P23	0.85	6P27	0.55
6Z4G	0.40	6C4	0.30	6Q7	0.45	12K5	0.55
6/30L2	0.75	6CD6GA	0.8A7	0.40	6R14	0.40	
6AB4	0.35	6C87	1.15	6R7	0.35	12Q7G	0.80
6AF4A	0.50	6CG7	0.50	6SK7	0.35	12R7	0.35
6AG7	0.40	6CH6	0.55	6SL7GTO.35	1.8R7	0.85	
6AH6	0.50	6CL6	0.50	6SN7GTO.35	20D1	0.45	
6AJ6	0.30	6C17	0.30	6GT	0.40	20L1	1.10
6AK5	0.30	6CY7	0.25	6R7	0.40	20P1	0.55
6AK6	0.57	6D8	0.45	6TS	0.35	20P4	1.10
6AL3	0.43	6DC8	0.75	6U4GT	0.60	20P5	1.10
6AL5	0.30	6DK6	0.48	6UA8	0.40	25C5	0.50
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6AQ3	0.35	6EA8	0.35	6Y3	0.35	25Z6GT	0.35
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30C15	0.80	85A2	0.40	DL96	0.42	ECC88	0.40
30C17	0.85	90AV	0.50	DM160	0.55	ECC89	0.50
30C18	0.75	90C1	0.90	DY88	0.33	ECC91	0.20
30F5	0.85	90CV	1.25	DY87	0.35	ECC189	0.60
30FL1	0.70	807	0.50	DY802	0.50	ECC90	0.35
30FL12	0.98	812A	3.50	E55L	2.75	ECC92	0.35
30FL14	0.75	813	3.75	E89CC	0.65	ECC96	0.65
30L1	0.40	866A	0.75	E180L	5.00	ECC94.50	
30L15	0.85	86A2	0.55	E180L	0.55	ECH42	0.70
30L17	0.80	6080	1.50	EABCC80.35	0.55	ECH81	0.30
30P12	0.80	6146	1.50	EAF42	0.55	ECH83	0.40
30P19	0.80	6146B	2.50	EBC33	0.50	ECH84	0.45
30PL1	0.70	6380	1.25	EBC41	0.55	ECL80	0.40
30PL13	0.98	6938	2.15	EBC81	0.80	ECL81	0.50
30PL14	0.90	7199	0.75	EBC82	0.40	ECL82	0.25
30L15	0.85	7360	1.50	EBF83	0.40	ECL83	0.65
35A5	0.55	7586	1.25	EBF89	0.30	ECL84	0.55
35A5	0.75	7896	1.25	EBC5	0.50	ECL85	0.55
35B5	0.65	9002	0.35	ECC8	0.80	ECL86	1.00
35D5	0.70	9003	0.50	ECC8	0.80	ECL87	0.50
35L6GT	0.50	AZ1	0.45	ECC90	0.58	ECL89	1.50
35V	0.30	AZ31	0.55	ECC2	0.35	EPF7A	0.60
35Z3	0.60	CB11	0.50	ECC8	0.50	EPF89	0.40
35Z4G	0.30	CB13.1	0.90	ECC810	2.25	EPF40	0.50
35Z5GT	0.40	CY31	0.35	ECC40	0.80	EPF41	0.65
60A5	0.70	DAF96	0.42	ECC81	0.33	EPF42	0.75
60B5	0.45	DF96	0.42	ECC82	0.30	EPF80	0.25
60C5	0.40	DK40	0.55	ECC83	0.50	EPF83	0.55

EF85	0.35	EZ40	0.45	PCL88	0.50	U78	0.30
EF86	0.30	EZ41	0.45	PCL800	0.38	U191	0.75
EF89	0.28	EZ80	0.25	PCL801	0.70	U201	0.35
EP01	0.38	EZ81	0.38	PD500	1.50	U281	0.40
EP82	0.40	GY60	0.80	PF86	0.50	U282	0.40
EP85	0.30	GZ80	0.40	PF818	0.85	U301	0.40
EP87	0.65	GZ81	0.33	PF200	0.70	U403	0.50
EP88	0.65	GZ82	0.48	PL33	0.35	U404	0.40
EP183	0.30	GZ32	0.70	PL36	0.55	U801	1.00
EP184	0.35	GZ34	0.60	PL81	0.50	UAB80	
EP800	1.00	HAB80		PL82	0.45		
EP804	1.25			PL83	0.45	UAF41	0.65
EK90	0.30	HK90	0.55	PL84	0.40	UAF42	0.65
EL33	1.25	KT66	1.70	PL302		UBC41	0.30
EL54	0.50	KT88	1.75	PL504	0.80	UBC81	0.40
EL86	0.50	N78	1.15	PL608	0.90	UBF90	0.40
EL41	0.55	PABC80.40		PL609	1.30	UBF99	0.35
EL42	0.55	PC88	0.40	PL609	1.30	UBL1	0.50
EL61	0.55	PC88	0.80	PL801	0.80	UBL21	0.80
EL83	0.45	PC97	0.70	PM84	0.50	UC92	0.35
EL84	0.25	PC900	0.48	PY31	0.30	UC95	0.40
EL85	0.43	PC84	0.40	PY33	0.35	UCF80	0.55
EL86	0.40	PC85	0.40	PY80	0.35	UC921	0.60
EL90	0.25	PC88	0.55	PY81	0.30	UCH42	0.70
EL93	0.35	PC98	0.50	PY82	0.30	UCH43	0.75
EL96	1.15	PC139	0.55	PY83	0.35	UCH83	0.35
EL98	0.50	PC806.05	0.55	PY88	0.40	UCL81	0.80
EL921	0.55	PC806.05	0.55	PY800	1.00	UCL82	0.35
EL922	0.90	PC80	0.30	PY800	0.50	UCL83	0.60
EL980	0.40	PC82	0.35	PY801	0.50	UF41	0.60
EM34	0.90	PCF84	0.50	PZ80	0.35	UF42	0.60
EM7	0.75	PCF88	0.50	QV2-6	2.15	UF43	0.60
EM80	0.40	PCF87	0.55	QQV3-10		UF89	0.35
EM81	0.60	PCF80.50	0.50	QQV3-1.25	1.25	UP85	0.40
EM84	0.35	PCF802.50	0.50	QQV303-20A	0.90	UP89	0.35
EM85	1.00	PCF805.75	0.75	2.25	UL41	0.85	
EM87	0.55	PCF806.07	0.70	2.25	UL84	0.80	
EN91	0.35	PCF808.07	0.75	TT22	2.50	UM68	0.80
EV1	0.40	PCF900.70	0.75	TT22	2.50	UY19	0.50
EV80	0.45	PCL81	0.50	U25	0.75	UY11	0.45
EV81	0.40	PCL82	0.35	U26	0.75	UY41	0.45
EV83	0.55	PCL83	0.65	U31	0.45	UY82	0.50
EV84	0.30	PCL84	0.45	U37	1.50	UY89	0.80
EV87	0.43	PCL85	0.40	U32	0.33	W725	0.30
EV88	0.43	PCL86	0.45	U76	0.50	Z808U	0.90

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2N444A	0.35	2S102	0.40	BCY72	0.30
2N696	0.20	2S104	0.50	BCZ11	0.40
2N897	0.23	2S701	0.60	BD121	0.80
2N898	0.40	2S702	0.50	BD123	0.35
2N705	0.70	2S748	0.30	BF115	0.90
2N706	0.15	AC113	0.15	BF115	0.90
2N708	0.30	AC125	0.30	BF173	0.30
2N753	0.25	AC126	0.25	BF181	0.25
2N929	0.30	AC127	0.30	BF184	0.25
2N930	0.35	AC128	0.30	BF185	0.20
2N997	0.25	AC133	0.25	BF194	0.15
2N131	0.45	AC154	0.15	BF196	0.15
2N132	0.45	AC156	0.15	BF196	0.20
2N184	1.25	AC169	0.10	BF197	0.30
2N1801	0.40	AC176	0.25	BFX88	0.25
2N1802	0.25	AC187	0.30	BFY17	0.40
2N1804	0.25	AC188	0.30	BFY19	0.40
2N1805	0.25	AC191	0.30	BFY80	0.25
2N1806	0.25	AC192	0.30	BFY82	0.25
2N1807	0.30	AC199	0.20	BSY26	0.25
2N1808	0.40	AC220	0.20	BSY27	0.30
2N1809	0.35	AC222	0.15	BSY28	0.30
2N1711	0.80	AD140	0.80	BSY65	0.20
2N1756	0.75	AD149	0.45	BSY95A	0.20
2N2147	0.75	AD161	0.35	OC19	0.75
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2N2217	0.30	AF114	0.25	OC23	0.40
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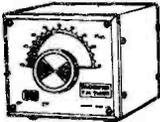
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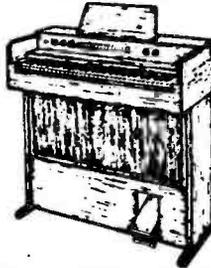
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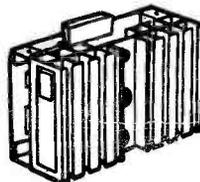
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