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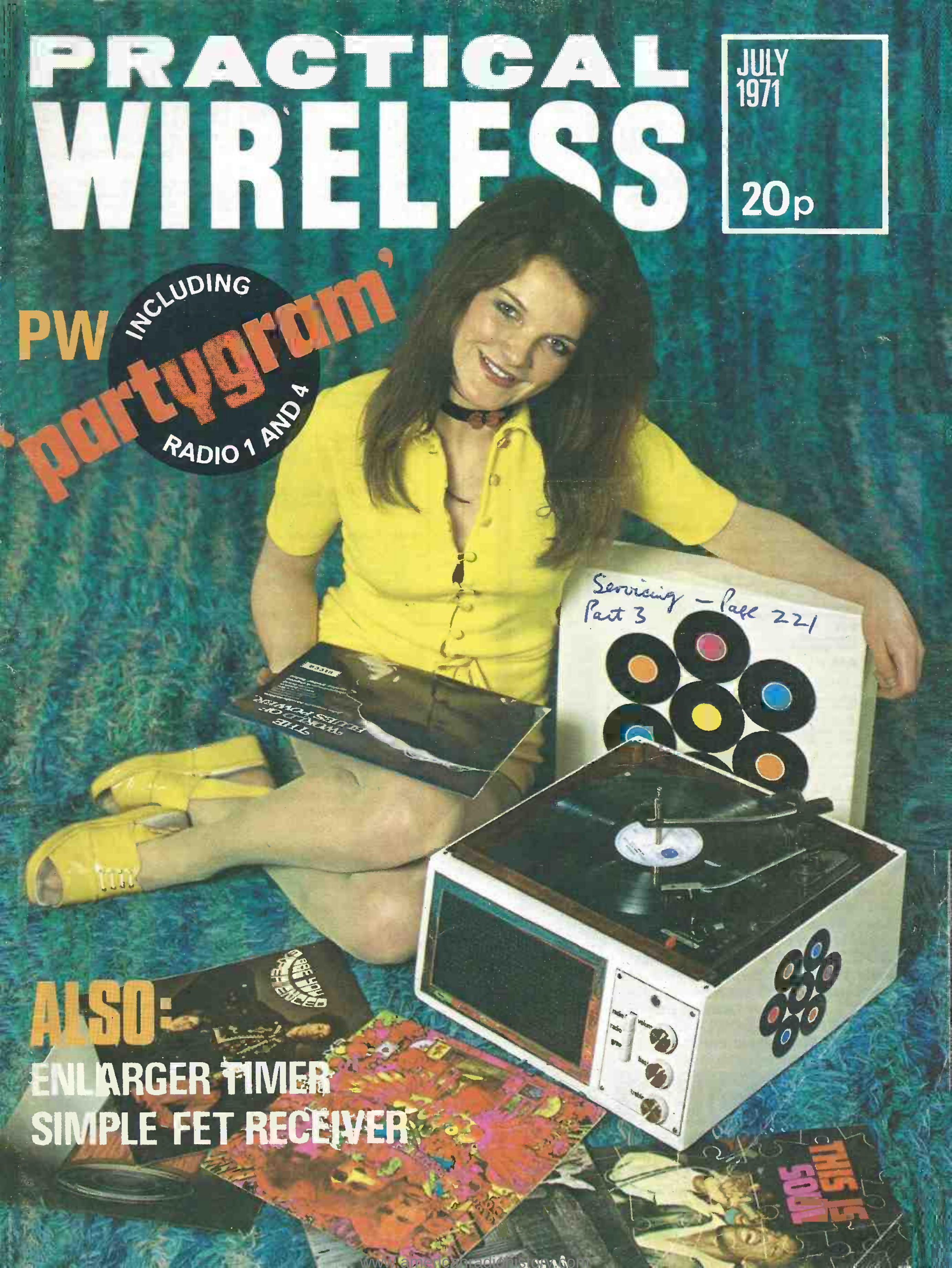


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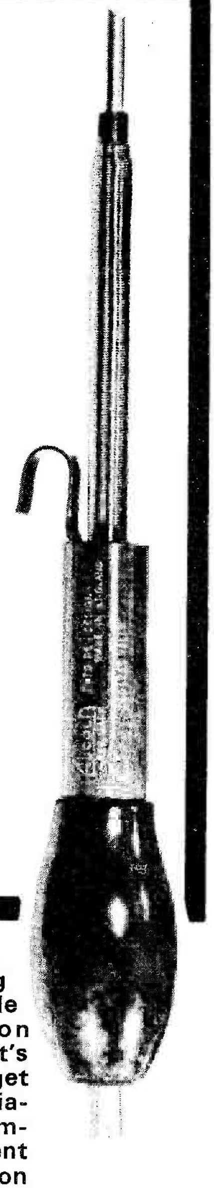

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The **APOLLO 3-WAY SPEAKER SYSTEMS** are designed and built on the Infinite Baffle Principle and are completely Airtight and fully padded to damp out any Panel Resonance. Polished on all sides they can be used either vertically or horizontally and are ideal for Shelf or Wall Mounting.
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# Introducing R.S.C. MkIII SUPER 30 HI-FI STEREO AMPLIFIER

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Only high grade components by leading manufacturers.
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PRINTED CIRCUITRY, TWENTY SILICON TRANSISTORS. FOUR DIODES, FOUR RECTIFIERS.
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- ★ **NEON INDICATOR**
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**OUTPUT:** 15 watts R.M.S. (Continuous) into 8 ohms. 10 watts R.M.S. (Continuous) into 15 ohms.
**HUM & NOISE**—75dB Min. Vol.—65dB Full Vol. **HARMONIC DISTORTION** 0·1% at 1000 Hz 10 Watts
**FREQUENCY RESPONSE:** −3dB 7Hz to 70KHz
**TREBLE CONTROL:** +16dB to −12dB at 14KHz
**BASS CONTROL:** +17dB to −16dB at 40Hz **CROSS TALK**—58dB
**SENSITIVITIES:** Disc Mag. 2·5mV. Ceramic 35mV. Radio 120mV. Tape 120mV.
**REAR PANEL SOCKETS** ARE FOR 3 PAIRS OF INPUTS (1) P.U. (2) Radio. (3) Tape Amp. Plus pair for tape recorder signal take off and 2 pairs for speaker connections

# 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 MKIII Turntable on Plinth with cover
- ★ GOLDRING CS90 Ceramic Pick up Cartridge with diamond stylus
- ★ PAIR OF STANWAY II Speaker Units

Special Total Price **£79·80** Carr. £1·50

- ★ Super 30 Amplifier (15 + 15 watt) in veneered housing
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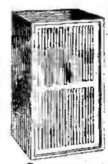
- ★ Pair of Stanway II speaker units

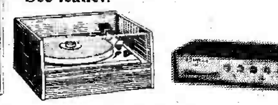
Special Total Price **£96·75** Carr. £1.50

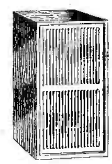
Matching as recommended for optimum performance. Send S.A.E for coloured brochure showing other money-saving offers.

**Package prices apply providing all individual units are purchased from any branch within 3 months. See leaflet.**



Stanway 11





**ATTRACTIVE TEAK or AFRORMOSIA VENEERED CABINETS and PLINTHS**

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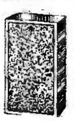
## 'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM



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- ★ **Response 30-20,000 c.p.s. Impedance 15 ohms**

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★ **Performance comparable with units costing considerably more.** Consists of (1) 12in. 15 watt Bass unit with cast chassis. Roll rubber cone surround for ultra low resonance, and ceramic magnet. (2) 3-way quarter section series cross-over system (3) 8 × 5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. £4·50 and 9 monthly payments £2·25 (Total £24·75).

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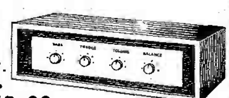
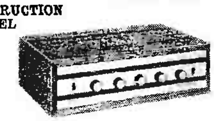


**Complete KIT of PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT** and comprehensive wiring diagram and instructions **£9·99** carr. 40p.
Or **FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £12·99** or dep £2·50 and 9 mthly pymnts. £1·45 (Total £15.55)

## R.S.C. TA12 MKIII 6·5 + 6·5 WATT STEREO AMPLIFIER

**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. −2dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise − 70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate & Knobs.
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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.**
Operation on 200 - 250v. A.C. mains.
Output rating. I.H.F.M

Luxurious Teak Veneer Finished Cabinets. Transparent plastic (tinted) cover included for main unit. Silver finished facia plate and matching control knobs.

**PAIR OF LOUDSPEAKER UNITS** incorporating high flux 8 × 5 ins. speaker. Size approx. 13×7½×8¾ ins.

Price complete ONLY **£42** Carr. £1·25

Terms: Deposit £5·50 and 9 monthly payments £4·50 (Total £46.)

A REALLY SURPRISING STANDARD OF QUALITY IS OBTAINABLE FROM THIS COMPACT LOW PRICED SYSTEM

## LOW DEPOSIT CREDIT TERMS

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**MIDDLESBROUGH** 106 Newport Rd. (Half-day Wed.) Tel. 47096
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# DISCOTHEQUE EQUIPMENT PACKAGE OFFERS

| | | |
|---|---|---|
| F.A.L. PHASE 50 MK.II AMPLIFIER £33.50<br>PR. R.S.C. L12/25 25W L/S in cabinets £21.00<br>Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50) | £52.50 | PACKAGE PRICE **£49·50** carr. £1 |
| F.A.L. PHASE 50 MK.II AMPLIFIER £33.50<br>PR. FANE POP 50 L/SPEAKERS £21<br>Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50) | £54.50 | PACKAGE PRICE **£49·50** carr. £1 |
| F.A.L. PHASE 100 AMPLIFIER £61.95<br>PR. L125 50W L/S in cabinets £59.80<br>Terms: Deposit £22 and 9 monthly payments of £11 (Total £121) | £121.95 | PACKAGE PRICE **£110** carr. £1.50 |
| F.A.L. PHASE 100 AMPLIFIER £61.95<br>4 FANE POP 50 L/SPEAKERS £42<br>Terms: Deposit £14 and 9 monthly payments of £10 (Total £104) | £103.95 | 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** Carr. 30p

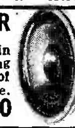
OR SENIOR 15 WATT INC. HF126 15,000 LINE SPEAKER carr. 35p **£6·75**

## AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

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 | £4.66 |
| HF102D | 10" | 10W | £3.40 | HF126 | 12" | 15W | £5.50 |
| HF120 | 12" | 15W | £4.10 | HF126D | 12" | 15W | £5.90 |

## FANE 807 HIGH FIDELITY LOUDSPEAKER



A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. 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 Hz to 15 KHz. Impedance 3 or 8-15 Ω. Gauss 10,000. Remarkable value. **£3.50**

## HI-FI SPEAKER ENCLOSURES

Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 25p. per enclosure
**JE8** Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£5·35**
**SE8** For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported **£6·74**
**SE10** For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£6·47**
**SE12** For exclnt prfmnce with 12in Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£7·87**

## 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 TRANSPARENT PLASTIC COVER **£6·30**

**LEADING MAKES HI-FI EQUIPMENT AT CLEARANCE PRICES AVAILABLE AT BRANCHES ONLY**

## R.S.C. BATTERY/MAINS CONVERSION UNITS

**TYPE BM1**
An all-dry battery eliminator. Size 5½ x 4½ 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 £3 or assembled ready for use £3.50

## RECORD PLAYING UNITS

Moneysaving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amp. or Tape recorder.

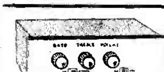
**RP1C** GARRARD 3000 4-speed Auto-change Unit with Sonotone 9TA/HC Ceramic Stereo Cartridge. **£19·45** Carr. 50p.

**RP23C** GARRARD SP25 Mk III fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. **£26·09** Carr. 50p.

**RPC6** GARRARD 5200 Auto Unit fitted Stereo Cartridge Plinth & Cover as RP23C. **£15** Carr. 50p.

Other types available with Magnetic cartridges and with alternative design plinths.

## R.S.C. TA6 6 Watt HI-FI SOLID STATE AMPLIFIER



200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. —2dB. 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 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9¾ × 2¾ × 5¼in. Attractive brushed silver finish facia plate 10½ × 3½in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7·50** 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 PUs. High Impedance "mikes". For Musical Instruments etc. Std. AC 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 **£10·50**
Factory built £14.75 or Dep. £3 and 9 mthly pymnts of £1.60 (Total £17.40.)

## R.S.C. COLUMN SPEAKERS

R·S·C HI-FI CENTRES LTD.

### IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

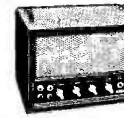
All types 15 Ohms covered in Rexine Vynair
TYPE C4100 IS ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

**TYPE C48S 25-30 WATTS** Fitted four 8" high flux 8 watt speakers. Overall size approx 48 x 10 x 5 in. Carr 50p Terms: Dep £3 and 9 monthly payments £2 (Total £21) **£17·75**

**TYPE C412S 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 £3 (Total £31) **£27·50**

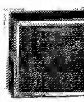
**TYPE C4100 100 WATTS** inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 × 16 × 10" Acoustically filled and pressurised. Terms: Dep. £7·50 and 9 mthly. pyts. £5·45 (Total £56·55). Carr. £1 **£50·50**

## 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 LOUDSPEAKER UNITS



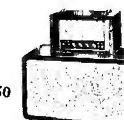
IN TEAK VENEERED CABINETS

**L13** 13" × 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. Also supplied Rexine covered **£10·50** carr. 45p

**L125 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 **£29·50**

## 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 optional horizontal or vertical mounting. **£60** Carr. £1.50
★ 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 MkII AMPLIFIER 50W

Solid state 4 Separately controlled inputs. Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3-30 ohms. Size 17" × 7" × 7½" 200-250v. A.C. mains. Output 60 watts music rating **£33·50**
Or deposit £6 & 9 monthly payments £3·50. Total £37·50. Carr. 65p

## 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**
Or deposit £12 & 9 monthly payments £6·25. Total £68·25. Carr. 75p
Send S.A.E. for leaflets.

## FANE ULTRA HIGH POWER LOUDSPEAKERS

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

**'POP' 100** 18" 100 Watt 14,000 gauss 8/15Ω **£22·05**
Dep: £6 and 9 monthly payments £2·10 (Total £24·90)

**'POP' 60** 15" 60 Watt 14,000 gauss 8/15Ω **£12·90**
Dep. £3.30 and 9 monthly payments. £1.30 (Total £15).

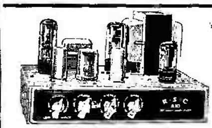
**'POP' 50** 12" 50 Watt 13,000 gauss 15Ω **£10·50**
Dep £2 and 9 monthly payments £1.15 (Total £12.35) Pair suitable all purposes

FOR BASS GUITAR, ELECT. ORGAN, ETC.

## FANE LOUDSPEAKERS '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).

## R.S.C A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER



Highly sensitive. Push-Pull high output, Hum level—70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. 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 £1.75 Or factory built with EL34 output valves and 12 months' guarantee for £19.75 **£15·75** Carr. 65p
TERMS: Deposit £4 and 9 monthly payments of £2·10 (Total £22·90). Send S.A.E. for leaflet.

## RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary

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

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| 250v., 60mA, 6.3v. 2a | 90p |
| 250-0-250v., 60mA 6.3v 2a | 95p |

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| 250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. | £1.99 |
| 300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. | £1.99 |
| 300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a. For Mullard 510 Amplifier | £2.40 |
| 350-0-350v. 100mA, 6.3v. 4a., 0.5-6.3v. 3a. | £1.99 |
| 350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a. | £2.40 |
| 425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a. | £4.49 |
| 425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a | £4.69 |
| 450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a. | £4.99 |

**TOP SHROUDED DROP-THRO' TYPE**

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| 250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a. | £1.20 |
| 250-0-250v. 100mA. 6.3v. 3.5a. | £1.40 |
| 250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a. | £1.45 |
| 350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a. | £1.50 |
| 250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. | £1.99 |
| 300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. | £1.99 |
| 300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier | £2.35 |
| 350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. | £1.99 |
| 350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a. | £2.35 |

**FILAMENT or TRANSISTOR POWER PACK** Types 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; 0.9-18v. 1¼a. 99p; 0-12-25-42v. 2a. £1.60

**CHARGER TRANSFORMERS** 0-9-15v. 1¼a. 95p; 2½a. 99p; 3a. £1.10; 5a. £1.30; 6a. £1.49; 8a. £1.85

**AUTO (Step UP/step DOWN) TRANSFORMERS** 0-110/120v. 200-230-250v., 50-80 watts 99p; 150 watts, £1.70 250 watts £2.49; 500 watts £5.25.

**OUTPUT TRANSFORMERS**

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| Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω | 45p |
| Push-Pull 8 watts EL84 to 3 Ω or 15 Ω | 75p |
| Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω | £1.25 |
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| Push-Pull Ultra Linear for Mullard 510, etc. | £1.99 |
| Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω | £1.80 |
| Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω | £2.99 |

**SMOOTHING CHOKES** 150mA, 7-10H. 250 Ω 65p; 100mA, 10H, 200 Ω 55p; 80mA, 10H, 350 Ω 45p; 60mA, 10H, 400 Ω 25p.

**SELENIUM RECTIFIERS F. W. (Bridged)** All 6/12v. D.C. output. Max. A.C. input 18v. 1a. 25p. 2a. 35p. 3a. 50p. 4a. 65p. 6a. 80p.

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| 6AU6 | .21 |
| 6AV6 | .30 |
| 6B8G | .13 |
| 6BA6 | .21 |
| 6BE6 | .22 |
| 6BH6 | .43 |
| 6BJ6 | .41 |
| 6BQ7A | .38 |
| 6BR7 | .79 |
| 6BR8 | .63 |
| 6BW6 | .72 |
| 6BW7 | .57 |
| 6BZ6 | .33 |
| 6C9 | .73 |
| 6CD6G | 1.09 |
| 6CH6 | .38 |
| 6CL6 | .43 |
| 6CW4 | .63 |
| 6F1 | .63 |
| 6F6 | .63 |
| 6F6G | .25 |
| 6F13 | .33 |
| 6F14 | .44 |
| 6F18 | .45 |
| 6F23 | .70 |
| 6F24 | .68 |
| 6F25 | .60 |
| 6F28 | .70 |
| 6H6GT | .15 |
| 6J5G | .19 |
| 6J5GT | .29 |
| 6J6 | .18 |
| 6J7G | .24 |
| 6J7GT | .38 |
| 6K7G | .10 |
| 6K7GT | .23 |
| 6K8G | .16 |
| 6L6GT | .39 |
| 6L7GT | .63 |
| 6L18 | .45 |
| 6L19 | 1.38 |
| 6LD20 | .48 |
| 6N7GT | .40 |
| 6Q7 | .43 |
| 6Q7G | .30 |
| 6R7 | .55 |
| 6R7G | .35 |
| 6SA7GT | .35 |
| 6SA7M | .35 |
| 6SG7GT | .33 |
| 6SG7 | .33 |
| 6SH7 | .53 |
| 6SJ7 | .35 |
| 6SK7GT | .23 |
| 6SQ7GT | .38 |
| 6V6G | .17 |
| 6V6GT | .31 |
| 6X4 | .22 |
| 6X5GT | .25 |
| 7A7 | .88 |
| 7B6 | .58 |
| 7B7 | .35 |
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| 7H7 | .28 |
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| 10C2 | .50 |
| 10F1 | .75 |
| 10F9 | .45 |
| 10F18 | .35 |
| 10LD11 | .53 |
| 10P13 | .59 |
| 10P14 | 1.10 |
| 10P18 | .32 |
| 12A6 | .63 |
| 12AC6 | .40 |
| 12AD6 | .40 |
| 12AE6 | .48 |
| 12AT6 | .23 |
| 12AT7 | .17 |
| 12AU6 | .22 |
| 12AU7 | .20 |
| 12AV6 | .28 |
| 12AX7 | .23 |
| 12BA6 | .30 |
| 12BE6 | .30 |
| 12BH7 | .40 |
| 12E1 | .85 |
| 12J7GT | .33 |
| 12K5 | .50 |
| 12K7GT | .34 |
| 12Q7GT | .28 |
| 12SA7GT | .40 |
| 12SC7 | .35 |
| 12SG7 | .23 |
| 12SH7 | .15 |
| 12SJ7 | .23 |
| 12SK7 | .24 |
| 12SQ7GT | .50 |
| 14S7 | 1.15 |
| 19AQ5 | .24 |
| 20F2 | .66 |
| 20L1 | .98 |
| 20P1 | .88 |
| 20P3 | .84 |
| 20P4 | .91 |
| 20P5 | 1.00 |
| 25A6G | .29 |
| 25L6G | .22 |
| 25Y5 | .38 |
| 25Y5G | .43 |
| 25Z4G | .30 |
| 25Z5 | .40 |
| 25Z6G | .43 |
| 30C1 | .29 |
| 30C15 | .62 |
| 30C17 | .79 |
| 30C18 | .63 |
| 30F5 | .72 |
| 30FL1 | .62 |
| 30FL2 | .75 |
| 30FL12 | .71 |
| 30FL14 | .70 |
| 30L1 | .31 |
| 30L15 | .60 |
| 30L17 | .71 |
| 30P4MR | .98 |
| 30P12 | .69 |
| 30P19/30P4 | .60 |
| 30PL1 | .61 |
| 30PL12 | .33 |
| 30PL13 | .78 |
| 30PL14 | .67 |
| 30PL15 | .89 |
| 35L6GT | .42 |
| 35W4 | .23 |
| 35Z4GT | .24 |
| 35Z5GT | .30 |
| 50L6GT | .45 |
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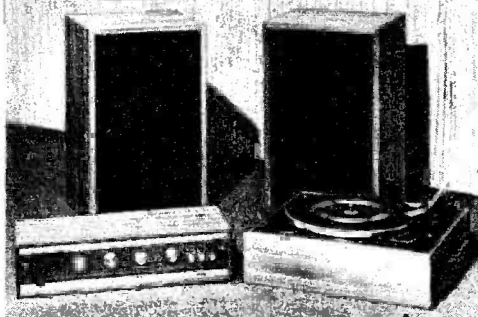
| AL60 | .78 |
| ATP4 | .12 |
| AZ1 | .40 |
| AZ31 | .46 |
| AZ41 | .53 |
| B36 | .33 |
| CY1C | .53 |
| CY31 | .32 |
| DAC32 | .33 |
| DAF91 | .20 |
| DAF96 | .35 |
| DF33 | .37 |
| DF91 | .14 |
| DF96 | .35 |
| DF97 | .68 |
| DH63 | .30 |
| DH76 | .28 |
| DH77 | .20 |
| DK40 | .55 |
| DK92 | .41 |
| DK96 | .36 |
| DL96 | .36 |
| DM70 | .30 |
| DM71 | .38 |
| DW4/350 | .38 |
| DW4/500 | .38 |
| DY86/7 | .26 |
| DY802 | .48 |
| E80F | 1.20 |
| E83F | 1.20 |
| E88CC | .60 |
| E180F | .95 |
| E182CC | 1.13 |
| E1148 | .53 |
| EA50 | .18 |
| EA76 | .88 |
| EABC80 | .31 |
| EAC91 | .38 |
| EAF42 | .49 |
| EB34 | .20 |
| EB91 | .11 |
| EBC41 | .48 |
| EBC81 | .33 |
| EBC91 | .30 |
| EBF80 | .32 |
| EBF83 | .40 |
| EBF89 | .30 |
| EBL21 | .60 |
| EC86 | .63 |
| EC88 | .60 |
| EC92 | .35 |
| ECC32 | 1.58 |
| ECC33 | 1.58 |
| ECC40 | .60 |
| ECC81 | .17 |
| ECC82 | .20 |
| ECC83 | .23 |
| ECC84 | .30 |
| ECC85 | .27 |
| ECC86 | .40 |
| ECC88 | .35 |
| ECC189 | .48 |
| ECC804 | .57 |
| ECC807 | 1.35 |
| ECF80 | .28 |
| ECF82 | .28 |
| ECF86 | .65 |
| ECF804 | 2.10 |
| ECH21 | .63 |
| ECH42 | .62 |
| ECH81 | .28 |
| ECH83 | .40 |
| ECH84 | .36 |
| ECL80 | .33 |
| ECL82 | .31 |
| ECL83 | .52 |
| ECL84 | .60 |
| ECL85 | .55 |
| ECL86 | .37 |
| EF22 | .63 |
| EF36 | .33 |
| EF37A | .35 |
| EF39 | .40 |
| EF40 | .50 |
| EF41 | .50 |
| EF42 | .33 |
| EF54 | .98 |
| EF80 | .23 |
| EF83 | .48 |
| EF85 | .28 |
| EF86 | .31 |
| EF89 | .24 |
| EF91 | .17 |
| EF92 | .13 |
| EF97 | .55 |
| EF98 | .65 |
| EF183 | .27 |
| EF184 | .30 |
| EH90 | .38 |
| EL32 | .18 |
| EL34 | .46 |
| EL37 | .87 |
| EL41 | .55 |
| EL42 | .53 |
| EL81 | .50 |
| EL83 | .38 |
| EL84 | .23 |
| EL85 | .40 |
| EL86 | .40 |
| EL91 | .28 |
| EL95 | .35 |
| EM34 | .90 |
| EM80 | .38 |
| EM81 | .40 |
| EM84 | .32 |
| EM87 | .36 |
| EY51 | .35 |
| EY81 | .35 |
| EY83 | .55 |
| EY84 | .50 |
| EY86/7 | .31 |
| EY88 | .43 |
| EY91 | .53 |
| EZ40 | .40 |
| EZ41 | .43 |
| EZ80 | .22 |
| EZ81 | .23 |
| EZ90 | .22 |
| FW4/500 | .75 |
| FW4/800 | .75 |
| GZ30 | .35 |
| GZ32 | .42 |
| GZ33 | .70 |
| GZ34 | .58 |
| GZ37 | .75 |
| HABC80 | .45 |
| HL23DD | .40 |
| HL41DD | .98 |
| HL42DD | .50 |
| HN309 | 1.40 |
| HVR2 | .53 |
| HVR2A | .53 |
| KT2 | .25 |
| KT8 | 1.75 |
| KT44 | 1.00 |
| KT66 | .82 |
| KT81 | 2.00 |
| KT88 | 1.70 |
| KTW61 | .63 |
| KTW62 | .63 |
| KTW63 | .50 |
| MHLD6 | .75 |
| N78 | 2.05 |
| N308 | .98 |
| N339 | 1.25 |
| P61 | .49 |
| PABC80 | .34 |
| PC86 | .49 |
| PC88 | .49 |
| PC95 | .53 |
| PC97 | .39 |
| PC900 | .35 |
| PCC84 | .31 |
| PCC85 | .29 |
| PCC88 | .44 |
| PCC89 | .46 |
| PCC189 | .49 |
| PCC805 | .60 |
| PCF80 | .29 |
| PCF82 | .31 |
| PCF84 | .40 |
| PCF86 | .45 |
| PCF200 | .67 |
| PCF801 | .32 |
| PCF802 | .44 |
| PCF805 | .63 |
| PCF806 | .59 |
| PCF808 | .70 |
| PCH200 | .62 |
| PCL82 | .33 |
| PCL83 | .60 |
| PCL84 | .35 |
| PCL805/85 | .42 |
| PCL86 | .40 |
| PCL88 | .67 |
| PD500 | 1.44 |
| PEN4DD | 1.38 |
| PEN36C | .75 |
| PEN45 | .35 |
| PEN45DD | .75 |
| PEN46 | .20 |
| PEN453DD | .98 |
| PENDD-4020 | .88 |
| PFL200 | .54 |
| PL36 | .47 |
| PL81 | .46 |
| PL81A | .50 |
| PL82 | .31 |
| PL83 | .33 |
| PL84 | .31 |
| PL302 | .60 |
| PL504/500 | .64 |
| PL505 | 1.44 |
| PL508 | 1.16 |
| PL509 | 1.44 |
| PL802 | .75 |
| PM84 | .36 |
| PX4 | 1.16 |
| PX25 | 1.16 |
| PY32/3 | .50 |
| PY80 | .33 |
| PY81 | .25 |
| PY82 | .25 |
| PY83 | .27 |
| PY88 | .33 |
| PY500 | 1.08 |
| PY800 | .35 |
| PY801 | .34 |
| PZ30 | .48 |
| QQV03/10 | 1.20 |
| QV04/7 | .63 |
| RG1-240A | 1.98 |
| R10 | .75 |
| R11 | .98 |
| R16 | 1.75 |
| R17 | .88 |
| R19 | .31 |
| SP42 | .75 |
| SP61 | .33 |
| TH4B | .50 |
| TH233 | .98 |
| TP2620 | .98 |
| UABC80 | .30 |
| UAF42 | .50 |
| UBC41 | .45 |
| UBC81 | .40 |
| UBF80 | .29 |
| UBF89 | .31 |
| UBL21 | .55 |
| UC92 | .35 |
| UCC84 | .34 |
| UCC85 | .35 |
| UCF80 | .35 |
| UCH21 | .60 |
| UCH42 | .61 |
| UCH81 | .31 |
| UCL82 | .34 |
| UCL83 | .49 |
| UF41 | .50 |
| UF42 | .60 |
| UF80 | .35 |
| UF85 | .34 |
| UF86 | .63 |
| UF89 | .30 |
| UL41 | .59 |
| UL84 | .32 |
| UM80 | .33 |
| UY1N | .50 |
| UY21 | .55 |
| UY41 | .38 |
| UY85 | .27 |
| U10 | .45 |
| U12/14 | .38 |
| U18/20 | .75 |
| U19 | 1.73 |
| U22 | .39 |
| U25 | .65 |
| U26 | .59 |
| U45 | .78 |
| U191 | .60 |
| U251 | .70 |
| U281 | .40 |
| U282 | .40 |
| U301 | .51 |
| U403 | .33 |
| U404 | .38 |
| U801 | .95 |
| U4020 | .38 |
| VP23 | .40 |
| VP41 | .38 |
| VR105 | .33 |
| VT61A | .35 |
| VU111 | .44 |
| VU120 | .60 |
| VU120A | .60 |
| VU133 | .35 |
| W76 | .34 |
| W107 | .50 |
| W729 | .60 |
| X41 | .50 |
| 2S323 | .50 |
| AA119 | .15 |
| AA120 | .15 |
| AA129 | .15 |
| AAZ13 | .18 |
| AC107 | .15 |
| AC113 | .25 |
| AC127 | .17 |
| AC128 | .20 |
| AC156 | .20 |
| AC157 | .25 |
| AC166 | .25 |
| AC168 | .38 |
| AC176 | .55 |
| AC177 | .28 |
| ACY17 | .25 |
| ACY18 | .20 |
| ACY19 | .19 |
| ACY20 | .18 |
| ACY21 | .19 |
| ACY22 | .15 |
| ACY28 | .18 |
| AD140 | .36 |
| AD149 | .50 |
| AD161 | .45 |
| AD162 | .45 |
| ADT140 | .63 |
| AF102 | .90 |
| AF106 | .50 |
| AF114 | .25 |
| AF115 | .15 |
| AF117 | .19 |
| AF121 | .30 |
| AF124 | .25 |
| AF126 | .18 |
| AF139 | .65 |
| AF178 | .68 |
| AF180 | .48 |
| AF186 | .55 |
| AF239 | .38 |
| B1181 | .50 |
| BA102 | .45 |
| BA115 | .14 |
| BA116 | .25 |
| BA129 | .13 |
| BA130 | .10 |
| BC107 | .13 |
| BC108 | .13 |
| BC113 | .25 |
| BC115 | .15 |
| BC116 | .25 |
| BC118 | .23 |
| BCY10 | .45 |
| BCY12 | .50 |
| BCY33 | .20 |
| BCY38 | .23 |
| BCZ11 | .38 |
| BD119 | .45 |
| BF159 | .25 |
| BF163 | .20 |
| BF173 | .38 |
| BF180 | .30 |
| BF181 | .40 |
| BF185 | .40 |
| BFY50 | .23 |
| BFY51 | .19 |
| BFY52 | .20 |
| BY100 | .18 |
| BY105 | .18 |
| BY114 | .18 |
| BY126 | .15 |
| BY127 | .18 |
| BYY23 | 1.00 |
| BYZ10 | .25 |
| BYZ11 | .25 |
| BYZ12 | .25 |
| BYZ13 | .25 |
| CG12E | .20 |
| FSY11A | .23 |
| GD9 | .20 |
| GET113 | .20 |
| GET116 | .40 |
| GET118 | .20 |
| GET119 | .20 |
| GET573 | .38 |
| GET587 | .43 |
| GET873 | .15 |
| GET887 | .23 |
| GET897 | .23 |
| GET898 | .23 |
| M1 | .15 |
| M3 | .15 |
| MAT100 | .39 |
| MAT101 | .43 |
| MAT120 | .39 |
| MAT121 | .43 |
| OA5 | .28 |
| OA9 | .13 |
| OA10 | .43 |
| OA47 | .10 |
| OA70 | .15 |
| OA73 | .15 |
| OA79 | .09 |
| OA81 | .09 |
| OA85 | .08 |
| OA90 | .13 |
| OA91 | .09 |
| OA95 | .09 |
| OA200 | .09 |
| OA202 | .10 |
| OC22 | .38 |
| OC23 | .38 |
| OC24 | .38 |
| OC25 | .38 |
| OC26 | .24 |
| OC28 | .60 |
| OC29 | .63 |
| OC35 | .32 |
| OC36 | .43 |
| OC42 | .63 |
| OC43 | 1.18 |
| OC44 | .10 |
| OC45 | .11 |
| OC46 | .15 |
| OC70 | .13 |
| OC71 | .11 |
| OC72 | .11 |
| OC74 | .23 |
| OC75 | .11 |
| OC76 | .15 |
| OC77 | .27 |
| OC78 | .15 |
| OC78D | .15 |
| OC81 | .11 |
| OC81D | .11 |
| OC82 | .11 |
| OC82D | .11 |
| OC83 | .20 |
| OC84 | .24 |
| OC123 | .23 |
| OC139 | .23 |
| OC140 | .95 |
| OC169 | .23 |
| OC172 | .35 |
| OC200 | .22 |
| OC201 | .38 |
| OC202 | .43 |
| OC203 | .30 |
| OC204 | .30 |
| OC205 | .48 |
| ORP12 | .58 |

All valves are unused, boxed, and subject to the standard 90 day guarantee. Terms of business — Cash or cheque with order only. Post/packing 0.03 per item, subject to a minimum of 0.09. Orders over 5.00 post/packing free. Same day despatch by first class mail. Any parcel insured against damage in transit for only 0.03 extra per order. Complete catalogue with conditions of sale price 0.07 post paid. Business hours Mon.-Fri. 9–5.30 p.m. Sats. 9–1 p.m.
We do not handle seconds nor rejects, which are often described as "New and Tested" but have a limited and unreliable life. No enquiries answered unless S.A.E. is enclosed for reply.

# BUDGET HIGH-FIDELITY STEREO SYSTEMS



PREMIER STEREO SYSTEM "ONE" Consists of an all transistor stereo amplifier, Garrard 2025 T/C auto manual record player unit fitted stereo mono ceramic cartridge with diamond stylus and mounted in teak finish plinth with perspex cover and two matching teak finish loudspeaker systems. Absolutely complete and supplied ready to plug in and play. 2500 amplifier has an output of 5 watts per channel with inputs for pick-up, tape and tuner also tape output socket. Controls: Bass, Treble, Volume, Balance, Selector, Power on/off. Solid teak cabinet with aluminium front panel. Size 12¼" × 4½" × 3½" high (Amplifier available separately if required £14·95 Carr. 40p).
PREMIER STEREO SYSTEM "TWO", as above but with Garrard SP25 MK III—ONLY £47. Carr. £1·75

**ONLY £40·95** carr. £1·75

**ONLY £57·75** carr. £1·75

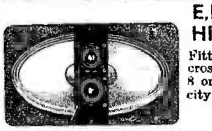
PREMIER STEREO SYSTEM "THREE" This consists of KLINGER KC903 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and ceramic pickup, tuner, tape in and out. Stereo earphone socket. Garrard SP25 Mk III in teak finish plinth with cover and fitted Sonotone 9TAHCD diamond stereo cartridge. A pair of HMF Speakers size 16½" × 10¼" × 9" fitted EMI units complete the matching system. ONLY £57·75 Carr. £1·75

ALL SYSTEMS SUPPLIED WITH FREE LEADS AND PLUGS

## SP25 MKIII SPECIAL!

GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 850 or AT66 MAGNETIC STEREO CARTRIDGE as available. COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER.
Total list price over £29.
PREMIER PRICE
**£19.90**
P. & P. 50p.

## E.M.I. 13×8in. HI-FI SPEAKERS



Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.
**£3.47** P. & P. 40p

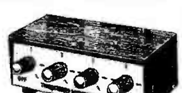
## HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2½in speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.
**£2.47** P. & P. 25p.
STEREO STETHOSCOPE SET Low imp. £1.25 P. & P. 10p.
MONO STETHOSCOPE SET Low imp. 52p. P. & P. 10p.

## PREMIER QUALITY MICROPHONES


Precision made, beautifully designed and offering reliability at reasonable price.
FANON MKO-47 MINIATURE DYNAMIC
Frequency response 60–13,000 Hz. Impedance 50K ohms (−59 db). Can be used with stand, hand held or around neck. Diecast body satin chrome finish. Features removable windscreen. Complete with 8ft. cable, stand adaptor and Lavalier cord.
PREMIER PRICE £5·97, P. & P. 20p.
FANON MKO-45 3-WAY DYNAMIC
Frequency response 60–12,000 Hz. High impedance. Complete with 8ft. cable, table stand and Lavalier cord.
PREMIER PRICE £2·87, P. & P. 20p.
FANON MKC-54 DYNAMIC
Frequency response 60–12,000 Hz. Impedance 50K ohms (−60 db) and 150 ohms (−71 db). On/Off switch. Complete with 20ft. cable and stand adaptor.
PREMIER PRICE £8·97. P. & P. 20p

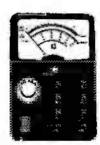
## VERITAS V-149 MIXER



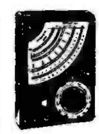
Battery operated 4-channel audio mixer providing four separate inputs. Size 6×3×2in. suitable for crystal microphone low impedance microphone, with transformer, radio, tape, etc. Max. input 1·5v. Max. output 2·5v. Gain 6 dB. Standard jack plug socket inputs, phonoplugs output. Attractive teak wood grain finish case.

MONO MODEL **£3** STEREO MODEL **£3.47** P. & P. 12p

## METER BARGAINS

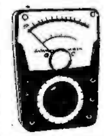


MODEL GT-800 MULTIMETER
A precision made pocket sized test meter, ideally suited for testing electronic circuits or electronic appliances. Supplied complete with test lead and batteries. RANGES—DC Voltages: 10, 50, 250, 1,000V (1,000 opV). AC Voltage: 10, 50, 250, 1,000V (1,000 opV). DC Current: 1mA, 100mA. Resistance: 0-150K ohms. Decibel: −10 +22db (at AC 10V range) £2.47, P. & P. 17p.



MULTIMETER 20,000 O.P.V.
Features large easy-to-read meter, wide choice of ranges. With test leads, batteries and manual. Size: 4½" x 3½" x 1". RANGES—DC Voltages: 0, 0.6, 6, 30, 120, 600, 1,200, 3,000, 6,000V (20,000 ohms/V). AC Voltages: 0, 6, 30, 120, 600, 1,200V (10,000 ohms/V). DC Current: 0, 0.6, 6, 60, 600mA. Resistance: 0, 6k, 600k, 6M, 60M (30, 3k, 30k, 300k ohms at centre scale). Capacity: 10uuf to .001uf, .001uf to .1uf Decibels: −20 to +22 db. £4.90, P. & P. 17p.

MODEL CT-620 MULTITESTER
RANGES—DC Voltages: 0, 5, 25, 100, 500/1,000V (20,000 ohms/V). AC Voltages: 0, 5, 25, 100, 500, 1,000V (10,000 ohms/V). DC Current: 0, 50uA, 0, 5, 50, 500mA. Resistance: 0, 6k, 600k, 6M, 60M ohms. Decibels: −20 db to +62 db in 5 ranges. £5.62. P. & P. 17p.



MODEL 630 MULTITESTER
RANGES—DC Voltages: 0, 3, 15, 60, 300, 600, 1,200V (30,000 ohms/V). AC Voltages: 0, 6, 30, 120, 600, 1,200V (15,000 ohms/V). DC Current: 0, 0.03, 3, 30, 300mA. Resistance: 0, 16k, 160k, 1.6M, 16M ohms (10, 100, 10k, 100k ohms at centre scale). Decibels: — to +63 db. £7.97, P. & P.

## "VERITONE" RECORDING TAPE


**SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED.** TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped–attractively boxed.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| LP3 | 3" | 250' | P.V.C. | 28p | DT6 | 5¾" | 1800' | POLYESTER | £1·12 |
| TT3 | 3" | 450' | POLYESTER | 37p | TT6 | 5¾" | 2400' | POLYESTER | £1·87 |
| DT3 | 3¼" | 600' | POLYESTER | 57p | SP7 | 7" | 1200' | P.V.C. | 62p |
| SP5 | 5" | 600' | P.V.C. | 42p | LP7 | 7" | 1800' | ACETATE | 75p |
| LP5 | 5" | 900' | P.V.C. | 50p | DT7 | 7" | 2400' | POLYESTER | £1·25 |
| DT5 | 5" | 1200' | POLYESTER | 75p | TT7 | 7" | 3600' | POLYESTER | £2·50 |

TAPE SPOOLS 3" 10p, 5", 5¾", 7" 9p,
Post and Packing 3" 5p, 5", 5¾", 8p, 7" 10p. (3 reels and over Post Free).

## TAPE CASSETTES

| | | | |
|---|---|---|---|
| C60 | (60 min.) | 37p | 3 for £1.05 |
| C90 | (90 min.) | 62p | 3 for £1.80 |
| C120 | (120 min.) | 87p | 3 for £2.55 |

P. & P. 5p.

***All cassettes can be supplied with library cases at 3p. extra each***

# PREMIER RADIO

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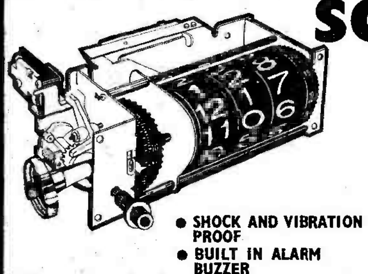
# Laskys

## EXCLUSIVE DIGITAL CLOCK SCOOP!



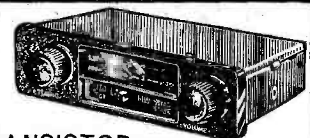
- MADE ESPECIALLY FOR LASKY'S BY FAMOUS MAKER
- MAINS OPERATION
- 12 HOUR ALARM
- AUTO "SLEEP" SWITCH
- HOURS, MINUTES AND SECONDS READ-OFF
- FORWARD AND BACKWARD TIME ADJUSTMENT
- SILENT OPERATION SYNCHRONOUS MOTOR
- SHOCK AND VIBRATION PROOF
- BUILT IN ALARM BUZZER

This unique DIGITAL CLOCK is now available EXCLUSIVELY FROM LASKY'S in chassis form for you to mount in any housing that you choose. All settings are achieved by two dual-concentric controls at the front including: ON-OFF-AUTO and AUTO ALARM, "sleep" switch, 10 minute division "click" set alarm (up to 12-hour delay), time adjustment. Ultra simple mechanism and high quality manufacture guarantee reliable operation and long life. The sleep switch will automatically turn off any appliance—radio, TV, light etc. at any pre-set time up to 60 min. and in conjunction with the AUTO setting will switch on the appliance again next morning. The clock measures 4¾W x 1¾H x 3¾D (overall from front of drum to back of switch) SPEC: 210/240V AC, 50Hz operation; switch rating 250V, 3A. Complete with instructions. **HUNDREDS OF APPLICATIONS. COMPLETE WITH KNOBS**

LASKY'S PRICE **£6.95** Post 18p

SPECIAL QUOTATIONS FOR QUANTITIES

## AUTO RUBY



Two waveband all TRANSISTOR car radio

A new two waveband all transistor car radio that really breaks the quality/price barrier. Covers full med. and long wavebands with slide switch wave change. Fully transistorised for superior sensitivity and reliability. Large easy to grip controls. Illuminated dial. Externally adjustable aerial trimmer ensures maximum output. Operating on all 12v. DC system. Negative or positive earth. Standard size 6¼(W) x 4½(D) x 2in. (H). Black with chrome trim. Complete with speaker, baffle, mounting brackets and instructions. Fully guaranteed.

*GREAT VALUE* **£8·95** Post 25p.

## BSR McDONALD

**MP 60** 4 speed Single Play unit
**LASKY'S PRICE £12·50** post 35p
with Plinth & Cover **£15·75** post 40p

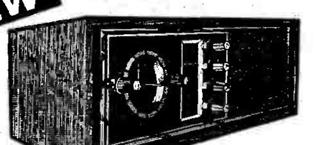
**610** 4 speed Automatic Turntable
**LASKY'S PRICE £15·45** post 35p
with Plinth & Cover **£18·75** post 40p

**510** 4 speed Automatic Turntable
**LASKY'S PRICE £13·45** post 35p
with Plinth & Cover **£16·95** post 40p

**310** 4 speed Automatic Turntable **LASKY'S PRICE £9·95** post 35p
with Plinth & Cover **£13·45** post 40p.

**NEW McDONALD 210** Complete package system 4-speed minichanger unit. Comp. with BSR SC7M Stereo Ceramic cartridge. With base cover **£11·95** post 35p.

## NEW — UNBEATABLE VALUE! SANYO 10FA-406



**AM/FM SOLID STATE CLOCK RADIO**

Another super bargain spring SCOOP — Only Lasky's can offer you such amazing value. A magnificent solid state clock radio housed in a beautiful walnut veneer cabinet combining an electric alarm clock, employing a special synchronised motor for precision time keeping, with a high sensitivity AM/FM (VHF) radio, at almost 50% below list price. This clock radio will not only lull you to sleep tuned to your favourite station, but will switch itself off at a pre-selected time. You have the choice of being roused by either the radio, the alarm buzzer or both. A unique feature of this magnificent set is the "DOZE" alarm, the radio switches itself on at your pre-selected time, 10 minutes later the alarm sounds, you press the doze button and 10 minutes later the alarm sounds again; this procedure repeats until you are fully awake and switch off the doze system. Tone control fitted. High sensitivity AM reception and special AFC device on FM guarantees excellent drift free reception. Technical specification: 7 transistors with integrated circuit IF stage. Frequency range: 535-1605 KHz (AM), 88-108MHz (FM). Power: 220/240 AC, 50Hz. Max. output: 800mW. 4in. dynamic speaker. Built-in ferrite rod aerial. Size: 13-9/16(W) x 6½(H) x 4¾in. (D).

**ORIGINAL LIST PRICE £36.95**

LASKY'S PRICE **£19.95** POST 25p.

## SONY TFM 8030L SCOOP!

**High performance 11 transistor Battery/Mains portable radio**

This top quality solid state receiver is now available from Lasky's at over 27% below the manufacturer's list price making it without a doubt **the SCOOP** of 1971! Look at these outstanding features. Covers MW, LW and FM (VHF). 11 transistor circuit for high sensitivity and stability. Powerful output to 5" P.M. Dynamic speaker. AFC for drift-free VHF reception. Push button wavechange selectors and tone control. Three power sources—9v battery (Ever Ready PP9 or equiv.), household mains or car battery with adaptors. Dial light for use in the dark. External jacks for earphone, tape recording, external power input and car aerial. Ultra modern styling and superb finish with padded leatherette covered cabinet for superior sound. Chrome trim, strong carrying handle. Technical Spec.: Freq. range FM 87-108 MHz, LW 150-285kHz, MW 530-1,605kHz, Circuit: 11 transistors, 7 diodes. Directional telescopic aerial for FM, internal ferrite bar for LW/MW. Size: 9¾ (w) x 8 7/16 (h) x 3½ (d). Complete with earphone and battery.

LIST PRICE £29·75 **LASKY'S PRICE £21·50**

**Optional extras:** AC-90E AC adaptor £4·00; DCC-128 stabilised car battery cord £6·00. Post FREE if bought with radio.

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Superb bass woofer specially made by Goodmans for Tandberg. SPEC: 12" paper cone. Voice coil 1½in. 4Ω impedance. Gap flux 15,500 gauss. Power handling 20W. Fundamental resonance 30Hz.

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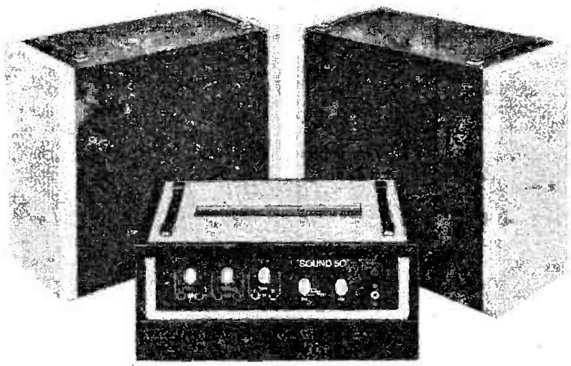
# SOUND 50

**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.
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To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.
**SPEAKERS!** Size 20″ × 20″ × 10″ incorporating 12″ heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

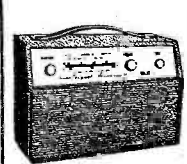
**COMPLETE SYSTEM** **£50** Plus £4 P. & P.
Sound 50 amp and 2 speakers

or available separately.

Amplifier **£28.50** plus £1.50 P. & P.

Speakers **£12.50** each plus £1.75 P. & P.

## 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: 75p extra.

Price **£5.25** plus 50p. P. & P.
Circuit 13p FREE WITH PARTS.

## The DORSET
**(600mW Output)**

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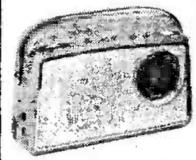
Circuit 13p FREE WITH PARTS



7-transistor fully tunable M.W.—L.W. superhet portable—with baby alarm facility. Set of parts. The latest modulised and pre-alignment techniques makes this simple to build. Sizes: 12 x 8 x 3in.
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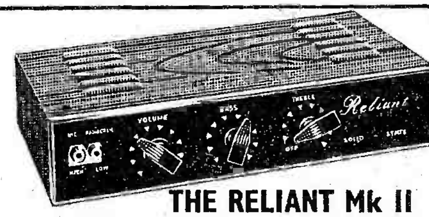


## THE RELIANT Mk II
## SOLID-STATE GENERAL PURPOSE AMPLIFIER

in simulated teak case **£7.25** plus P. & P. 50p

SPECIFICATIONS
Output 10 watts. Output impedance—3 to 4 ohms.
Inputs 1. -xtal 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—10¾in. x 4¾in. x 2¼in. 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.
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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 5¾in. £4.20 each. 50p P. & P.

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*See top of previous page for address*

**SET OF PARTS**
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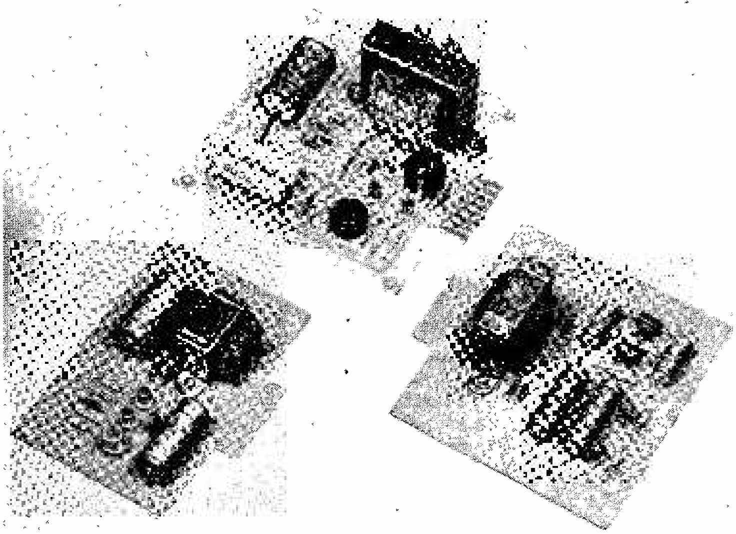

**71Z RANGE.** Basic zener stabilised P.U. with floating output. For general use including switching & op. amp. circuits. Size 4" x 4".

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| **71Z9** | ± 9v at 30mA | Price £3·95 each + £0·25 P & P |
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|---|---|---|
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| **71ZR12** | + 12v at 40mA nom. | |
| **71ZR15** | + 15v at 40mA nom. | |

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**71ZA.** 15v ± 3v at 100mA. Price £5·50 each + £0·25 P & P.

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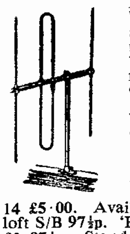

B.B.C. (Band I) Loft £1·25. Wall S/D £1·62½. 'H' array £3·00. ITV (Band 3) 5 element loft array £2·25. 7 element £2·75. Wall mounting 5 element £3·25. Combined BBC/ITV loft 1 + 5 £2·75. 1 + 7 £3·37½. Wall mounting 1 + 5 £3·87½. Chimney mounted 1 + 5 £4·50. Preamps from £3·75. Combined BBC/ITV/BBC 2 aerials 1 + 5 + 9 £4·00. 1 + 5 + 14 £4·50. 1 = 7 = 14 £5·00. Available loft only. FM radio loft S/B 97½p. 'H' £1·92½. 3 element array £2·87½. Standard co-axial cable 5p yd. Coax plugs 8½p. Outlet boxes 30p. Diplexer crossover boxes 87½p p. & p. Aerials 40p; accessories 15p C.W.O. or C.O.D. (Min C.O.D. charge 17½p.) 5p for fully illustrated lists.

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Solve your communication problems with this **4-Station Transistor Intercom** system (**1 master** and **3 Subs**), in de-luxe plastic cabinets for desk or wall mounting. Call/talk/listen from **Master** to **Subs** and **Subs** to **Master.** Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. £0.40.

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### Transistor TELEPHONE AMPLIFIER

**£2.98**

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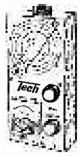
## TE15 TRANSISTORISED GRID DIP METERS



Six ranges. 440 Kc/s.-280 Mc/s. Operates on 9v. battery. Full instructions. £12·50. P. & P. 17½p.

## CRYSTAL CALIBRATORS NO. 10

Small portable crystal controlled wavemeter. Size 7 × 7½ × 4in. 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. £4·47½. Carr. 37½p.

## 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.

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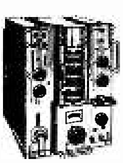
Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20-80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1µV-100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 × 8½ × 9in. Supplied in brand new condition complete with all connectors fully tested. £45. Carr. £1.

## AVO CT.38 ELECTRONIC MULTIMETERS

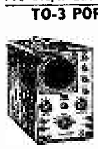
High quality 97 range instrument which measures A.C. and D.C. Voltage. Current, Resistance and Power Output Ranges D.C. volts 250mV–10,000v. (10 meg Ω –11 0meg Ω input). D.C. current 10µA–25 amps. Ohms, 0–1,000 meg Ω A.C. volt 100mV.–250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10µA–25 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



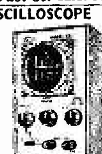
High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 150-300 Kc/s, 560 Kc's-1.5Mc/s; 3.9–30.5 Mc/s I.F. 500/Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O. calibrator I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 vol A.C. Size 19½ × 13½ × 16in. Weight 114lb. 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. £17·50. 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. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½ lb. 220/240V. A.C. Supplied brand new with handbook. £37·50. Carr. 50p.

## TO-2 PORTABLE OSCILLOSCOPE



A general purpose low cost economy oscilloscope for everyday use. Y amp. Bandwidth 2CPS–1 MHZ. Input imp. 2 meg Ω 25 P.F. Illuminated scale. 2in. tube. 115 × 180 × 230mm. Weight 8lb. 220/240 V a.c. Supplied brand new with handbook. £22.50. Carr. 50p.

# SEW PANEL METERS

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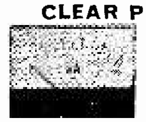
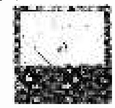


| | | | |
|---|---|---|---|
| | | 20V. D.C. .. | £2·97½ |
| 50µA ...... | £3·47½ | 50V. D.C. .. | £2·97½ |
| 50–0–50µA | £3·37½ | 300V. D.C. | £2·97½ |
| 100µA .... | £3·37½ | 1 amp. D.C. | £2·97½ |
| 100–0–100µA | £3·25 | 5 amp. D.C. | £2·97½ |
| 500µA .... | £3·12½ | 300V. A.C. | £2·97½ |
| 1mA ...... | £2·97½ | VU Meter.. | £3·75 |

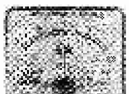
### BAKELITE PANEL METERS TYPE S-80 80 mm. square fronts



| | | | |
|---|---|---|---|
| 50µA ...... | £3·12½ | | |
| 50–0–50µA | £2·97½ | 50V. D.C... | £2·47½ |
| 100µA .... | £2·97½ | 300V. D.C. | £2·47½ |
| 100–0–100µA | £2·87½ | 1 amp. D.C. | £2·47½ |
| 500µA .... | £2·62½ | 5 amp. D.C. | £2·47½ |
| 1mA ...... | £2·47½ | 300V. A.C. | £2·62½ |
| 20V. D.C... | £2·47½ | VU Meter.. | £3·37½ |

## "SEW" CLEAR PLASTIC METERS

### Type MR.85P. 4¼in. × 4¾in. 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 |
| 50µA ...... | £3·60 | 150V. D.C. | £2·60 |
| 50–0–50µA | £3·10 | 300V. D.C. | £2·60 |
| 100µA .... | £3·10 | 15V. A.C... | £2·60 |
| 100–0–100µA | £3·10 | 300V. A.C. | £2·60 |
| 200µA .... | £2·87½ | S Meter 1mA | £2·87½ |
| 500µA .... | £2·75 | VU Meter.. | £3·60 |
| 500–0–500µA | £2·60 | 1 amp. A.C.* | £2·60 |
| 1mA ...... | £2·60 | 5 amp. A.C.* | £2·60 |
| 1–0–1mA .. | £2·60 | 10 amp. A.C.* | £2·60 |
| 5mA ...... | £2·60 | 20 amp. A.C.* | £2·60 |
| 10mA .... | £2·60 | 30 amp. A.C.* | £2·60 |

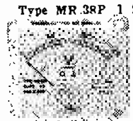
### Type MR.52P. 2⅜in. square fronts.

| | | | |
|---|---|---|---|
| 50µA ...... | £3·10 | 10V. D.C. .. | £2·00 |
| 50–0–50µA | £2·60 | 20V. D.C. .. | £2·00 |
| 100µA .... | £2·60 | 50V. D.C. .. | £2·00 |
| 100–0–100µA | £2·87½ | 300V. D.C. | £2·00 |
| 500µA .... | £2·25 | 15V. A.C. .. | £2·00 |
| 1mA ...... | £2·00 | 300V. A.C. | £2·00 |
| 5mA ...... | £2·00 | S Meter 1mA | £2·10 |
| 10mA .... | £2·00 | VU Meter .. | £3·10 |
| 50mA .... | £2·00 | 1 amp. A.C.* | £2·00 |
| 100mA .... | £2·00 | 5 amp. A.C.* | £2·00 |
| 500mA .... | £2·00 | 10 amp. A.C.* | £2·00 |
| 1 amp. .... | £2·00 | 20 amp. A.C.* | £2·00 |
| 5 amp. .... | £2·00 | 30 amp. A.C.* | £2·00 |

### Type MR.65P. 3⅜in. × 3¼in. fronts.

| | | | |
|---|---|---|---|
| 50µA ...... | 3·37½ | 10V. D.C. .. | £2·10 |
| 50–0–50µA | £2·75 | 20V. D.C. .. | £2·10 |
| 100µA .... | £2·75 | 50V. D.C. .. | £2·10 |
| 100–0–100µA | £2·60 | 150V.D.C... | £2·10 |
| 200µA .... | £2·60 | 300V. D.C. | £2·10 |
| 500µA .... | £2·37½ | 15V. A.C... | £2·10 |
| 500–0–500µA | £2·10 | 50V. A.C... | £2·10 |
| 1mA ...... | £2·10 | 150V. A.C. | £2·10 |
| 5mA ...... | £2·10 | 300V. A.C. | £2·10 |
| 10mA .... | £2·10 | 500V. A.C. | £2·10 |
| 50mA .... | £2·10 | S Meter 1mA | £2·37½ |
| 100mA .... | £2·10 | VU Meter.. | £3·37½ |
| 500mA .... | £2·10 | 50mA A.C. * | £2·10 |
| 1 amp. .... | £2·10 | 100mA A.C.* | £2·10 |
| 5 amp. .... | £2·10 | 200mA A.C.* | £2·10 |
| 10 amp..... | £2·10 | 500mA A.C.* | £2·10 |
| 15 amp. .. | £2·10 | 1 amp. A.C.* | £2·10 |
| 20 amp. .. | £2·10 | 5 amp. A.C.* | £2·10 |
| 30 amp. .. | £2·10 | 10 amp. A.C.* | £2·10 |
| 50 amp. .. | £2·37½ | 20 amp. A.C.* | £2·10 |
| 5V. D.C. .. | £2·10 | 30 amp. A.C.* | £2·10 |

### Type MR.38P 1 21/32in. square fronts.



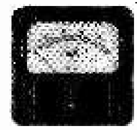
| | | | |
|---|---|---|---|
| | | 200mA .... | £1·37½ |
| | | 300mA .... | £1·37½ |
| | | 500mA .... | £1·37½ |
| | | 750mA .... | £1·37½ |
| | | 1 amp. .... | £1·37½ |
| | | 2 amp. .... | £1·37½ |
| | | 5 amp. .... | £1·37½ |
| | | 10 amp. .. | £1·37½ |
| 50µA ...... | £2·00 | 3V. D.C. .. | £1·37½ |
| 50–0–50µA | £1·87½ | 10V. D.C... | £1·37½ |
| 100µA .... | £1·87½ | 15V. D.C... | £1·37½ |
| 100–0–100µA | £1·75 | 20V. D.C... | £1·37½ |
| 200µA .... | £1·75 | 100V. D.C. | £1·37½ |
| 500µA .... | £1·50 | 150V. D.C. | £1·37½ |
| 500–0–500µA | £1·37½ | 300V. D.C. | £1·37½ |
| 1mA ...... | £1·37½ | 500V. D.C. | £1·37½ |
| 1–0–1mA .. | £1·37½ | 750V. D.C. | £1·37½ |
| 2mA ...... | £1·37½ | 15V. A.C... | £1·37½ |
| 5mA ...... | £1·37½ | 50V. A.C... | £1·37½ |
| 10mA .... | £1·37½ | 150V. A.C. | £1·37½ |
| 20mA .... | £1·37½ | 300V. A.C. | £1·37½ |
| 50mA .... | £1·37½ | 500V. A.C. | £1·37½ |
| 100mA .... | £1·37½ | S Meter 1mA | £1·60 |
| 150mA .... | £1·37½ | VU Meter.. | £2.10 |

### Type MR.45P. 2in. square fronts.

| | | | |
|---|---|---|---|
| 50µA ...... | £2·25 | 5 amp. .... | £1·50 |
| 50–0–50µA | £2·10 | 10V. D.C. .. | £1·50 |
| 100µA .... | £2·10 | 20V. D.C. .. | £1·50 |
| 100–0–100µA | £1.87½ | 50V. D.C. .. | £1·50 |
| 200µA .... | £1·87½ | 300V. D.C. | £1·50 |
| 500µA .... | £1·60 | 15V. A.C. .. | £1·50 |
| 500–0–500µA | £1·50 | 300V. A.C. | £1·50 |
| 1mA ...... | £1·50 | S Meter 1mA | £1·87½ |
| 5mA ...... | £1·50 | VU Meter.. | £2·25 |
| 10mA .... | £1·50 | 1 amp. A.C.* | £1·50 |
| 50mA .... | £1·50 | 5 amp. A.C.* | £1·50 |
| 100mA .... | £1·50 | 10 amp. A.C.* | £1·50 |
| 500mA .... | £1·50 | 20 amp. A.C.* | £1·50 |
| 1 amp .... | £1·50 | 30 amp. A.C.* | £1·50 |

## "SEW" BAKELITE PANEL METERS

### Type MR.65. 3¼in. 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 |
| 25µA ...... | £3·50 | 30V. A.C.* | £1·75 |
| 50µA ...... | £2·37½ | 50V. A.C.* | £1·75 |
| 50–0–50µA | £2·25 | 150V. A.C.* | £1·75 |
| 100µA .... | £2·25 | 300V. A.C.* | £1·75 |
| 100–0–100µA | £2·25 | 500mA A.C.* | £1·75 |
| 500µA .... | £2·10 | 1 amp. A.C.* | £1·75 |
| 1mA ...... | £1·75 | 5 amp. A.C.* | £1·75 |
| 1–0–1mA .. | £1·75 | 10 amp. A.C.* | £1·75 |
| 5mA ...... | £1·75 | 20 amp. A.C.* | £1·75 |
| 10mA .... | £1·75 | 30 amp. A.C.* | £1·75 |
| 50mA .... | £1·75 | 50 amp. A.C.* | £1·75 |
| 100mA .... | £1·75 | VU Meter .. | £3·10 |

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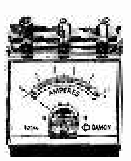

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| | | | |
|---|---|---|---|
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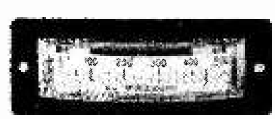
| 1mA ...... | £3·97 | 300V d.c. ... | £3·97 |
| 50-0-50µA .. | £4·25 | | |
| 1-0-1mA.... | £3·97 | Dual range | |
| 1A d.c. ...... | £3·97 | 500mA/5A d.c. | £4·25 |
| 5A d.c. ..... | £3·97 | 5V/50V d.c... | £4·25 |
| 10V d.c. .... | £3·97 | | |



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| | | | |
|---|---|---|---|
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| 50–0–50µA | £2·87½ | 1mA ...... | £2·37½ |
| 100µA .... | £2·87½ | 300V. A.C. | £2·37½ |
| 100–0–100µA | £2·75 | VU Meter.. | £3·25 |
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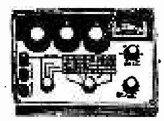

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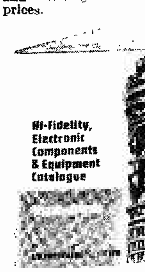


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| 6X4 | 30p | ECL83 | 65p | UBC41 | 50p |
| 6X5G | 30p | ECL86 | 40p | UBC81 | 40p |
| 6X5GT | 27p | EF37A | 60p | UBF80 | 40p |
| 10C2 | 50p | EF39 | 40p | UBF89 | 35p |
| 10F1 | 90p | EF40 | 50p | UCC84 | 49p |
| 10P13 | 55p | EF41 | 65p | UCC85 | 40p |
| 10P14 | £1·10 | EF42 | 70p | UCF80 | 55p |
| 12AT6 | 30p | EF80 | 25p | UCH21 | 60p |
| 12AT7 | 30p | EF85 | 35p | UCH42 | 70p |
| 12AU7 | 30p | EF86 | 30p | UCH81 | 35p |
| 12AX7 | 30p | EF89 | 28p | UCL82 | 35p |
| 12AV6 | 33p | EF91 | 33p | UCL83 | 60p |
| 12BA6 | 35p | EF92 | 40p | UF41 | 60p |
| 12BE6 | 35p | EF183 | 30p | UF80 | 35p |
| 12BH7 | 40p | EF184 | 35p | UF85 | 40p |
| 19AQ5 | 35p | EH90 | 40p | UF89 | 35p |
| 20D1 | 45p | EL34 | 50p | UL41 | 65p |
| 20F2 | 75p | EL33 | £1·25 | UL84 | 30p |
| 20L1 | £1·10 | EL41 | 55p | UY41 | 45p |
| 20P1 | 50p | EL42 | 58p | UY85 | 30p |
| 20P3 | 60p | EL81 | 55p | VR105/30 | 38p |
| 20P4 | £1·10 | EL84 | 25p | VR150/30 | 35p |
| 20P5 | £1·20 | EL85 | 43p | | |
| 25L6 | 45p | EL91 | 32p | | |

**SEND SAE FOR FULL LISTS!**
**DISCOUNTS** 10% on 12+ any one type. 15% on 25+ any one type.
Large quantity discounts on application.
Postage: Semi-Conductors 8p; Valves 15p.

### ZENER DIODES

200mw. (3.3 to 33v) **15p**; 1.5watt (2.4 to 400v) **20p**; 40 watt (3.9 to 100v) **25p**.

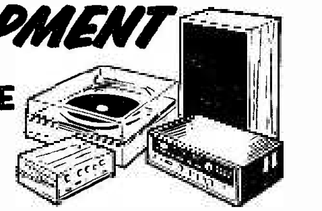
### INTEGRATED CIRCUITS

L900 **40p**; L914 **40p**; L923 **60p**; IC-10 **£2·50**; SL403 **£2·25**; MC1303 **£2·62**; MC1304 **£2·75**; PA246 **£2·45**; CA3005 **£1·17**; CA3011 **74p**; CA3052 **£1·65**; FCH131 **50p**; FCH161 **50p**; FJH141 **25p**; FJH171 **25p**; FJH181 **25p**; FJH221 **25p**; FJH231 **25p**; FJH241 **25p**; FJH251 **25p**; FJJ121 **60p**; FJJ131 **60p**; FJJ211 **£1·25**; FJY101 **25p**

# HI-FI EQUIPMENT

## SAVE UP TO 33⅓% OR MORE

SEND S.A.E. FOR DISCOUNT PRICE LISTS AND PACKAGE OFFERS!



# GARRARD

**FULL CURRENT RANGE OFFERED BRAND NEW AT FANTASTIC SAVINGS**

| | | | |
|---|---|---|---|
| 40 Mk II stereo | £8·40 | SL72B | £26·97 |
| 2025T/C stereo | £9·87 | AP76 | £20·97 |
| 3000 stereo | £10·50 | SL75B | £28·50 |
| SP25 Mk III | £11·75 | SL95B | £38·50 |
| | | 401 | £29·50 |
| SL65B | £14·97 | | |

Carriage 50p extra each item.

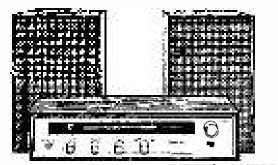
TEAK PLINTHS & PERSPEX COVERS
1. For SP25, SL65, SL55, 3000, 2025 T/C 2025, 1000. **£3·97½**.
2. For AP75, SL75, SL95. **£5·97½**.
3. For SP25 etc. to operate with lid in place **£5·97½**. Carriage 37½p extra each type. Full range of Garrard accessories available.

## SPECIAL OFFERS!

Garrard SP25 MK III fitted Goldring G800 cartridge and wooden plinth and plastic cover. Ready wired. Total list price £35.
OUR PRICE **£20.95** Carr. 50p

GOLDRING GL69/2 fitted Goldring G800 cartridge complete with deluxe base and cover. Total list price £50.80.
OUR PRICE **£39** Carr. 50p

## TELETON SPECIAL OFFER !



**CR10T AM/FM STEREO TUNER AMPLIFIER WITH MATCHING PAIR SA1003 SPEAKER SYSTEMS.** Output 4 watts per channel. Excellent reception, AFC, built-in MPX. Cer/XTAL Input. Total List **£50·25**. OUR PRICE **£29·95**. Carr. 62½p.

Also available with Garrard 2025T/C Record Changer, Plinth, cover and stereo cartridge. Ready wired **£43**. Carr. £1·00.

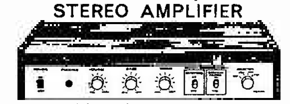
## TAPE CASSETTES

Top quality in plastic library boxes.
C90 60 min **42½p**, 3 for **£1·22½**.
C60 90 min **62½p**, 3 for **£1·80**.
C120 120 min **75p**, 3 for **£2·17½**.
Cassette Head Cleaner **56p**. *Post Extra.*

## HOSIDEN DH-02S STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable headband. 8 ohm impedance. 20-12,000 cps. Complete with lead and stereo jack plug. ONLY **£2·37½**. P. & P. 12½p.

## TELETON SAQ-206 STEREO AMPLIFIER



Latest exciting release. Brand new model. 6 + 6 watts rms. Inputs for mag, xtal, aux tape. Volume, bass, treble, sliding balance, scratch filter and loudness controls. Rec. List £32.50 OUR PRICE **£19·97** Carr. 37p.

## AMERICAN TAPE

First grade quality American tapes. Brand new. Discount on quantities.

| | |
|---|---|
| 3in. 225ft. L.P. acetate | 17½p |
| 3¾in. 600ft. T.P. mylar | 50p |
| 5in. 600ft. std. plastic | 42½p |
| 5in. 900ft. L.P. acetate | 50p |
| 5in. 1,200ft. D.P. mylar | 75p |
| 5¾in. 1,200ft. L.P. acetate | 62½p |
| 5¾in. 1,200ft. L.P. mylar | 80p |
| 5¾in. 1,800ft. D.P. mylar | £1·12½ |
| 5¾in. 2,400ft. T.P. mylar | £1·97½ |
| 7in. 1,200ft. std. acetate | 62½p |
| 7in. 1,800ft. L.P. acetate | 75p |
| 7in. 1,800ft. L.P. mylar | £1·00 |
| 7in. 2,400ft. D.P. mylar | £1·25 |
| 7in. 3,600ft. T.P. mylar | £2·25 |

Postage 10p. Over £3 post paid.

## B.S.R. McDONALD

| | | | |
|---|---|---|---|
| MP60 | £11·95 | 610 | £15 90 |
| 510 | £12·95 | 310 | £10·95 |

Carriage 37½p extra each item

**TEAK BASE AND PERSPEX COVER** for above BSR range **£3·97½**. Carriage 37½p

**TPDI SERIES** with plinth and cover and ready wired.
MP60 **£19·50** 610 **£22·97**
510 **£20·97**
Carriage 50p extra each item

## GOODMANS SPECIAL OFFERS!

MAXAMP 30 Stereo Amplifier 15+15 watt r.m.s. with matching STEREOMAX AM/FM Tuner. Total list price £136·52.
OUR PRICE **£89** THE PAIR Carriage £1

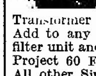
## GOODMANS SPEAKERS !

**MAXIMS**
OUR PRICE **£32·60** pr. Carr. 50p.
**MINISTERS**
OUR PRICE **£39·97** pr. Carr. 50p.
**MEZZO III,**
OUR PRICE **£25.50** pr. Carr. 50p
**MAGNUM K2,** teak.
OUR PRICE **£33·00** each Carr. 50p
**MAMBO,** teak.
OUR PRICE **£32·50** pr. Carr. 50p
**MARIMBA**
OUR PRICE **£35·00** pr. Carr. 50p.
**MAGISTER**
OUR PRICE **£41·50** each. Carr. £1

**TE-1035 STEREO HEADPHONES**
Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance. 25-18,000 Hz. With lead and stereo jack plug. ONLY **£1·97½**. P. & P. 12½p.

## SINCLAIR EQUIPMENT

Project 60. Package offers.



2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply. **£16·75** Carr. 37½p. Or with PZ6 power supply **£18·85** Carr. 37½p. 2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply. **£20·25**. Carr. 37½p.
Transformer for PZ8. **£2·97½** extra.
Add to any of the above **£4·87½** for active filter unit and **£16** for a pair of Q16 speakers.
Project 60 FM Tuner **£20·97½**. Carr. 37½p.
All other Sinclair products in stock.
2000 Amplifier **£25·00** Carr. 37½p.
3000 Amplifier **£35**. Carr. 37½p.
Neoteric Amplifier **£45·97½** Carr. 37½p.

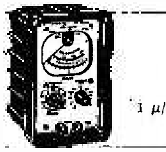
## HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES

Features unique mechanical 2 way units and fitted adjustable level controls. 8 ohm impedance. 20–20,000cps. Complete with spring lead & stereo jack plug **£7·97½**. P. & P. 12½p.

← See previous page • G.W. SMITH & Co. (RADIO) LTD. • See opposite page →

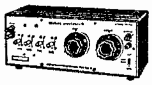
## RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from ·2 sec to 100 milli sec/cm.
Supplied complete with all accessories and instructions **£87.** Carr. paid.



**MARCONI T/44/TF956**
**AF Absorption Wattmeter**
1 μ/watts to 6 watts.
**£20.** Carr. £1.

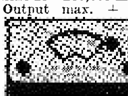
**TE111. DECADE RESISTANCE ATTENUATOR**



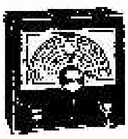
Variable range 0–111dB. Connections, Unbalanced T and Bridge T. Impedance 600 Ω range (0.1dB × 10) + (1dB × 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200kHz (−3dB). Accuracy: 0.05dB. +Indication dB × 0.01. Maximum input less than 4W (50V). Built in 600 Ω load resistance with internal/external switch. Brand new. **£27·50.** P. & P. 25p.

## BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

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

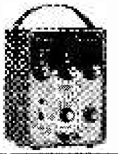


Operation internal batteries Attractive 2-tone case 7¾" × 5" × 2". Price **£17·50.** Carr. 17½p.



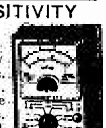
**TE-16A Transistorised Signal Generator.** 5 ranges 400kHz—30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3⅝in. Complete with instructions and leads. **£7·97½.** P. & P. 20p.

## BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR



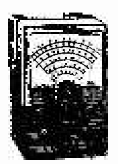
New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. A.C. Size 215mm x 150mm x 120mm.
Price **£27·50.** Carr. 25p.

## TE-40 HIGH SENSITIVITY A.C. VOLTMETER



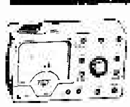
10 meg. input 10 ranges 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17·50.** Carr. 25p.

**TE-65 VALVE VOLTMETER**



High quality instrument with 28 ranges. D.C.volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17·50.** P. & P. 30p. Additional probes available: R.F. **£2·12½**; H.V. **£2·50.**

# MULTIMETERS *for EVERY purpose!*



**TECH PT-34.** 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/100/500mA. D.C. 0/100K. **£1·97½.** P. & P. 12½p.

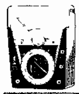
**HONOR TE.10A.** 20kΩ/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50uA/2.5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22 dB. 10–0, 100 mfd. 0.100–0.1 mfd. **£3·47½.** P. & P. 15p.

**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 megΩ. −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. 0/30uA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£5·97½.** 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. 1/2·5/10/25/100/250/500/1,000v. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg./60 Meg Ω. **£8·87½.** Post paid.

**MODEL PL436** 20kΩ/Volt D.C. 8kΩ/Volt AC. Mirror scale. .6/3/12/30/120/600V D.C. 3/30/120/600V A.C. 50/600uA/60/600 mA. 10/100K/1 Meg/10 MegΩ. —20 to + 46db. **£6·97½** P & P 12½



**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. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 Meg Ω. **£5·50.** P. & P. 15p.

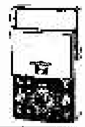
**MODEL TE-90** 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. D.C. .03/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. −20 to +63 db. **£7·50.** P. & P. 15p.

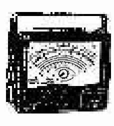
**TMK MODEL TW-50K** 46 ranges, mirror scale. 50K/Vol. D.C. 5K /Volt A.C. D.C.: Volts .125, .25, 1.25, 2.5, 5, 10. 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1.5, 3, 5, 10, 25. 50, 125, 250, 500, 1000V. D.C. Current: 25, 50uA, 2.5, 5, 25. 50, 250, 500mA, 5, 10 amp, Resistance: 10K, 100K, 1 MEG, 10 MEGΩ. Decibels: −20 to + 81·5 dB. **£8·87½.** P. & P. 17½p.

**TMK MODEL TW-20CB FEATURES 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 MEGΩ. Decibels: −20 to +52 db. **£11·50.** P. & P. 17½p.

**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. 0/50uA/110/100/500mA/10 amp. D.C. 02K/200K/20 MEG. OHM. **£15.** P. & P. 25p.

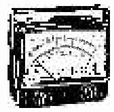
**MODEL AS-100D.** 100K Ω/Volt. 5in., mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200 v. D.C. 0/6/30/120/300/600 v. A.C. 0/10uA/6/60/300MA/12 Amp. 0/2K/200K/2M/200MΩ. −20 to +17 bB. **£12·50.** P. & P. 17½p.



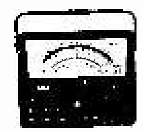


**MODEL 5025.** 57 Ranges, Giant 5½in. Meter, Polarity Reverse Switch. Sensitivity: 50K /Volt D.C. 5K /Volt A.C. D.C. Volts: .125, .25, 1.25, 5, 10, 25, 50, 125, 250, 500, 1,000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1,000V. D.C. Current: 25, 50uA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 2 K,10K, 100K, 1MEG, 10 MEGΩ. Decibels: −20 to +85 db. **£12·50.** P. & P. 17½p.

**TMK LAB TESTER.** 100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: .5, 2.5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100uA, 10, 100, 500mA, 2.5, 10 amp. Resistance: 1K, 10K. 100K, 10MEG, 100 MEGΩ. Decibels: −10 to 49 db. Plastic Case with Carrying Handle. Size 7½in. x 6⅞in. x 3¼in. **£18·90.** P. & P. 25p.



**MODEL TE-12** 20,000 O.P.V. 0/0.6/6/30/120/600/1,200/3,000/6,000v. D.C. 0/6/30/120/600/1,200v. A.C. 0/60μA/6/60/600mA. 0/6K/600K/6Meg./60 Meg. Ω 50pF. 0.2mFd. **£5·97½.** P. & P. 17½p.

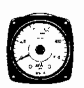


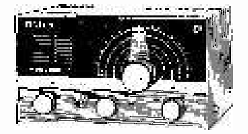
**SKYWOOD SW-500** 50K Ω/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to +57 db. **£7·50.** P. & P. 15p.

## FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. **£6·97½.** P. & P. 15p.

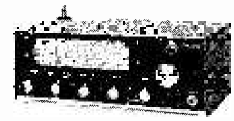
**270° WIDE ANGLE 1mA METERS**
MW1-6 60mm square **£3·97½**
MW1-8 80mm square **£4·97½**
P. & P. extra





**UNR-30 RECEIVER**
4 Bands covering 550kc/s–30mc/s. B.F.O. Built-in Speaker 220/240v. A.C. Brand new with instructions. **£15·75.** Carr. 37½p.

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



**UR-1A SOLID STATE COMMUNICATION RECEIVER**
4 Bands covering 550kc/s–30mc/s. FET, S Meter, Variable BFO for SSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12⅛" x 4¾" x 7". Brand new with instructions. **£25.** Carr. 37½p.

**LAFAYETTE HA-600 SOLID STATE RECREIVE**

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 9¾" x 8¼". 18 lbs. 220/240v. A.C. or 12v. D.C Brand new with instructions. **£45.** Carr. 50p.

**LAFAYETTE HA-800 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 9¾" x 8¼". 18 lbs. Brand new with instructions. **£57·50,** Carr. Paid. (100kc/s Crystal **£1·97½** extra.)

## FULL RANGE OF TRIO EQUIPMENT IN STOCK

**EDDYSTONE VHF RECEIVERS** Model 770R 19—165 Mc/s. Excellent condition. **£150**

**VOLTAGE STABILISER TRANSFORMERS**
180—260v. input. Output 230v. Available 150w or 225w. **£12·50.** Carr. 25p.

## AUTO TRANSFORMERS

0/115/230V. Step up or step down. Fully shrouded.

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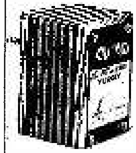
| 150 W. | **£2·37½** | P. & P. 17½p |
| 300 W. | **£3·25** | P. & P. 22½p |
| 500 W. | **£4·97½** | P. & P. 32½p |
| 1000 W. | **£7·25** | P. & P. 37½p |
| 1500 W. | **£8·97½** | P. & P. 42½p |
| 5000 W. | **£36·00** | P. & P. £1 |

## SOLID STATE VARIABLE A.C VOLTAGE REGULATORS



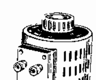
Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240v. A.C. Output continuously variable from 20v—230v. Model MR 2305 5 amp 68 x 46 x 43mm **£8·37½.** Model MR 2310 10 amp 90 x 68 x 60mm **£11·97½.** Postage 12½p.

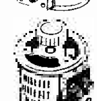
# POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.

**25 WATT.** 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **72½p,** P. & P. 7½p.
**50 WATT.** 10/25/50/100/250/500/1000/2500 or 5000 ohms, **£1·05** P. & P. 7½p.
**100 WATT.** 1/5/10/25/50/100/250/500/1000 or 2500 ohms, **£1·37½** P. & P. 7½p.

## "YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS





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**General Purpose Bench Mounting**

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| 2.5 Amp | **£6·75** |
| 5 Amp | **£9·75** |
| 8 Amp | **£14·50** |
| 10 Amp | **£18·50** |
| 12 Amp | **£21·00** |
| 20 Amp | **£37·00** |

**MODEL S-260 B**
**Panel Mounting**

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| 1 Amp | **£5·50** |
| 2.5 Amp | **£6·62½** |

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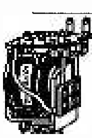
50/60 CYCLES,
OUTPUT VARIABLE
0-260 VOLTS.
Special discounts for quantity



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**MANY ITEMS AT NEW REDUCED PRICES**

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|---|---|---|---|---|---|---|---|---|---|
| 1N914 | 5p | 2N2905A | 47p | 40361 | 55p | BC148 | 9p | BFX87 | 29p |
| 1N4148 | 5p | 2N2924 | 20p | 40362 | 68p | BC149 | 10p | BFX88 | 26p |
| 2N696 | 20p | 2N2925 | 22p | AC107 | 46p | BC153 | 19p | BFY50 | 23p |
| 2N697 | 22p | 2N2926 | 11p | AC126 | 20p | BC154 | 20p | BFY51 | 20p |
| 2N706 | 12p | 2N3053 | 27p | AC127 | 20p | BC157 | 12p | BFY52 | 23p |
| 2N930 | 29p | 2N3055 | 65p | AC128 | 20p | BC158 | 11p | BSX20 | 16p |
| 2N1131 | 36p | 2N3702 | 13p | AC153K | 22p | BC159 | 12p | C407 | 17p |
| 2N1132 | 40p | 2N3703 | 13p | AC176 | 16p | BC167 | 11p | MC140 | 25p |
| 2N1302 | 19p | 2N3704 | 13p | ACY20 | 20p | BC168 | 10p | MPS6531 | 35p |
| 2N1303 | 19p | 2N3705 | 13p | ACY22 | 16p | BC169 | 11p | MPS6534 | 30p |
| 2N1304 | 23p | 2N3706 | 13p | AD140 | 56p | BC177 | 14p | NKT211 | 25p |
| 2N1305 | 33p | 2N3707 | 13p | AD142 | 50p | BC178 | 13p | NKT212 | 25p |
| 2N1306 | 33p | 2N3708 | 13p | AD149 | 60p | BC179 | 14p | NKT214 | 23p |
| 2N1307 | 36p | 2N3709 | 13p | AD161 | 33p | BC182L | 10p | NKT274 | 18p |
| 2N1308 | 36p | 2N3710 | 13p | AD162 | 36p | BC183L | 10p | NKT403 | 65p |
| 2N1309 | 36p | 2N3711 | 13p | AF114 | 30p | BC184L | 11p | NKT405 | 79p |
| 2N1613 | 23p | 2N3794 | 15p | AF115 | 30p | BC212L | 16p | OC71 | 29p |
| 2N1711 | 26p | 2N3819 | 35p | AF117 | 28p | BC213L | 16p | OC81 | 25p |
| 2N1893 | 54p | 2N3906 | 35p | AF124 | 30p | BC214L | 16p | OC83 | 20p |
| 2N2147 | 95p | 2N4058 | 13p | AF127 | 28p | BCY70 | 19p | ZTX300 | 17p |
| 2N2218 | 34p | 2N4059 | 10p | AF139 | 33p | BCY71 | 33p | ZTX301 | 17p |
| 2N2218A | 43p | 2N4060 | 11p | AF239 | 36p | BCY72 | 15p | ZTX302 | 22p |
| 2N2219 | 38p | 2N4061 | 11p | ASY26 | 27p | BF115 | 23p | ZTX303 | 22p |
| 2N2219A | 53p | 2N4062 | 12p | ASY28 | 27p | BF167 | 18p | ZTX304 | 27p |
| 2N2270 | 62p | 2N4124 | 18p | BC107 | 12p | BF173 | 19p | ZTX500 | 18p |
| 2N2369A | 19p | 2N4126 | 27p | BC108 | 11p | BF194 | 14p | ZTX501 | 21p |
| 2N2483 | 35p | 2N4284 | 15p | BC109 | 12p | BF195 | 15p | ZTX502 | 25p |
| 2N2484 | 42p | 2N4286 | 15p | BC125 | 15p | BFX29 | 31p | ZTX503 | 22p |
| 2N2646 | 54p | 2N4289 | 15p | BC126 | 22p | BFX84 | 25p | ZTX504 | 52p |
| 2N2904A | 42p | 2N4291 | 15p | BC147 | 10p | BFX85 | 34p | ZTX530 | 27p |
| 2N2905 | 44p | 2N4292 | 15p | | | | | | |

### RESISTORS

| Code | Power | Tolerance | Range | Values available | 1 to 9 | 10 to 99 (see note below) | 100 up |
|---|---|---|---|---|---|---|---|
| C | 1/20W | 5% | 82 Ω–220K Ω | E12 | 9 | 8 | 7·5 |
| C | 1/8W | 5% | 4·7 Ω–330K 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 | 0·22 Ω–3·9 Ω | E12 | 7 | 7 | 6 |
| WW | 3W | 5% | 12 Ω–10K Ω | E12 | 7 | 7 | 6 |
| WW | 7W | 5% | 12 Ω–10K Ω | E12 | 9 | 9 | 8 |

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

*Prices are in pence each for same ohmic value and power rating, NOT mixed values. (Ignore fractions of 1p. on total value of resistor order)*

**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.

### ZENER DIODES

5% full range E24 values; 400mW: 2·7V to 30V **15p** each 1W: 6·8V to 82V **27p** each 1·5W: 4·7V to 75V **60p** each Clip to increase 1·5W rating to 3 watts (type 266F) **4p.**

### CARBON TRACK POTENTIOMETERS, long spindles

Double wiper ensures minimum noise level.

| | | |
|---|---|---|
| Single gang linear | 220 Ω, to 2·2M Ω | 12p |
| Single gang log | 4·7K Ω to 2·2M Ω | 12p |
| Dual gang linear | 4·7K Ω to 2·2M Ω | 42p |
| Dual gang log | 4·7K Ω to 2·2M Ω | 42p |
| Log/antilog | 10K, 47K, 1M Ω only | 42p |
| Any type with ½A D.P. mains switch, extra | | 12p |

*Please note: only decades of 10, 22 and 47 are available within ranges quoted.*

### CARBON SKELETON PRE-SETS

Small high quality, type PR, linear only 100 Ω, 220 Ω 470 Ω, 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M2, 5M, 10M Ω Vertical or horizontal mounting **5p** each.

**ENAMELLED COPPER WIRE** even No S.W.G. only. 2oz reels 16.22 S.W.G. **25p**; 24-30 S.W.G. **30p**; 32-34 S.W.G. **33p**; 36-40 S.W.G. **35p**; 4oz reels 16-22 S.W.G. only **42p.**

### MULLARD polyester C280 series

250V 20% 0·01; 0·022; 0·033, 0·047 **3p** ea. 0·068; 0·1, 0·15 **4p**, 0·22 **5p**, 10%: 0·33 **7p**, 0·47 **8p**, 0·68 **11p**, 1µF **14p**, 1·5µF **21p**, 2·2µF **24p.**

### MULLARD SUB-MIN ELECTROLYTIC

**C426 range axial lead** 6p each
Values (µF/V): 0·64/64; 1/40; 1·6/25; 2·5/16; 2·5/64; 4/10; 4/40; 5/64; 6·4/6·4; 6·4/25; 8/4; 8/40; 10/2·5; 10/16; 10/64; 12·5/25; 16/40; 20/16; 20/64; 25/6·4; 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; 100/6·4; 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.

### LARGE CAPACITORS

High ripple current types: 1000/25 **28p**; 1000/50 **41p**; 1000/100 **82p**; 2000/25 **37p**; 2000/50 **57p**; 2000/100 **£1·44**; 2500/64 **77p**; 2500/70 **98p**; 5000/25 **62p**; 5000/50 **£1·10**; 5000/100 **£2·91**; 10000/25 **£1·40**; 10000/50 **£2·40.**

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10% on orders for components for £5 or more. 15% on orders for components for £15 or more (No discount on nett items).

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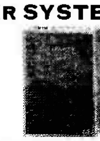

### MAINLINE AMPLIFIER KITS

RCA/SGS designed main amplifier kits.
Input sensitivity 500–700mV for full output into 8 Ω.

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| 25W | £9·50 nett | £4·92 |
| 40W | £10·50 nett | £6·03 |
| 70W | £12·60 nett | £6·87 |

### 30 WATT BAILEY AMP. PARTS

Sensitivity 1.2V for full output into 8Ω
Transistors and PCB for one channel **£6·36**
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Capacitors and resistors (metal oxide) **£1·95** per channel
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Suitable heatsink 10DN 400C, **55p**

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### NEON INDICATOR LAMPS

Chrome bezel, round red NR/R, **24p**; chrome bezel, round amber NR/A, **24p**; chrome bezel, round clear NR/C, **24p.** Neon, square red type LS5C/R, **17p**; amber type LS5C/A, **17p**; clear type LS5C/C **17p.** All above are for 240v. mains operation. **Filament types:** 6v. 0·04A square red type LS5C/R-6v., **20p**; 6v. 0·04A amber type LS5C/A-6v., **20p**; 6v. 0·04A clear type, LS5C/C-6v., **20p**; 6v. 0·04A green type LS5C/G-6v. **20p**; 12v. 0·04A LS5C/R-12v. **23p**; 28v. 0·04A LS5C/R-28v., **28p.**

### DIN CONNECTORS

| | | plug | socket |
|---|---|---|---|
| Loudspeaker .. | 2-pole | 12p | 10p |
| Audio .. | .. 3-pole | 13p | 10p |
| Audio .. | .. 4-pole | 14p | 12p |
| Audio .. | .. 5-pole 180deg. | 15p | 12p |
| Audio | .. 5-pole 240deg. | 15p | 12p |
| Audio .. | .. 6-pole | 15p | 13p |

**CORED SOLDER**—60/40 alloy, 20 s.w.g. 8oz. reel, **65p.** 1lb. reel **£1·20.**

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**£9.75** Post 25p

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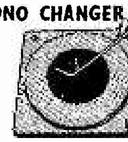
Size 18 × 15½ × 7¾in. Cut for above deck. Amplifier space 14 × 5 × 3½in. Satin aluminium front grille. Really smart appearance. Black/White or Green/Grey. Chrome fittings. **£4** Post 25p

## BSR C.109 SUPERSLIM

### STEREO AND MONO CHANGER



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| RA2W Ferrite Aerial | 65p | Spare Cores | 3p |
| Osc. P50/1AC | 30p | Driver Trans. LFDT4 | 50p |
| I.F. P50/2CC 470 kc/s. | 33p | Printed Circuit, PCA1 | 50p |
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Mullard Ferrite Rod 8 × ⅜in. 20p, 6 × ¼in. 25p.

**VOLUME CONTROLS** Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

**80ohm Coax 4p. yd.** BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 60 yd. £2. FRINGE LOW LOSS Ideal 625 and colour. **10p** yd.

WIRE-WOUND 3-WATT POTS. Small type with small knob. Values 10 Ω to 30 K., Carbon 30 K to 2 meg. **25p**

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VEROBOARD 0·15 MATRIX

2½ × 5in. 19p. 2½ × 3¾in. 16p. 3¾ × 3¾in. 19p. 3¾ × 5in. 26p.
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PINS 36 per packet 17p. FACE CUTTERS 38p.
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S.R.B.P. undrilled 1/16in. Board 10 × 8in. 15p.

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ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 8p; 8 × 6in. 15p; 10 × 7in. 17p; 12 × 8in. 23p; 14 × 9in. 27p; 12 × 12in. 32p.

1¼ inch DIAMETER WAVE-CHANGE SWITCHES 25p.
2 p. 2-way, or 2 p. 6-way or 3 p. 4-way 25p each. 1 p. 12-way, or 4 p. 2-way, or 4 p. 3-way 25p.
1 inch DIAMETER Wavechange "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way, 1 wafer 60p, 2 wafer 90p. Extra wafers up to six 30p each.
TOGGLE SWITCHES, sp. 14p; dp. 18p; dp. dt. 23p.

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200/250 v. A.C. Leaflet S.A.E. **£2.35** Post 15p

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for Mike, Tape, P.U., Guitar, etc. Battery 9-12v or H.T. line 200-300v D.C. operation. Size 1½" x 1½" x ½". Response 25 c.p.s. to 25 Kc/s. 26db gain. For use with valve or transistor equipment. Full instructions supplied. Brand new. Guaranteed. Details S.A.E. **90p** Post 10p

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| 8/450V .. | 14p | 500/25V .. | 20p | 60+100/350V .. | 58p |
| 16/450V | 15p | 8+8/450V | 18p | 32+32/250V .. | 18p |
| 32/450V | 20p | 8+16/450V | 20p | 32+32/450V .. | 33p |
| 25/25V | 10p | 16+16/450V | 25p | 32+32+32/350V | 43p |
| 50/50V .. | 10p | 32+32/350V | 25p | 100+50+50/350V | 48p |

SUB-MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p; 500, 1000mF 12V 18p; 2000mF 25V 35p.
CERAMIC 1pF to 0·01 mF, 4p. Silver Mica 2 to 5000pF, 4p.
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SILVER MICA. Close tolerance 1% 2·2-500pF 8p; 500-2·200 pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p; each.
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CHROME TELESCOPIC AERIAL, swivel base, 23in. 20p.
TUNING. Solid dielectric. 100pF. 500pF, 35p each.
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RECTIFIERS CONTACT COOLED ½ wave 60mA 38p; 85mA 48p. SILICON BYZ13 30p; BY100 30p; BY 127 30p.
EX-GOVERNMENT RECTIFIERS 250v, 200mA, 30p.
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RESISTORS. ¼ w., ½ w., 20% 1p; 2 w. 5p.
HIGH STABILITY. ½ w. 2% 10 ohms to 1 meg., 10p. Ditto 5% Preferred values 10 ohms to 10 meg., 4p.
WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt, 10 ohms to 100K. 10p each; 2½ watt, 1 ohm to 8·2 ohms 10p

## Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key

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| ⅜in. | 83p | ¾in. | 88p | 1⅛in. | 98p | 1¼in. | £1·20 | 2⅜in. | £2·21 |
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ALL POST 25p each

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| MINIATURE 200 v. 20mA., 6·3 v. 1 a. 2½ × 2½ × 2in. | 75p |
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GENERAL PURPOSE LOW VOLTAGE. Tapped Outputs at 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £2·00 1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60, £2·00 2 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £3·00
AUTO TRANSFORMERS 0-115-230 v. Input/Output. 150w. £2·00; 500w. £5; 1000w. £12.
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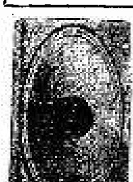
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12 v. outputs, 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p.
All transformers Postage 25p extra.



## E.M I. 13½ × 8in. LOUDSPEAKERS

With flared tweeter cone and ceramic magnet. 10 watts. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm. **£2.25** Post 15p

Also with twin tweeters. With crossover. 10 watt. State 3 or 8 or 15 ohm. **£4** Post 15p

Recommended Teak Cabinet Size 16 × 10 × 9in. Post 25p **£5**

## 10W MINI-MODULE LOUDSPEAKER KIT £3.25

Post 25p

Triple speaker system combining on ready cut baffle. ½ in. chipboard 15 in. × 8¾ in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5 in. Bass Woofer unit has a low resonance cone. The mid-Range unit is specially designed to add drive to the middle register and the tweeter recreates the top end of the musical spectrum. Total response 20-15,000 cps. Full instructions for 3 or 15 ohm.

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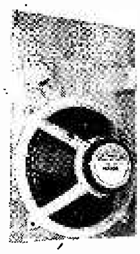

30-14,500 c.p.s., 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c.p.s. Rated 20 watts. Voice coils 3 or 8 or 15 ohms. Post Free

Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. **£11.50**

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| 'Group 25' | 'Group 35' | 'Group 50' |
|---|---|---|
| 12 inch 25 watt **£7** | 12 inch 35 watt **£9** | 15 inch 50 watt **£19** |
| 3 or 8 or 15 ohm | 3 or 8 or 15 ohm | 8 or 15 ohm |

TEAK HI-FI SPEAKER CABINETS. Fluted wood front
For 12in. round Loudspeaker .......... £9. Post 25p
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LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft.

**THIS ELAC CONE TWEETER IS OF THE VERY LATEST DESIGN AND GIVES A HIGHER STANDARD OF PERFORMANCE THAN MORE EXPENSIVE UNITS.**

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3½ × 3½ × 2in. deep. Rating 10 watts. 3 ohm or 15 ohm models. **£1.90** Post 10p

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With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5½in. × 4in. with control knob, tweeter and woofer leads and input terminals. Suitable for 3 to 8 ohm imp. **£1.90** Post 10p

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TWO-WAY 3000cps CROSSOVERS 3 or 8 or 15 ohm 95p.
SPECIAL OFFER! 80 ohm, 2½in. dia.; 35 ohm. 3in.
25 ohm, 3in. dia.; 6 × 4in.; 8 × 5in.
15 ohm 3½in. dia; 7 × 4in.; 8 × 5in. **£1** EACH TYPE
3 ohm, 2½in, 3in, 5in. 5 × 3in. 7 × 4in.
LOUDSPEAKERS P.M. 3 OHMS. 6½in. £1.10; 8 × 5in. £1·25; 8 × 2½in. 90p; 8in. £1.75; 10 × 6in. £1.90.
5in. WOOFER 8 watts max. 20-10,000 cps. 8 or 15 ohm. £1·80.
ELAC 8 in. De Luxe Ceramic 3 ohm or 15 ohm £2·50.
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. dia. 4 watt; 10in. dia. 5 watt; 12in. dia. 6 watt 3 or 8 or 15 ohm models £1.95 each. Post 15p.
OUTPUT TRANS. EL34 etc. 25p; MIKE TRANS. 50:1 25p.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
GOODMAN'S OUTPUT TRANSFORMER 5 watt push-pull for valves EL84 etc., 3, 8 and 15 ohms 85p, Post 20p.

### 100 WATT ALL PURPOSE POWER AMPLIFIER

4 inputs speech and music. Response 10-30,000 cps Matches all loudspeakers. A.C. 200/250V. Treble and Bass Controls Details. S.A.E. **£36** Post Free

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SUPPLIED AT LOWEST PRICES
ILLUSTRATED EAGLE CATALOGUE 20p. Post Free.

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BARGAIN 4 CHANNEL TRANSISTOR MIXER Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt. **£3**

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BARGAIN FM TUNER as above less cabinet **£7.50**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. **£3.50**

COAXIAL PLUG 6p. PANEL SOCKETS 6p. LINE 18p. OUTLET BOXES, SURFACE OR FLUSH 25p.
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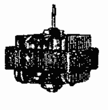
VALVE HOLDERS, 5p; CERAMIC 8p; CANS 5p.



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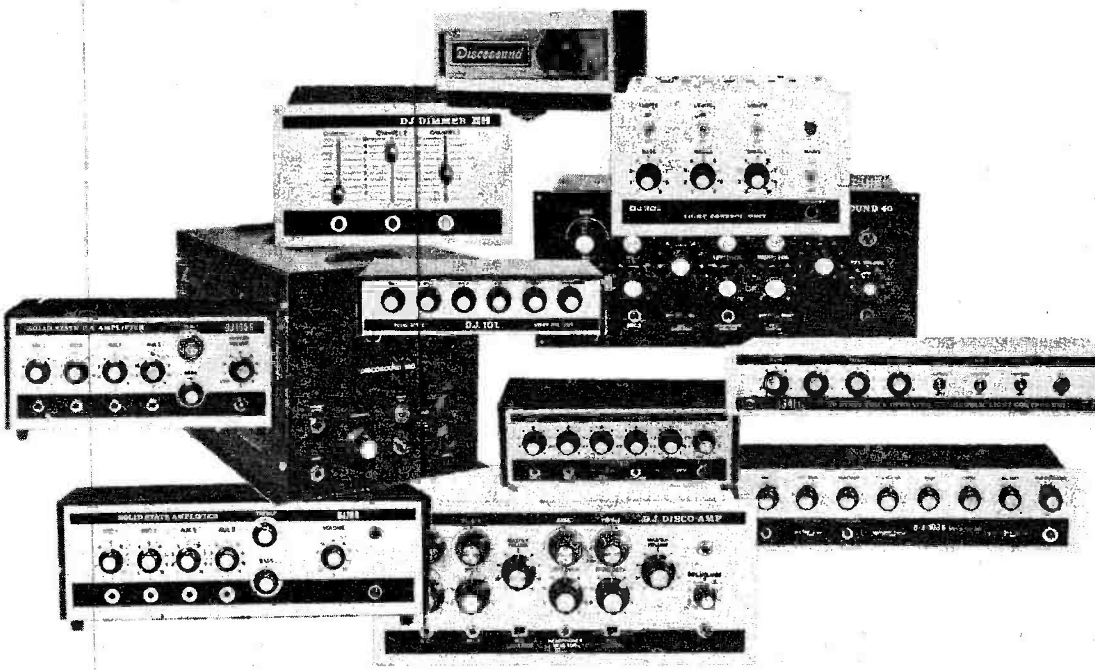
**—A COMPREHENSIVE RANGE COVERING EVERY REQUIREMENT**

**AMPLIFIERS, MIXERS, LIGHT CONTROL UNITS.**




**D.J. 102 Discotheque Mixer Pre-Amplifier**
4 inputs each with its own volume control plus master volume control, PFL monitoring and mic override switches.
Size 10½" x 4" x 4".
**Suggested Retail Price £25·00**

**D.J. 105S P.A. Amplifier**
4 channel mixing facilities each with separate inputs and volume controls 30 watts r.m.s. power output A.C. Mains 200/250v A.C. Size 11½" x 5" x 6".
**Suggested Retail Price £41·00**

**D.J. 70S Integrated Mixer Amplifier**
Power output 70 watts r.m.s. 4 channel mixer with separate inputs and volume controls, plus master volume and separate bass and treble controls.
Size 15½" x 5" x 6".
**Suggested Retail Price £63·00**

**D.J. Disco-Amp**
Designed specifically for use with discotheques. Power output 100 watts r.m.s. Two mike inputs and two gram inputs. with independent volume controls plus bass and treble controls. Incorporates many exclusive features.
Front panel size 16½" x 7".
**Suggested Retail Price £85·00**

**D.J. 101 Mixer Pre-Amplifier**
Six inputs allow full mixing facilities for all types of equipment. 9v battery operation. Size 10¾" x 2⅝" x 4⅝".
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**Discosound 40 Discotheque Pre-Amplifier**
Features independent inputs and volume controls for two microphones and two turntables plus separate bass, treble and master volume controls Self powered and ideal for use with Discosound 100 Power Amplifier (is capable of running 10 of these power amplifiers—total 1000 watts)
Front panel size 16½" x 7".
**Suggested Retail Price £40·00**

**Discosound 100 Power Amplifier**
100 watts r.m.s. power amplifier (at 8 ohms) utilising all silicon transistors and features full automatic overload against short or open circuits. Frequency response 20-20,000 Hz ± 3db. Distortion less than 1% at 70 watts r.m.s. ± 1db.
Size 10½" x 8" x 7".
**Suggested Retail Price £49·50**

**D.J. 103S Stereo Pre-Amplifier**
A high quality stereo discotheque pre-amp unit. Incorporating two microphone and two turntable inputs each with independent volume control, plus bass, treble, balance and master volume control Offers full mixing and monitoring facilities.
Front panel size 16½" x 3½".
**Suggested Retail Price £49·50**

**D.J. 30L Psychedelic Light Control Unit**
3 channel light unit enabling bass, middle and treble frequencies from the amplifier to be operated individually. Handles 1000 watts per channel.
Front panel size 10" x 6".
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**D.J. 40L Sound Operated 3 Channel Light Unit**
Features built-in microphone which eliminates the need for connections to any amplifier or sound source.
Handles 1000 watts per channel.
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**D.J. DIMMER 3000**
3 channel light dimmer unit offered in two versions: Dimmer 3000—a straight three channel dimmer unit with mains input and three light outputs. Dimmer 3000S—for use in conjunction with D.J.30L Light Control unit only and has three mains inputs and three light outputs Front Panel size 10" x 6".
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**Discosound Disco-Wheel**
A projector designed to project a range of liquid wheels and colour change wheels for special lighting effects, adding colour and variety to any form of entertainment.
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**A range of complete Discotheques with matching Speakers also available.**

**DISCOSOUND PRODUCTS ARE GUARANTEED FOR 12 MONTHS**

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# PRACTICAL WIRELESS

VOL 47 NO 3
*Issue 773*

JULY 1971


## TOPIC OF THE MONTH

### ★ What Spirit?

ALTHOUGH amateur radio in its various guises has stood the test of time as a hobby in its own right, and will doubtless continue to do so into the foreseeable future, it is clear that a little competitive stimulation adds a spice to ones activities. The only danger is that it is easy to lose sight of the original concept.

Perhaps the fields in which friendly competition often teeters on the brink of vicious partisanship are those of amateur transmitting and DX listening. On the main long distance communications bands the occupants often seem to be nail-biting fanatics prepared to do or die in the attempt to work more DX than anyone else even of it means breaking the laws of etiquette, bending the rules of the license and throwing ethics overboard. During contests the rat race becomes a stampede.

The SWL fraternity have their quota of border-line cases, too. In the quest for rare QSL cards, not only is the usefullness of a reception report hardly considered but many artifices are adopted to gain possession of much sought after pieces of pasteboard which are either dubious or blatantly dishonest.

Of course, every hobby has its quota of followers who overstep the mark and because of the inherent element of competition amateur radio leaves itself wide open to abuse. The important thing is not to opt out of the competitive activities involved in the hobby but to guard against crossing the line which divides keenness from fanaticism.

Once upon a time, much used to be made of that esoteric quality, said to enamate from all amateur radio buffs, which was called the Ham Spirit. Not much is heard of this today and in the context of modern living the phrase does have a rather antedeluvian ring about it, like something the hero proclaims in a Victorian novelette.

Nevertheless, if the more agressively objectionable operators were to reflect on what it implied and thought a little less about their own so-called achievements, then the majority of enthusiasts (whose ranks are likely to grow larger year by year and so increase the congestion) would find the hobby more a relaxation in their leisure hours than a test of endurance and stamina!

W. N. STEVENS—*Editor.*

## NEWS AND COMMENT



## CONSTRUCTIONAL



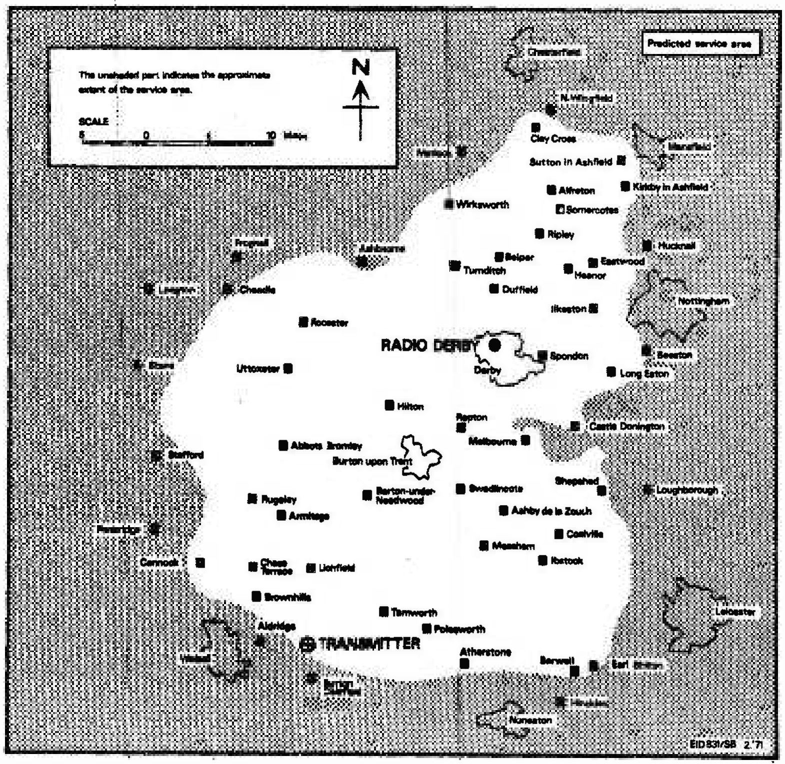
## OTHER FEATURES



**AUGUST ISSUE WILL BE PUBLISHED ON JULY 9th**

# NEWS... NEWS... NEWS...

## BBC Radio Derby Opens




BBC Radio Derby opened on April 29, on 96·5MHz in the v.h.f. band, with slant polarization, bringing the number of BBC local radio stations in operation to twenty.

A service area map and an information sheet dealing with slant polarization are available from BBC Radio Derby, 56 St. Helen's Street, Derby, DE1 3HY, or BBC Engineering Information Department, Broadcasting House, London, W1A 1AA.

## Frequency Counter

A new assembled solid-state Frequency Counter SM-105A has recently been produced by the Heath Company. It is capable of accurate readings from 10Hz to over 80MHz.

Readout consists of five 7 segment LED (light emitting diode) arrays, and a single LED for an overrange indicator. This type of display eliminates the driver transistors, high voltage, and larger physical size inherent in most other counters. A conventional crystal clock is incorporated.

Only a power switch and a kHz/MHz timebase switch are used for operating the counter. Because of the input protection circuit, the input attenuator switch found in most other counters has been eliminated.

This instrument is sold factory assembled and tested at £196.

For additional information write to *Heath (Gloucester) Limited, Gloucester GL2-6EE. Tel. (0452) 29451.*

## Audio 71

Venue for the 1971 Northern International Hi-Fidelity Festival (Audio 71) is the Majestic Hotel, Harrogate.

Public viewing days are September 17 to 19 admission free.

There will be Lectures given by leading personalities, a Recording Feature, Fashion Shows—something for the ladies and maybe the gentlemen too!—which proved so successful at Audio 70, Live Music Concerts with a very varied selection of music and performers, a High Fidelity in the Home Furnishing Feature, and many others, always bearing in mind that these extra items must never detract from the main object of this exhibition which is a truly International Audio Festival that Britain can be proud of.

## B.A.E.C. Exhibition

The British Amateur Electronics Club Exhibition of Electronic Games will this year be from the 17th to 24th July inclusive, and will once more be held at the Shelter at the centre of the Esplanade, Penarth. Besides the very popular games they exhibited previously they will also be demonstrating for the first time the B.A.E.C. Electronic Maze. This game is the result of some interesting experiments with transistor-transistor logic (TTL). They will once more be holding a raffle in conjunction with their Exhibition, and this year the proceeds from both the Exhibition and raffle will be given to the British Empire Cancer Campaign. The first prize is a 12in mains/battery portable television set which will get all channels on 405 and 625 lines. This set is nearly new and is fully guaranteed.

The Hon. Secretary of the B.A.E.C., Mr. J. G. Margetts, has now moved to a new permanent address which is 17 St. Francis Close, Abergavenny, Mon. If any readers are interested in the British Amateur Electronics Club and would drop him a line, he would be only too pleased to send details.

# NEWS... NEWS... NEWS...

## Diamonds for Derby

Derby and District Amateur Radio Society held their Diamond Jubilee Exhibition in April. It took place at the Derby Museum and Art Gallery. The Mayor of Derby, Alderman Miss M. E. Grimwood-Taylor—daughter of one of the founder members—performed the opening ceremony.

Two h.f. band stations and one v.h.f. band station were operating—the v.h.f. one taking the form of a mockup of a typical field-day site. These stations used the call-sign GB3ERD.

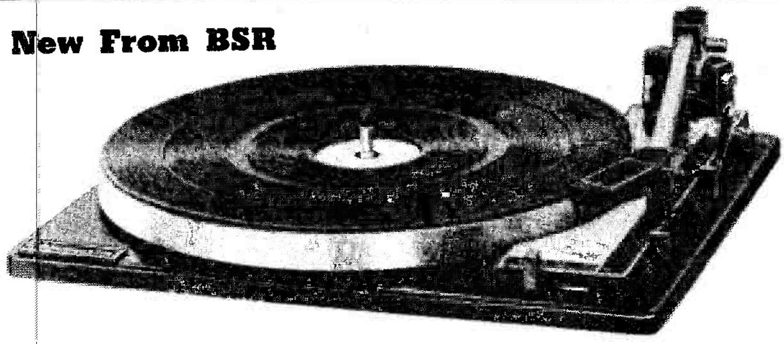
The exhibition's aim was to show the visitors the many and varied activities of the Society and a special section was specifically devoted to the Society's excellent collection of vintage radio equipment.

Fred Ward, G2CVV, the Hon. Sec. and 1971 R.S.G.B. President stated that the Society hopes to be able to establish a national amateur radio museum at Derby.

Also shown was a life-sized reproduction of a typical ham station of the 1911-1913 period, the exhibit being based on a 1913 photograph of the Society's club room. A mock up of a garden shed present-day shack was shown for comparison.

*No, it's not Riches or Dow of "Going Back" fame, it's the Derby Vintage Radio Shack.*

## New From BSR



Leader of the three latest models from BSR is the BSR HT70 McDonald deck. It has all the features of the MP60 with three important developments: a heavier 5¼lb. deep rim turntable, a synchronous 4-pole dynamically balanced motor and a rotating record stub spindle to combat record drag.

The HT70 will not replace the MP60 but complements the existing unit providing additional quality features for the more discerning hi-fidelity enthusiast. Price is £17·72 plus £4·27 PT. In total package form with plinth and cover the unit costs £25·62 plus £6·18 PT.

## A Transistorised G.G.?


Bob Elliott, Newmarket Transistors' Commercial Manager, was up at first light to see that everything was in good order on the first day of Newmarkets Distribution Conference.

The venue was Newmarket racecourse and he stood beside the photographer as he took this view. However, the back door of his estate car was wide open and one of the horses from this string broke away, came up to the car, and tried to eat a bowlful of germanium transistors which Bob had brought along for a demonstration.

Although the horse didn't succeed in swallowing any, they were a sticky mess by the time he had been enticed away!

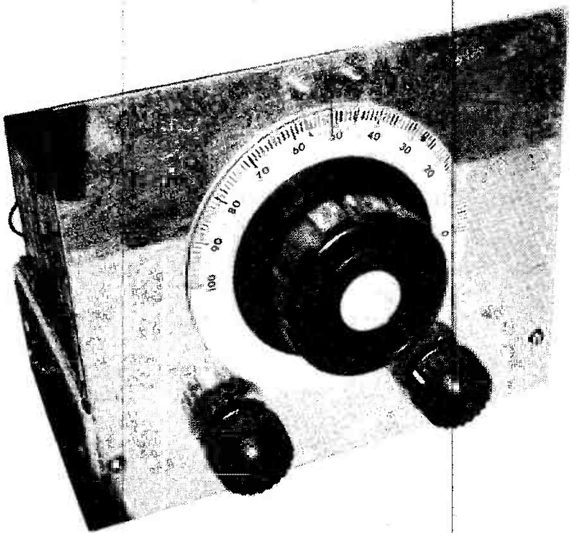
## Will Badman

Britain's oldest active radio amateur, Will Badman, G2ZG, died in February. He was operating on the 160m and 80m bands right up to his death.

Will was an early pioneer of radio and at the age of 18, whilst working in his father's electrical business at Weston-super-Mare, he charged the batteries used by Marconi in 1897 when his successful Bristol Channel spark test transmissions were carried out.

The call G2ZG was issued to him in 1922 for fixed station operations, and G2KQ as a portable call for experimental broadcasts.

On April 11, 1922, he transmitted a service from Sunnyside Church, Weston-super-Mare, on 160m and one month later, using the frequency of 1000m he transmitted a programme from the local town hall.



# FET RECEIVER

## G3OGR

THIS receiver employs ready-made plug-in coils, in conjunction with an f.e.t. transistor detector, using controlled regeneration. Such a circuit is quite selective and sensitive, and can give good reception of a very large number of transmissions.

Three plug-in coils are used, and the manufacturer's range numbers and approximate coverages are as follows:

**Range 2. 515—1545kHz. 580—194 metres.**
**Range 3. 1·67—5·3MHz. 180—57 metres.**
**Range 4. 5·0—15MHz. 60—20 metres.**

Range 2 provides medium wave coverage, and Range 4 includes most of the general short wave bands. Range 3 is useful for some of the lower s.w. frequencies, and 80m and 160m amateur bands.

Fig. 1 is the receiver circuit. Tr1 is provided with source bias, and tuned circuit input to the gate. Regeneration is obtained from the drain, and largely controlled by VC2. The potentiometer VR1 allows this stage to receive the best voltage, which considerably influences regeneration. VC1 is for tuning. The coils fit a 9-pin holder, with tags numbered as shown, and band changing is by inserting the wanted coil.

The primary of T1 provides a suitable load for Tr1. Tr2 is the first audio amplifier. Coupling is through C6 to the output transistor Tr3, which was found to give easily adequate power for headphones.

The most suitable phones are those of fairly low d.c. resistance and medium impedance. The headphones actually used were inexpensive surplus, of 60 ohms resistance, and these were found to be very satisfactory. High resistance headphones were not found to be suitable, as Tr3 collector voltage is reduced too much, and results were extremely weak.

### Construction

Since the coils have to be reached, a wholly enclosed cabinet is not suitable. The receiver is therefore built on a 7x4in. chassis, with a panel for the drive and dial. Only VC1, the coil, and battery are on top of the chassis.

If a case or cabinet is required, the most convenient type would be one with a hinged lid. It could be of metal or wood, according to materials available, or preference.

VC1, VC2, VR1, the coil holder, and aerial, earth, and phone sockets are mounted on the chassis and panel. Most of the other components are held on two small circuit boards—one for the detector stage, and the second for the audio amplifier. When these

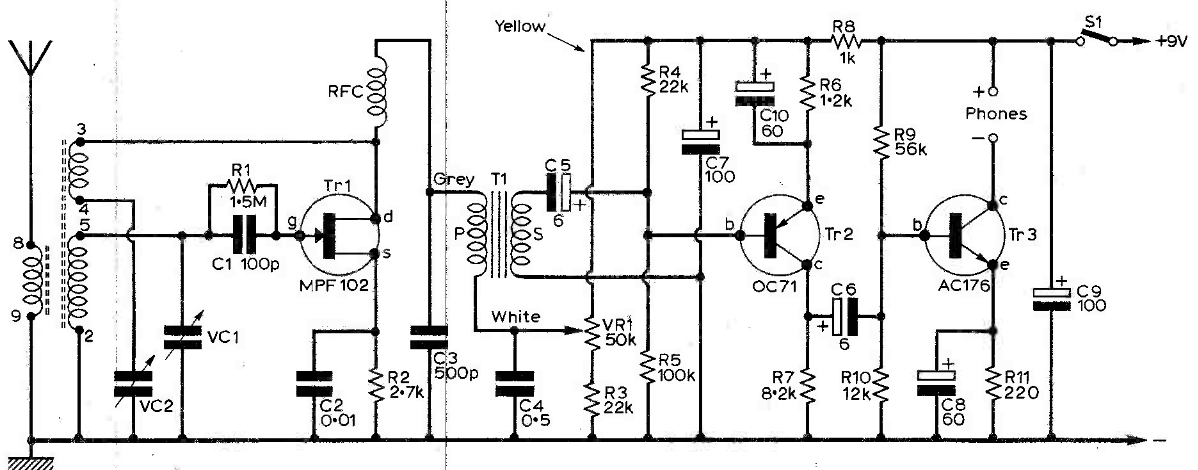
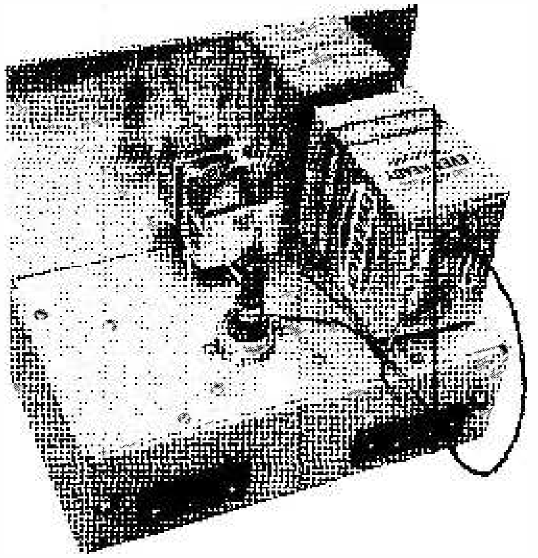


*Fig. 1: Circuit diagram of the f.e.t. receiver*

boards have been prepared and wired, they are inserted in the chassis, and output and other leads are connected.



*Above chassis view of the receiver.*

## Detector Stage

Components and wiring for this are shown in Fig. 2. The board is about 2in. x 2$\frac{1}{2}$in. and two 6BA $\frac{1}{2}$in. bolts are placed as indicated, and locked tight. When the board is wired, extra nuts are put on these bolts, which pass through holes in the metal chassis. Further nuts are then put on and tightened, so that the board is securely held, with all wiring etc. clear of the metal.

A holder is used for the field effect transistor, and is a tight fit in a hole in the insulated board. The holder could be fastened with adhesive, if loose. Care is taken that its tags and leads to them will not touch the metal chassis, when the board is in position.

One of the bolts mentioned has a tag, which forms the MC or negative return, when the board is in place. The components are held by passing their wire ends through small holes. They are connected as shown, and excess wire snipped off.

Leads are soldered on, to run to the coil holder, and primary of the transformer T1 on the audio amplifier panel.

Transistor leads are identified by reference to the flat side, as in Fig. 2. These wires can be left $\frac{1}{2}$in. or so long. When construction is finished, the transistor wires are pushed into the holder sockets, taking care that they come as in Fig. 2.

## Audio Amplifier

This is assembled on an insulated board approximately 2in. x 3in. Fig. 3 shows both sides of the board, with components on top and wiring on the reverse side.

Two bolts with tags and extra nuts provide chassis connections, in the manner described for the detector stage panel. A $\frac{1}{16}$in. or $\frac{5}{64}$in. drill is suitable for the other holes, for the wire ends of components. The simplest way to prepare the board is to scribe guide lines with a sharply pointed tool, and drill all the holes. Slots for the feet of T1 are made by placing two or three small holes closely together.

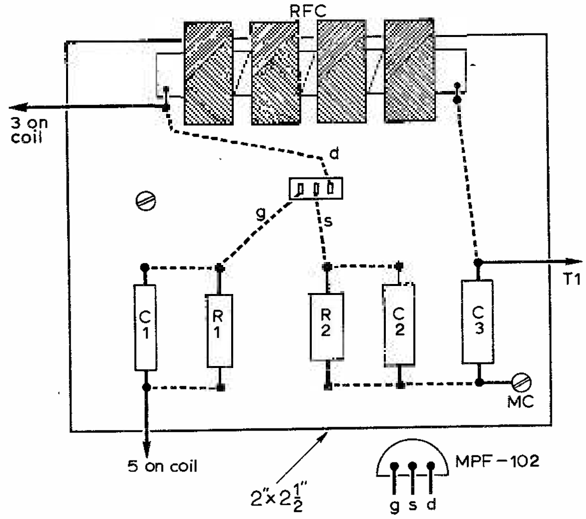



*Fig. 2: Detector stage circuit board.*

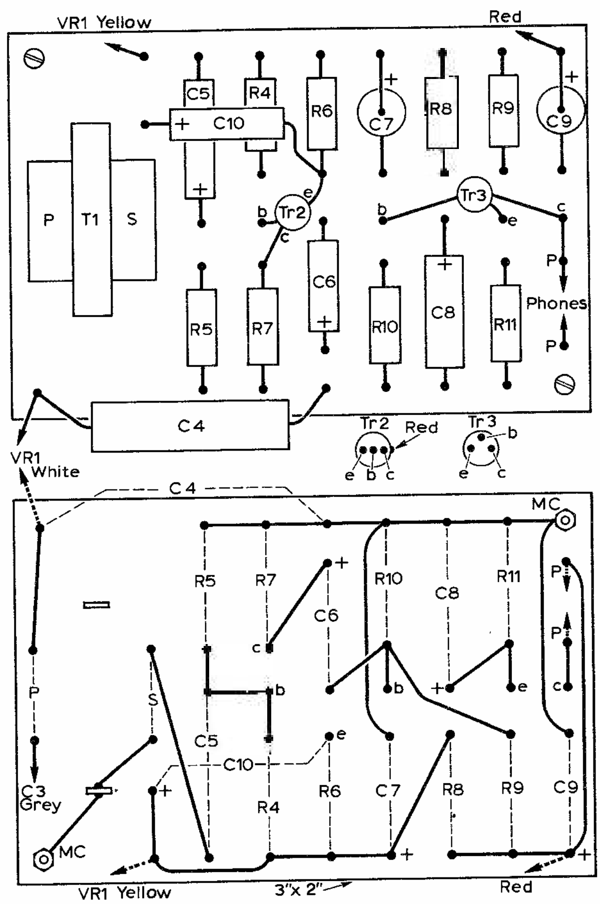



*Fig. 3: View showing both sides of the audio amplifier board.*

Components may be inserted one at a time, and soldered. Or T1, and all the resistors and capacitors can be put in, and the board turned over, and underneath wiring completed as in Fig. 3. Electrolytic capacitors should have the polarity shown.

The wire ends of Tr2 and Tr3 are then placed through the correct holes, and soldered. These leads can be left at such a length that there is ½in. or so of wire between the insulated board and transistors.

Leads and joints are kept against the board, so that they will not touch the metal chassis when the finished audio amplifier is mounted. Sleeving is put on wires which cross or may touch others.

External connections are soldered to the board before fixing it in place. The chassis and battery negative circuit is completed by the fixing bolts and lock nuts. The red lead will run to battery positive, via the on/off switch incorporated in the potentiometer VR1.

Leads from Tr3 collector and the positive line are anchored at P-P in Fig. 3, and go to the jack or socket strip used for headphone purposes. It is best to take the phone positive connection to the battery positive side of this circuit.

The grey lead from the primary of T1 passes to C3 on the detector panel. The yellow lead from R4 runs to VR1, and the white lead from C4 goes to VR1 slider. These connections are arranged and soldered after the circuit boards have been fitted to the chassis.

## ★ components list

**Resistors:**

| | | | |
|---|---|---|---|
| R1 | 1·5Meg. | R7 | 8·2kΩ |
| R2 | 2·7kΩ | R8 | 1kΩ |
| R3 | 22kΩ | R9 | 56kΩ |
| R4 | 22kΩ | R10 | 12kΩ |
| R5 | 100kΩ | R11 | 220Ω All ¼W 10% |
| R6 | 1·2kΩ | | |
| VR1 | 50kΩ linear pot. with switch | | |

**Capacitors:**

| | |
|---|---|
| C1 | 100pF silver mica |
| C2 | 0·01μF |
| C3 | 500pF |
| C4 | 0·5μF |
| C5 | 6μF 6V |
| C6 | 6μF 6V |
| C7 | 100μF 12V |
| C8 | 60μF 6V |
| C9 | 100μF 12V |
| C10 | 60μF 6V |

**Miscellaneous:**

VC1, Jackson Type O, 365pF 1-gang; Drive, Jackson 6 : 1 No. 4489/C; VC2, 100pF air dielectric; T1, Home Radio Cat. No. TR64; Chassis and panel, two CU133 4 x 2in. sides, CU136 7 x 2in. side, CU158 7 x 4in. plate and CU177 7 x 6in. plate, Home Radio. RFC, Denco RFC7 choke; Coils, Denco "Green" ranges 2, 3 and 4; Coil holder; Tr1 MPF-102; Transistor holder; Tr2 OC71; Tr3 AC176; Paxolin board; twin socket strips; knobs, etc.

## *Panel and Chassis*

Fig. 4 is the top of the chassis. VC1 spindle passes through a clearance hole. Spacers or extra nuts are needed on the three bolts which secure VC1 to the panel, so that the spindle does not project too far for the drive.

The drive listed is made in such a way that it fits completely on the outside of the panel. The large knob is removed by undoing the central screw. The ball drive can then be fitted on VC1, and the drive lug arranged to engage with the fixed pin. Place the dial at 100 with VC1 closed, and lock the drive to the spindle. The knob is then replaced. A small transparent indice is provided with the drive, and is mounted with bolts.

Fig. 5 is the underside of the receiver. The chassis items listed enable a chassis to be assembled with front lugs to take bolts holding the panel, as in Fig. 5. VR1 and VC2 are attached to the panel. If a 4-sided chassis is used, matching holes must allow VR1 and VC2 to pass through both the front chassis runner and panel, which can be secured together with the fixing nuts of these controls.

Fig. 5 shows how the circuit boards are placed and wired. Each is held by two 6BA bolts. As mentioned, these must be long enough for all connections and joints to be clear of the metal chassis. Lock-nuts must also be used as explained,

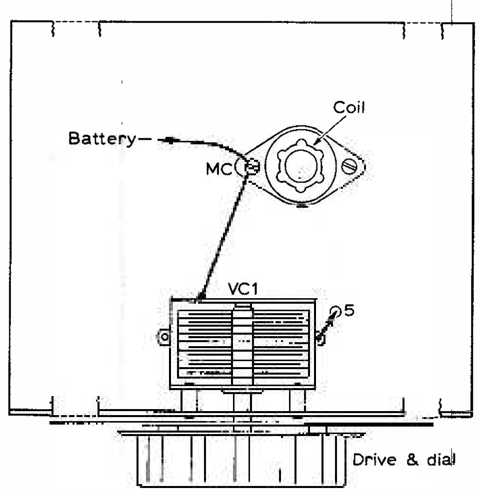



*Fig. 4: Above chassis layout.*

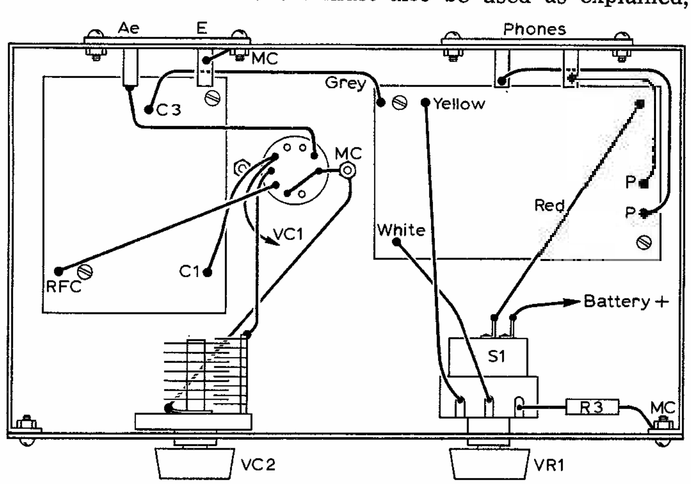


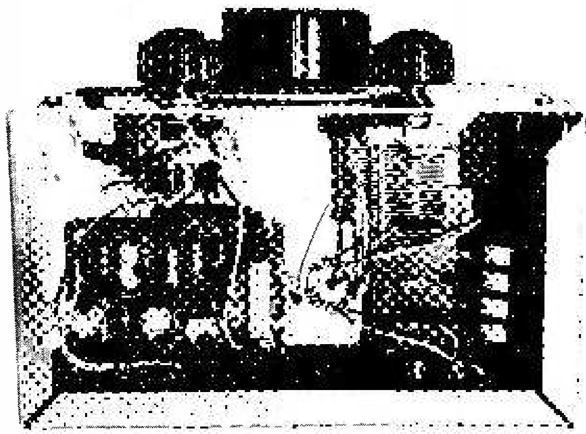

*Fig. 5: Underside wiring and interconnection.*

to secure proper electrical contact.

Leads running to the coil holder should be reasonably clear of each other.

It is of course not essential to use coloured leads as shown. However, these do simplify wiring the units together correctly, when the boards are in the chassis.

When fitting the battery, note that the chassis or "earth" line is negative. Any 9V battery is suitable. Current drain is around 10mA, depending on the setting of VR1, and other factors. If a meter placed in one battery leads shows a heavy current when the receiver is first tested, switch off immediately and look for a wrong connection, short-circuit, or other fault.



*Underside view of the completed receiver.*

## *Aerial and Earth*

Many transmissions can be received with only a short indoor aerial. But with any receiver an improved aerial, and possibly an earth, will give better results. This was found to be particularly so with amateur, shipping, and other signals on Range 3. Here, the use of an outdoor aerial, and earth lead, resulted in the reception of many signals which could not be picked up at all with a short indoor aerial. On Range 4, however, a short indoor aerial provided many signals.

Where no earth is available, and the aerial is very short, it is better to take the aerial lead directly to tag 5 of the coil, or the fixed plates of VC1. This connection is unsuitable for longer aerials, but can be tried with aerials of moderate length if a small pre-set capacitor is placed in series with the lead.

Adding an earth increases the volume of most signals. Taking an aerial to tag 5, as mentioned, flattens tuning, and may cause regeneration and hand-capacitance troubles.

It is absolutely essential that regeneration is correctly used, for the reception of all but very strong, local signals.

When VR1 is only rotated a small way, and VC2 is fully open, regeneration is at a minimum. Closing VC2 slightly, and rotating VR1 to increase the voltage at Tr1 drain, will give an improvement, which is initially not very great. But as the point where oscillation will arise is approached, there will be a sudden great increase in sensitivity and volume. Rotating the controls further will cause oscillation, and VR1 or VC2 should be backed off from this point slightly.

With each range there are settings of VC2 and VR1 which give most smooth and controllable regeneration. It is quite useless turning VR1 to maximum, as if a volume control, or using VC2 in the same way.

Band coverage is influenced by the positions of the coil cores, and this also has some effect on regeneration. The cores are locked with nuts, so that dial calibration is not lost.

If the circuit is otherwise working properly, lack of success with a t.r.f. receiver is almost always due to wrong manipulation of the regeneration controls. The correct method is easy for "old timers" who have used regenerative s.w. receivers. But if the user is more accustomed to a superhet, with volume control, it must be remembered that proper results are absolutely impossible if the regeneration controls are merely fully advanced, in the expectation that this gives best volume. Instead, they should maintain the detector *just* below the point where oscillation would begin, heard as a whistle when tuning through a transmission. ■

---

# CQ! CQ! CQ! CQ! CQ! CQ! CQ!

**EQUIPMENT WANTED**

...frame output transformer for a Murphy V250 TV.—A. Murphy, Harford House, Stogursey, Bridgwater, Somerset.

**EQUIPMENT FOR DISPOSAL**

...an AR77E communication receiver manufactured by R.C.A.—C. Morris, 12 Crwys Place, Roath, Cardiff, CF2. 4NS.

...Sinclair Q16 loudspeaker unused and unwanted. S.A.E. for details from T. Hudnott, "Linden" Benson Lane, Crowmarsh, Wallingford, Berkshire. Tel. Wallingford 3163 (evenings).

...Murphy A104 receiver (25 years old) working. Will exchange for pair of stereo headphones or offers.—H. Parry, 24 Tara Street, Holyhead, Anglesey.

**CORRESPONDENTS WANTED**

...boy or girl of my own age (17) who is interested in electronics, pop music and sports.—Anthony Galea, 119-B Main Street, Mosta, Malta.

**BOOKS WANTED**

...Mullard Circuits for Audio Amplifiers (second edition) 1962 and at the time 8s. 6d.—G.W. Saunders, 26 Rowan Crescent, Streatham, London, S.W.16.

...a copy of Practical Wireless Circuits.—S. Buettner, 2 Poplar Catts, Icknield Street, Bealey, Redditch, Worcestershire.

**EQUIPMENT WANTED**

.. plug-in coils for the Eddystone 358 receiver.—D. J. Anderson, 25 Ivanhoe, Monkseaton, Whitley Bay, Northumberland.

...R1392, R1132, P104 or similar v.h.f. receiver. —W. A. Mitchell, 105 Carisbrooke Road, Leicester, LE2, 3PG.

...Motek, Magnavox 363 or similar tape deck for Sinclair IC10 + £5. Please state make and condition.—H. Lozrenski, 63 Cloudesdale Road, London, S.W.17.

**TAPESPONDEET WANTED**

...tapespondent of my own age (18) interested in electronics, generally. My equipment can take cassette (2 track) and also standard ¼in, tape at 3¾in. and 7½in. (2 track).—Stewart Clark, 17 Newmarch Avenue, Upper Hillside, Salisbury, E.61., Rhodesia.

**ISSUES FOR DISPOSAL**

.. following P.W. blueprints: Beginners 5-band Rx/Home Intercom, Progressive S.W. Rx/Mini Amp, Citizen. P.E. blueprints are also available. S.A.E. for details—E. Shown, Tiptree Hall Annexe, Tiptree Colchester, Essex.

...back issues of P.W from December 1966—January 1970 (except January 1968). All are complete with data sheets etc.—G. .M Robinson, 99 Marine Drive, Rottingdean. Brighton, BN2. 7GE, (Sussex).

...November and December 1963. June, July, Sept., Oct., Nov., Dec., 1964. January May, July, August, Sept., Oct., Nov., 1965 and May and June 1966. Radio Constructor for Dec. 1969, Nov. 1966 and Jan. 1970. P.E. for December 1969 and February 1971.—J. Richards, 52 Cookson Street, Liverpool, L1.5EW.

**INFORMATION WANTED**

.. any information on the geiger counter indicating unit 6665-110108 and probe 6665–110110.—P. Biggs, 9 St. Andrews Road, Plaistow, E.13.

...circuit diagram for Pilot radio model G509A. Ten valve 6 waveband Rx about 1938 offered.—H. Fleming, 46 Shelbourne Road, Dublin 4, Ireland.

...radio and TV servicing charts. S.A.E. with details please.—J. J. McCourt, Silverstream P.O., Monaghan, Eire.

...instruction manual on the Universal Avo Bridge (which appeared on the market about 1950).—S. W. Siwek, 134 Birkhall Parade, Aberdeen.

...service manual, circuit diagram or any other information on PCR2 Communications Receiver made during the war in the U.K.—Lionel L. Sharp, VK4NS, 19 Kelso Street, Chermside, Queensland, 4032, Australia.

...instruction manual on receiver type 1147A. All letters answered.—F. Richards, 9 Dales Grove, Worsley, Manchester, Lancashire.

.. circuit or manual of Heathkit USC—1 stereo control.—E. H. Smith, 84 Westgate, Louth, Lincs.

...circuit diagram of a "Falcon" radiogram (about 1954)—mono speaker and grams Wavebands are : L.M.S. and VHF with magic eye tuning indicator.—T. F. Callow, 27 Sprules Road, Brockley, London, S.E.4.

...Dynatron service sheet "Ether Princess" radiogram p/108.—Young, 25 Chalkland Rise, Brighton, BN2. 6RJ.

...schematic diagram of Admiralty patt. Avo Valve Tester. This model consists two separate instruments—the valve multiple baseboard which plugs into the meter instrument is one. I have the circuit diagram but this does not help me to position the metal rectifier on the MAV C. INS toggle switch which has come adrift.—H. Butterworth, Flat 132 Chartist House, Hyde, Cheshire, SK14.INS.

# TAKE 20

JULIAN ANDERSON

## No. 27
## ONE TRANSISTOR RADIO

**A series of simple transistor projects, each using less than twenty components and costing less than one pound to build.**

MOST readers will have begun their hobby by building a crystal set, but of course these have a number of disadvantages. The output is low, it is not selective and, because of the need for a long wire aerial, is far from portable. The addition of a transistor, a d.c. blocking capacitor, a bias resistor and a battery will boost the output but will not overcome the other disadvantages.

By rearrangement of the components needed for an amplified crystal set and by adding components costing no more than 10p, it is possible to increase the performance remarkably—to such an extent that the external aerial is no longer needed and the selectivity and sensitivity and output becomes so good that reception of all local stations and many foreign ones becomes possible.

It is suitable for miniaturisation or for any other form of construction. Building it into a small plastic case will result in a very good portable earpiece radio which will fit into one's pocket.

It is necessary to wind one's own ferrite rod aerial. Those who have not tried this should not be put off as it takes but a few minutes and the materials are easily come by and not expensive. The ferrite rod should be about $\frac{3}{8}$in. in diameter and 3in. long but this is usually sold in lengths of 6in. or more. We have had many letters from readers asking how to cut this as the apparently obvious method, using a hacksaw, doesn't work. All that is necessary is to file a V shaped groove in the material and smartly break it. This usually gives a nice neat break at right angles.

Eighty-eight turns are needed with a tap at eight turns. The wire gauge used is not important and can be between 26s.w.g. and 34s.w.g. The wire should be held in place by plastic tape.

The tuning capacitor, VC1, is shown as 350pF but this is not too critical and nearly all tuning capacitors between 176pF (a common value) and 500pF will do. To keep within our price limitation one of the Radio-spares compression trimmers will have to be used and 250pF or 500pF versions are both suitable. These normally cost about 8p though simple modifications will have to be made to convert it from a trimmer to a variable capacitor.

The tuned circuit comprises VC1 and the 80 turns of the coil, this being completed by C1. The 8 turns transform the signal to a suitable impedance to feed the transistor.

Tr1 is shown as a 2N2926 type, but the BC109, BC169, BC184L and 2N4292 will do just as well. If miniaturisation is the aim, the 2N4292 is physically small and so will be preferred.

The r.f. signal is greatly amplified by Tr1 and at the collector it finds its way blocked by the high inductance of the 2000Ω magnetic earphone. A tiny part of the signal is fed back to the top end of the tuned circuit via VC2 which is made up from a pair of plastic covered wires, each about $1\frac{1}{2}$in. long, twisted together.

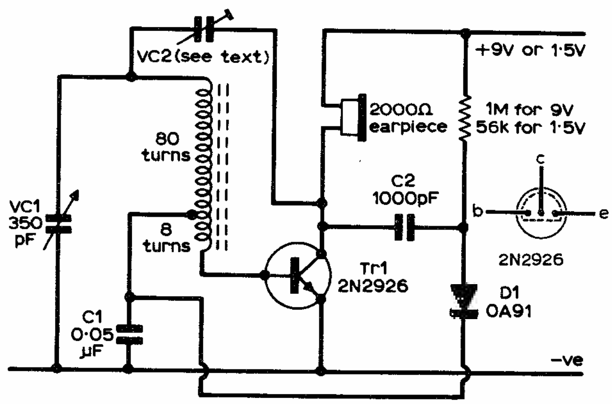



*Fig. 1: The circuit of the one transistor radio.*

By twisting these together, a low value capacitor of about the right value is made and allows the degree of feedback to the tuned circuit to be properly controlled. This small part of the signal introduces regeneration which has the effect of considerably improving the selectivity and sensitivity of the circuit.

The amount of feedback is critical and the wires should be twisted till the whole circuit is just below the point of oscillation at the high frequencies.

The remainder of the r.f. signal at the collector of Tr1 passes through C2; the 1000pF capacitor will hardly impair the passage of an r.f. signal at all. The signal is then detected by the diode, an inexpensive germanium type which has replaced the older OA81, but it is similar electrically.

The detected r.f. signals are then smoothed by C1 which removes the remaining r.f. component and the resulting a.f. signal passes through the eight turns of the coil and directly to the base of the transistor for a second time.

At the collector the amplified a.f. signal will hardly pass through VC2 or C2 but finds its easiest path through the earpiece which on the r.f. amplification stage acted as a barrier.

Base bias for the transistor is connected through the diode and through the coil. The value will depend to some extent on the actual transistor used but the value shown here is the most common. A PP3 9V battery is probably the best and the resistor value for this will be 1MΩ but the circuit will operate using 1·5V pen-cell batteries and in this case the value should be reduced to 56kΩ. For use with 1·5V it will be found that the value of VC2 will have to be increased greatly and the wires may have to be even longer than the $1\frac{1}{2}$in. previously suggested.

Headphones of the high impedance magnetic type can be used, but these are expensive compared to earpieces but note that whichever is used must have an impedance of at least 1000Ω and 2000Ω are even better. ■

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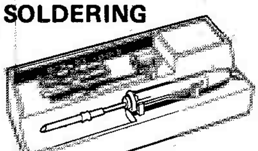
## SK1 SOLDERING KIT



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**Model F** - 40 watts. Fitted $\frac{5}{16}$" bit. Spare bits $\frac{3}{32}$", $\frac{1}{8}$", $\frac{3}{16}$" and $\frac{1}{4}$" available. For 240, 220, 110, 20 volts. From **£2·38**

**Model E** - 20 watts. Fitted $\frac{1}{4}$" bit. Spare bits $\frac{3}{32}$", $\frac{1}{8}$" and $\frac{3}{16}$" available. For 240, 220 or 110 volts. From **£1·80**

**Model ES** - 25 watts. Fitted $\frac{1}{8}$" bit. Spare bits $\frac{3}{32}$", $\frac{3}{16}$" and $\frac{1}{4}$" available. For 240, 220 or 110 volts. From **£1·83**

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# WIRING UP STEREO

W. E. COBBETT

AT last, the stereo system you had been waiting and saving for is sitting in a stack of boxes in your living room. You are now ready to unpack it, wire it up, and play the first record.

But before you rush at those expensive boxes in the corner, and get yourselves in a terrible muddle, let us discuss the methods used in wiring and installing your system. If we do the operation in a sensible and logical manner, the system is more likely to work first time when completely linked up. Stereo is not as simple as you think or as the super-salesman would have you think. There are a number of small factors which when added up make the difference between a system that works and one that doesn't.

## Plugs and sockets

The first step is to unpack the amplifier, or tuner-amplifier, whichever you have chosen for the system. It is a good idea to put to one side any plugs and accessories which the manufacturers may have included. They will be required at a later stage. Closely examine the controls of the unit, studying the maker's instructions and making sure that you know what each control does. Next, study the rear of the unit, which houses the input and output connections. Referring to the instructions, identify the inputs for Record Deck, Tuner, Tape and Auxiliary. Also check on the output to the speakers. Most amplifiers use DIN sockets or phono sockets. The wiring up of suitable plugs will be covered later in the article. The speaker output may use any one of a number of different connections, these are, two-pin DIN plugs, screw-terminals, non-reversible plugs and wander plugs. Some amplifier manufacturers use their own design of speakers plugs. If you have an amplifier like that, try to avoid misplacing the plugs supplied with the unit, as it is often quite difficult to obtain replacements.

Now fit a suitable mains plug to the unit, remembering that amplifiers now have the new colour-coded mains wire fitted. The new colours are as follows: Brown is live (old colour—red), Blue is neutral (old colour—black) and green-yellow is earth (old colour—green). Most amplifiers have a 'Mains on' indicator. This is useful because when you start connecting up you can see at a glance if the unit is switched on. Make sure that you will be placing your amplifier away from a source of heat, such as a radiator or fire. This is because in modern equipment the output transistors have to run as cool as possible in order to develop full power.

Next, unpack the record player. Again refer to manufacturer's instructions, study the controls and be sure you know how the deck works. If no wires are fitted, look underneath the unit to check on the type of connections used. Some decks have phono sockets fitted (Fig. 1) and others have a tag-strip with five tags (Fig. 2). Referring to the numbers on the tags in Fig. 2, tags 1 & 2 make connections to one channel and tags 4 & 5 make connections to the other. Tags 2 & 4 are the earths of each channel, and are both connected to tag 3, which is the earth for the deck itself. Mains wire may have to be connected to the deck, for the motor. three core wire is used and connected according to manufacturer's instructions. If the tagstrip is used for audio connections, as described above, the earth wire may be connected to tag 3, which is screwed to the metal of the deck. If phono sockets are fitted to the deck, then phono plugs must be fitted to a length of suitable stereo cable.

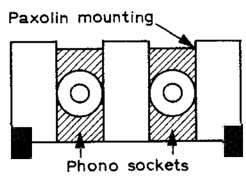



*Fig. 1*

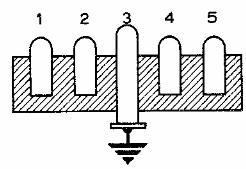



*Fig. 2*

*Phono sockets or tag strips will be found on the underside of record decks.*

The best type of phono plug is that with a metal screw-on body and tags inside for soldered connections. This type of plug is very strong, and helps to screen the wire carrying the signal (Fig. 3). The wire used is twin-screened audio wire, which consists of two shielded cables laid side by side. This wire is available from most shops at approx. 12p yard.

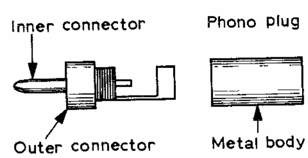



*Fig. 3*

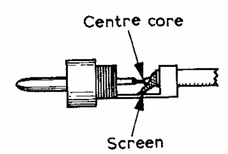
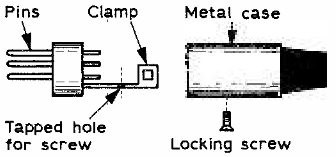



*Fig. 4*

*Showing method of fitting leads to phono plug.*

The wire is stripped so that the screen and the centre core can be easily soldered into the phono plug. The screen goes to the outer terminal on the plug, and the centre core goes to the middle terminal (Fig. 4). The cable is held in place by a clamp which forms part of the outer terminal. This clamp is tightened on to the cable with a pair of pliers. If the deck has the tagstrip connector, then the screens will go to tags 2 & 4, and the centre cores will go to tags 1 & 5. Take the mains and the audio lead out through a hole in the plinth, mount the deck and secure it, and your record player is complete.

If the amplifier uses phono sockets, plugs will be fitted to the cable as before. If, however, it has DIN socket inputs, the correct plugs must be fitted, referring to the amplifier maker's instructions to see which pins in the DIN plug will be used. The best type of DIN plug to get is the metal type, again because of the strength and screening properties and because of their reliability. These plugs only have two parts, whereas the common type consist of four parts, the plastic block holding the pins and terminals, the two metal parts forming the body, and a flimsy plastic covering over the whole lot. The recommended type is shown in Fig. 5.



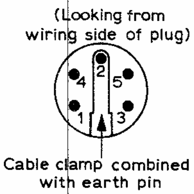




*Fig. 5* *Fig. 6*

*Exploded view of fully screened DIN plug.*

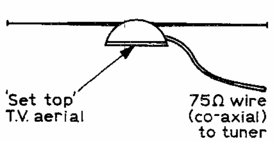
Fig. 6 shows the wiring side of the plug, together with the numbers of the pins and their layout. The screening of the wires always goes to pin 2. If the two screens are connected together at the other end of the cable, it will not be necessary to use them both when wiring up the plug.

Once you have wired the deck to your satisfaction, the cartridge can be fitted. Most decks have a removable head-shell. This makes it easier to fit the cartridge and connect up. Connections are made by pushing small tags on to pins on the cartridge. The cartridge and/or deck manufacturers usually include literature with their equipment which indicates which tags and pins go together. NOTE—some amplifiers have a mains outlet provided on the back—it may be convenient to run the record player from this, rather than have another wire running to the mains socket on the wall.

If you have bought a tuner to use in the system, this will be wired up in very much the same way, using either DIN plugs or phono plugs.

There are tuners with 75 ohm or 300 ohm aerial inputs, and some with both. A tuner with a 75 ohm input will run quite satisfactorily off an ordinary television aerial (v.h.f. type). In areas of good signal strength, an indoor television aerial of the rod-type may be used. When used for f.m. reception, the two rods are extended horizontally (Fig. 7).

Very good results have been obtained by using a set-top aerial in this manner.



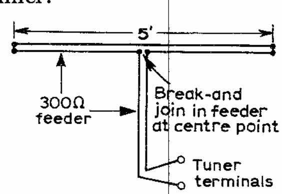




*Fig. 7* *Fig. 8*

*Two types of aerials that may be used for f.m. reception*

If your tuner has a 300 ohm input, 300 ohm balanced twin feeder is used, as in Fig. 8. If this wire is not easily obtainable, an aerial transformer (or balun) is used, this is a device that can match 300 ohm cable to 75 ohm equipment and 75 ohm cable to 300 ohm equipment. This device costs approximately 85p and is available from most aerial dealers. If 300 ohm cable can be found, it is easier to set up than a T.V. aerial and easier to hide out of the way.

You may have chosen a tape deck for use with your system, and the wiring for this is quite straightforward. Most amplifiers have Tape inputs and outputs, and these are wired to the corresponding sockets on the Tape unit. Phono plugs are often used for the connections between units. Some amplifiers and Tape deck also have a 5-pin DIN socket marked "Rec/Play". If these sockets are linked with the correct lead (often supplied with the tape deck) the recording and playback can all be routed through one lead, which makes wiring tidier and easier. If the lead is not supplied with the deck, most Hi-Fi retailers carry stocks of made-up leads which are available quite cheaply.

## Phasing the speakers

Lastly, the speakers. There are many different connectors in use on currently available speakers. These connectors have already been noted, all that remains is to show how they are wired up. Wiring of speaker plugs is not difficult, because there are only two wires to each speaker and two pins in each plug or two screw terminals. One wire is soldered to each pin in the plug, taking care not to short across the pins with a blob of solder. When wiring up, attention must be given to the phasing of the speakers. If one speaker is connected the wrong way round, the speakers will be working out of phase, or against each other. The easiest way to check for correct phasing is to put on a record, and boost the bass, using the amplifier controls. While listening to the speakers, reverse one connection. If the bass effect decreases, re-connect the right way round. The connections that give increased bass output are the correct ones.

For maximum stereo effect, the speakers should be between 6 and 12ft apart, but purchase plenty of speaker cable to allow for long cable runs.

If you decide to run headphones from your amplifier, make sure that the impedances match. If there is no headphone socket on the amplifier, a junction box is available which fits between the amplifier and the speakers and enables you to plug in headphones.

If all the signal wires have been screened, and all units earthed, you should have no hum problem. Hum is sometimes caused when a mains wire runs adjacent to audio signal wiring. This is annoying and the only cure is to re-route the wiring.

Note: If one of the units appears to be faulty, check your wiring! Many irate people have phoned dealers with complaints about faulty equipment when in fact they have incorrectly connected or wired their leads! And please don't follow the example of the man who thought the mains outlet on his amplifier was the speaker output, and blew up an expensive speaker.

I trust that these notes will make the task of "wiring-up" easier for the hi-fi enthusiast. ■

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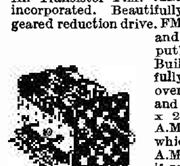

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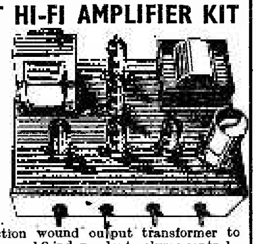

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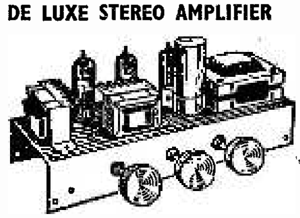

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# SERVICING

## AN INTRODUCTION TO FAULT-FINDING

### PART 3

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WHEN a receiver gets into trouble the first thing we have to do is to discover the approximate area in which the fault lies. Detailed knowledge of the circuit and the various stages involved (Part 2) hastens this discovery, so wherever possible a manual or service chart appropriate to the receiver under examination should be obtained.

The electronics of all modern receivers are built upon printed circuit boards so that without a diagram relating the components in the theoretical circuit to those on the printed circuit board a great deal of extra effort is required to identify the circuit sections of the various stages. It is not particularly easy to trace the printed wiring from component to component, since the wiring is usually printed on one side of the board, while the components are mounted on the other side.

However, when such conductor tracing is essential, the effort required can be reduced by mounting the board vertically, with the component side forward, and illuminating the printed wiring side behind with a fairly powerful bench light. The conductors between the components can then be seen by viewing the components side of the board. Some printed circuit boards, in fact, are made of semi-transparent laminate, which facilitates the operation.

## LOOK, TOUCH, SMELL AND LISTEN

As much as possible should be learnt of the fault condition before the receiver is dismantled; indeed, in many cases it is possible virtually to locate the faulty section purely by the human senses without the application of an instrument. For example, if a valve set is dead **look** for the glowing heaters. If there is no glow (all valves out) an early check should be made of the mains supply, including the mains socket, plug (and fuse therein if 13A type), the mains cable to set, on/off switch, set fuse (if fitted), valve heaters (if set uses a mains dropper), series resistors and thermistor.

One valve out in a set equipped with a mains transformer would almost certainly indicate failure of that one particular heater. One valve can also fail in a receiver with series-connected heaters and a mains dropper. If this is merely an open-circuit heater, then all the other valves in the chain will fail to light; but if it is a heater/cathode short only a part of the heater chain will be bypassed to chassis via the cathode circuit of the faulty valve, thus causing any resistor in circuit to severely overheat and, possibly, an associated electrolytic capacitor to explode!

If all the heaters of a dead set are alight, then adopt the sense of **touch** to check the temperature of the valves. All valves run relatively cool when the fault is h.t. failure; but if they are all cool except the h.t. rectifier, which is running very hot with its anodes glowing red (!), a short-circuit (possibly in the reservoir electrolytic) directly after the rectifier d.c. output would be a very likely cause.

The sense of **smell** is a good detector of a short-circuit or overload. A set emanating a smell of rotten fish is often found to have a faulty selenium h.t. rectifier. Different components exhibit their own characteristic smell when burning out or badly overloaded. A small resistor cooking merrily would almost certainly imply a shorting bypass capacitor. Resistors of value between about 470 and 4·7kΩ are most prone to this capacitor-short-burn-up. Higher value components might fail to pass sufficient fault condition current to burn significantly, though the temperature would rise; but remember large resistors and wire-wound components are often designed to run warm or even hot.

The sense of **hearing** is also of diagnostic value. An apparently dead mains set will produce mild residual mains hum from the speaker when the ear is placed close to it when the h.t. supply and audio output stage are active. If the hum is loud with distorted reproduction in the background a smoothing electrolytic will be in need of replacement. Mild, though abnormally high mains hum could indicate a reduced value smoothing electrolytic (or reservoir) or a heater/cathode leak in an audio valve.

Whistles on all stations tuned in would indicate instability (e.g., oscillation) probably in the i.f. channel indicating that realignment may be necessary, while a motor-boat type of interference would indicate similar trouble in the audio channel, possibly due to a failed bypass capacitor somewhere.

Continuous crackling noises would indicate either intermittent circuit discontinuity or continuously varying resistance through a circuit, component or joint. For example, leakage resistance through a component which should have a high value of insulation, like a capacitor or transformer with isolated windings, is a common cause of the symptom. In severe cases sparking or arcing would result eventually in complete failure (either open-circuit or short-circuit) of the component.

Valves sets which have been in operation for some years are prone to the development of an oxide film on the valve pins and valve-holder sockets. Under certain conditions the oxide junction can act as a rectifier and cause not only crackling, but also intermittent hum and distortion. Check by rocking the valves in their holders while the set is operating. If the symptom is precipitated or cleared by such action, the pins should be cleaned with fine emery cloth and then washed in a switch cleaning fluid, such as Electrolube. Valve-holder sockets might require similar attention. Use a shaved-down match-stick for this operation, taking care to avoid enlargement of the sockets.

Crackling and intermittent hum can also be caused

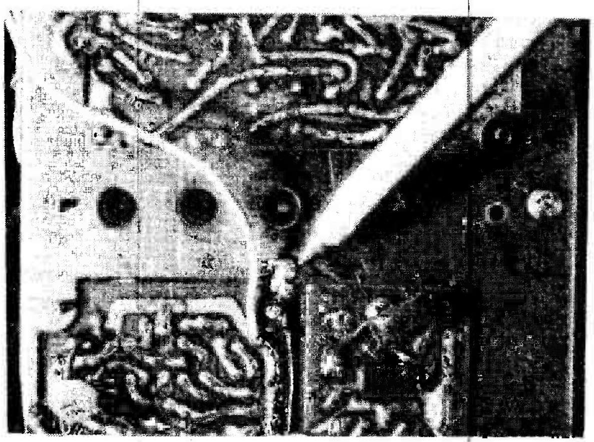


*Fig. 1: A poor soldered connection like this is often responsible for crackling sounds and intermittent hum.*

by ineffective soldering between the 'earthy' areas of the printed circuit board and the metal chassis or framework of the receiver (Fig. 1). When resoldering make sure that the iron is sufficiently powerful to outweigh the thermal inertia of any large mass of metal and that both the conductor to be soldered and the metal chassis at the point of soldering are sufficiently hot to cause solder diffusion in the joint. Unless the solder flows freely the dry joint will remain.

The same applies to resoldering the lead-out wire of a component to a printed circuit board conductor. This time, however, the soldering bit should be sufficiently small to concentrate heat at the actual joint. Apply a well tinned bit to bring up the temperature and then introduce the solder for free flow (Fig. 2). Avoid prolonged application of insufficient heat. It is better to use a high-temperature bit for the shortest possible time.

Some transistor receivers, especially the more expensive models, are adopting plug-in transistors (Fig. 3). These sometimes work loose in their holders or develop oxide film like valve pins, resulting in crackling symptoms or complete failure.

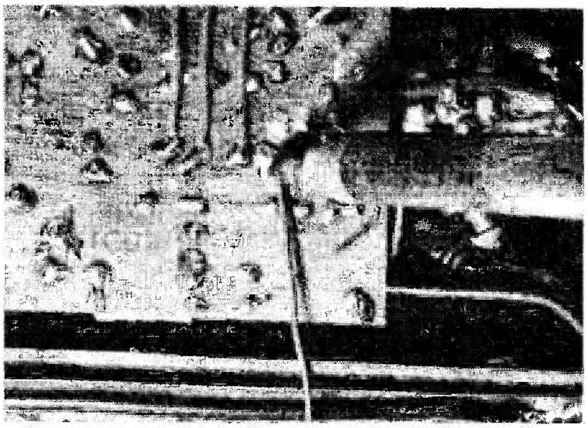


*Fig. 2: Illustration of the correct way to solder a connection.*

Useful diagnostic information can often be obtained merely by operating the controls of a faulty receiver. For example, by operating the wavechange switch it might be found that reception is possible on one waveband, the others being dead. In this event we can be sure that the trouble lies in the front-end, and that the i.f. channel, detector, audio section, power supply and speaker are all working normally.

Similarly, an a.m./f.m. receiver active only on the a.m. bands would most likely be in trouble at the v.h.f. f.m. front-end. F.M. and no a.m., on the other hand, could be indicative of trouble in the a.m. frequency changer section. Subsequent tests, of course, would be necessary to establish the initial diagnosis; but remember we are still trying to find the most likely area of trouble with the least amount of dismantling, etc.

Trouble responsible for complete failure could lie anywhere in the receiver, but we can focus on the affected area in several ways. Most transistor sets, for example, yield a 'thump' from the speaker when switched on. This is caused by the power supply charging the coupling capacitor in series with the speaker. Thus, if this normal effect occurs when the faulty set is switched on, we can be fairly sure that the power supply, speaker and its coupling capacitor and output transistors are, from first principles, at least working. The trouble would be most likely to exist, therefore, in the stages prior to the audio section.

Most volume controls produce a mild hiss or

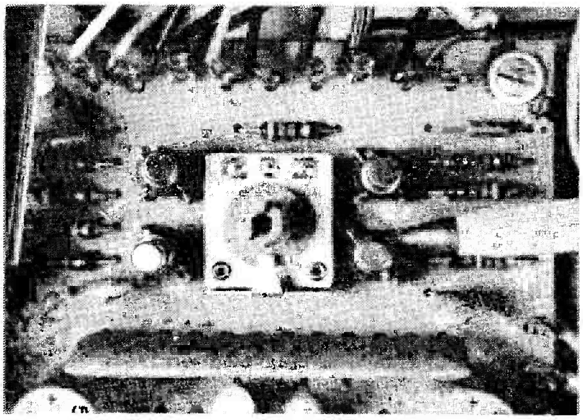


*Fig. 3: Here we see four plug-in type transistors, the lead-out wires forming small pins. Check wires and sockets for intermittent connections.*

crackle when turned. If this happens on the defunct set then, again, we can be fairly sure that the audio section, power supply and speaker are all right.

If the set is dead on all bands and it is found that clicks emanate from the speaker when the wave-change switch is operated, all sections beyond the front-end could be assumed to be active, the suspect sections thus being the front-end. This effect commonly results when the local oscillator fails.

If reception can be had when the wavechange switch is critically adjusted either side of a 'click' position, then the switch (or one section of it) itself would be in trouble. Dirty contacts is a common cause, and when this is so, normal reception can be restored by putting a few drops of switch cleaning fluid into the switch sections. The same fluid will sometimes correct a noisy volume control. Disconnect the set from the mains or batteries and allow a few drops of fluid to get to the track down the shaft, after which the control should be operated over its range vigorously for a little while. If the noise persists the control will have to be replaced.

Intermittent reception or crackling when the tuning knob is operated generally signifies shorting plates of the capacitor gang sections. However, a poor earth or varying resistance coupling between the rotor plates and the contact wiper can also cause these symptoms. Use switching cleaning fluid on the rotor/wiper contacts.

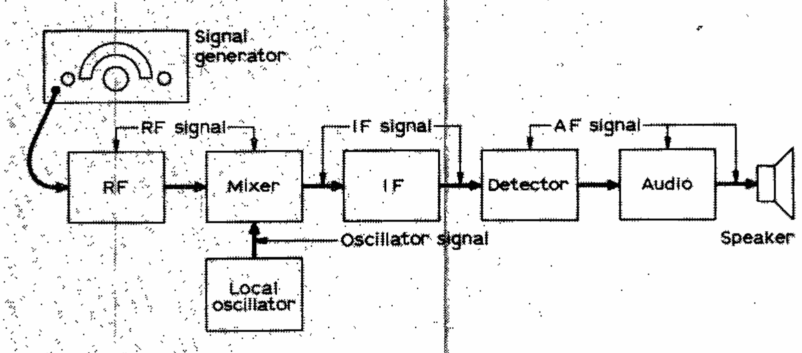



*Fig. 4 (left): Block diagram showing the type of signal to be expected at each stage of a receiver.*

## SIGNAL TRACING

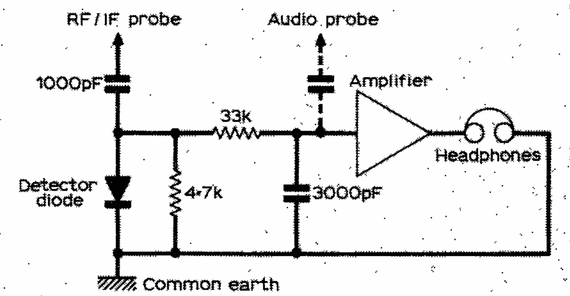
When as much information has been obtained on the fault condition by the methods detailed, it may still be necessary to locate the defective section by more scientific means. Signal tracing is commonly practised by service technicians. This calls for observation of the presence, absence and character of a test signal applied to key points in the receiver. We thus need a test signal and an instrument suitable for detecting it as it passes through the various stages of the receiver. Thus its presence at one point and absence at another indicates conclusively the section of signal discontinuity.

While the test signal can be a signal picked up by the aerial from a transmitter, it is often desirable to employ a signal of known characteristics from a generator of some sort. An r.f. generator with modulation suitable for the receiver under test is commonly employed. This has the advantage that a greater signal level than that obtainable from the transmitter can be had, thereby making it possible to use a detector of lower sensitivity. Some generators for signal tracing produce waveform rich in harmonics so that it passes through the r.f., i.f., detector and audio stages.

Fig. 4 shows the block diagram of a typical receiver to the input of which is applied a suitably modulated signal from a generator. When the set is working correctly, signals as indicated will appear at the various stages. The plan, then, is to trace these signals with some sort of detecting device. Since it is not easily possible to measure r.f. and i.f. signals directly on a servicing type of indicating meter, it is best to modulate the test signal, as already intimated, and then to use a simple diode detector followed by an audio amplifier to extract the modulation so that it can be heard in a headphone set, as shown in Fig. 5. Instruments like this are available commercially.

Thus with a setup as in Fig. 5 we can detect the modulated test signal from the input of the receiver all the way up to the input of the detector stage. It is, of course, necessary to tune the receiver to match the generator signal frequency. Clearly, then, discontinuity of signal through the system will indicate the point of trouble. For example, the presence of signal up to the input of the mixer, but no i.f. signal output, would indicate mixer or local oscillator trouble. If the i.f. signal was present at, say, the base of the first i.f. transistor but not at the collector tuned circuit, then something would be amiss in the i.f. transistor stage. Similarly, a powerful i.f. signal at the detector input, but no a.f. output would indicate detector trouble.

*Fig. 5 (below): Circuit of a detector probe for signal tracing. The audio probe feeding the amplifier permits rapid tracing of audio signals.*




To check or trace audio signals, though, we need to bypass the probe detector and couple the signal direct to the amplifier input (via the dotted line audio probe in Fig. 5). In this way we can trace the r.f., i.f. and audio signals from receiver aerial input to the speaker terminals.

One signal that cannot be detected by the tracing probe described is that produced by the local oscillator. However, some commercially produced tracing instruments include a meter or "magic-eye" indicator which responds when fed with pure r.f. signal of a level likely to be encountered in a local oscillator stage.

There are other ways of checking whether the local oscillator is delivering signal or whether lack of results is due to no oscillator signal. If we suspect the oscillator, we can couple to the mixer an unmodulated signal from the generator, and then tune the generator to give the i.f. sum/difference relative to the station to which the receiver is tuned. This provides a speedy and conclusive test.

If we have a valve-voltmeter with an r.f. probe we might well find that this is sensitive enough to record oscillator signal direct; but check on a set which is working first to make sure the instrument is sufficiently sensitive!

Still another oscillator test is to operate the faulty receiver close to a portable receiver with a ferrite rod aerial tuned to a station whose frequency is within range of the local oscillator signal radiated from the set under test. If the faulty set has an oscillator working above the signal frequency, then by tuning the portable, say, to a station at 970kHz, the oscillator of the faulty set will produce a whistle on the station when its tuning is adjusted to 500kHz —assuming, of course, that the oscillator of the faulty set is working. The 970kHz oscillator signal results from the 500kHz signal frequency **plus** the 470kHz i.f. (see Part 1).

Another good scheme for stage-to-stage testing is illustrated in Fig. 6. Here we use an audio generator to clear the stages from the rear, starting at the speaker. With the set switched off, an audio signal of suitable power can be injected into the speaker (after disconnecting one wire), and if this is heard (albeit weakly, if the matching is poor), then the speaker is all right. We can then inject the signal into the input of the audio section (best at the volume control), and if this is reproduced we can be sure that the audio section is satisfactory. It is desirable to inject the signal via an isolating capacitor (about 0·1μF for audio and 100 pF for r.f.) and to keep the generator signal output well down, especially when feeding to the input of the audio section.

The detector can be similarly checked by feeding a high level of modulated i.f. signal to its input. We can then progress backwards towards the r.f. stage (aerial) input, using the speaker as the indicator. Obviously, when checking the i.f. stages and the r.f. and frequency changer sections the signal generator will have to be tuned accordingly, and at r.f. (and mixer input) ensuring that the set is tuned to a suitable frequency. A stage or section in trouble will be revealed by the signal getting through when applied to the output, but not when applied to the input.

## CIRCUIT TESTING

When the defective stage has been brought to light, the first thing to do is to measure the voltage across the cathode (valve) or emitter (transistor) resistor with a reasonably sensitive voltmeter (see the Supplement, Guide to Test Instruments, April PW). The idea is shown in Fig. 7. The cathode of a valve is normally positive with respect to chassis in receivers, while the emitter of a transistor could be positive or negative. With an n-p-n device, as illustrated, the collector is positive, the same as a valve anode, which means that the emitter is also positive with respect to chassis. A p-n-p device, however, has a negative collector and hence a negative emitter **relative to chassis.**

Any meter indication will be the voltage drop across the cathode or emitter resistor, implying that current is flowing in the circuit and hence through the active device. Many circuits or manuals specify the voltage at this electrode to be expected when the receiver is working normally, so significant

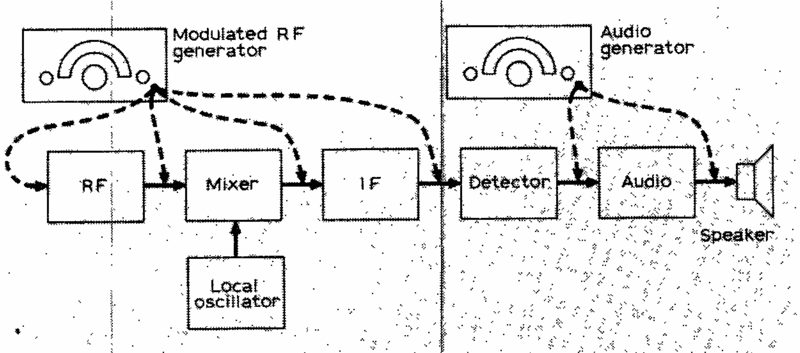



*Fig. 6 (left): By first checking the speaker and audio stage for correct operation these sections of a receiver can then be used to indicate proper operation of earlier stages.*

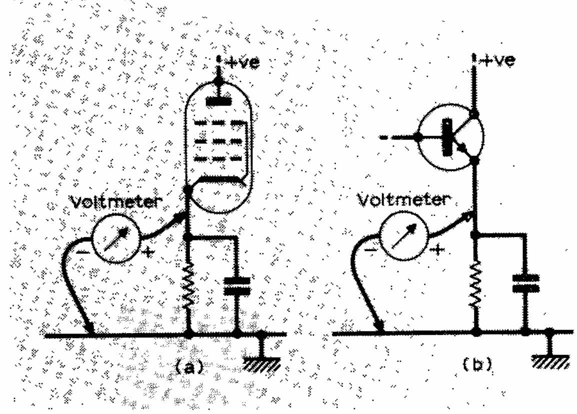



*Fig. 7 (below): A tell-tale test for correct operation is the use of a voltmeter at the cathode of a valve or the emitter of a transistor.*

deviation would reflect a fault condition.

Lack of voltage (and remember that small signal transistor stages might give less than 1V across this resistor, hence the need for a sensitive instrument) means that no d.c. current is flowing through the device. The device could thus be open-circuit or biased to cut-off by virtue of the fault condition.

A valve or transistor stage acts in two modes. One the d.c. mode and two the a.c. or signal mode. The latter mode cannot occur unless the d.c. mode is correct, but a correct d.c. mode does not necessarily imply a correct a.c. mode. In other words, we may measure reasonably correct electrode voltages with a d.c. meter, and yet the stage could still be inactive from the signal point of view.

A typical example in this respect is misalignment of, say, the i.f. channel. The d.c. electrode potentials of the valves or transistors in the channel would be normal, but due to the misalignment the signal would fail to pass through the channel. Other examples are a shorting coil or an open-circuit signal coupling capacitor.

Actually, the local oscillator is the generator of a signal rather than a signal amplifier, but the signal is essential for the mixer to yield the i.f. signal, as we have seen.

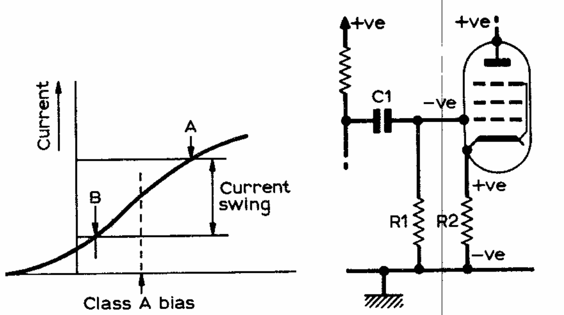



*Fig. 8: (left) Transfer characteristic showing Class A biasing. Fig. 9 (right) Method of biasing a valve.*

All small signal stages are biased to class A. This means that the anode or collector current occurs towards the middle of the linear portion of the characteristic, as shown in Fig. 8. This is achieved by biasing (grid bias for a valve and base bias for a transistor). Superimposed upon the bias is the signal for amplification, positive peaks causing instantaneous current decrease, with the current swing never exceeding the linear portion of the characteristic.

Thus the first thing we have to do is to ensure that the biasing is correct for class A amplification.

Returning to Fig. 7, an excessive voltage reading could mean that too much current is flowing through the device. This would push the operating point towards 'A' on the characteristic of Fig. 8. On the other hand, too little current (abnormally low voltage reading) would push the operating point towards 'B'. Biasing towards 'A' would delete the positive swings of signal and towards 'B' the negative swings. The former is 'bottoming' and the latter 'cut-off' (the device through current going to zero at the lower end of the characteristic). Either condition could render the stage inactive from the signal point of view.

It can be understood, therefore, why the simple test shown in Fig. 7 is a potent monitor of the d.c. conditions. The total current of the device must flow through the cathode or emitter resistor, so the voltage measured across the resistor is a measure of the current. Simple Ohm's Law states that the voltage is equal to the current times the resistance. If the current is expressed in mA, the resistance can be in kilo-ohms. By dividing the voltage measured by the resistance we can easily calculate the current. For example, if we measure 3V and the resistor is 1kΩ the current is 3mA. This saves breaking the circuit to introduce a milliammeter; but don't forget the shunting effect of the voltmeter (see April PW Supplement on Instruments). Current flowing in any resistive element of the circuit can be so calculated provided the resistance value is known.

## STAGE BIASING

Sometimes the biasing is affected by a 'leaky' coupling capacitor. Look at Fig. 9. This shows the control grid returned to chassis via R1, the grid resistor. The cathode resistor R2 makes the cathode go positive with respect to chassis. Now, since the grid is also at chassis potential (via R1), this electrode assumes a negative potential with respect to *cathode*. This is how the stage is biased, the biasing being the volts dropped across R2.

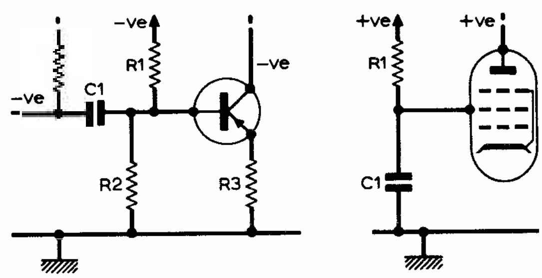



*Fig. 10: (left) Method of biasing a transistor. Fig. 11 (right) Conventional way of supplying h.t. to screen grid of a valve.*

If the coupling capacitor C1 becomes 'leaky', the positive potential from its left-hand side will tend to reduce the negative grid bias, thereby causing the valve to pass excessive current, reflected by an increased volts drop across R2. A 'leaky' audio coupling capacitor can introduce excessive distortion. Check by monitoring the voltage across R2 with and without C1 connected to the grid. If there is a rise in reading when C1 is connected, then the capacitor is definitely in need of replacement.

A transistor stage is commonly biased as shown in Fig. 10. This is a p-n-p transistor, so the collector needs a negative potential, as also does its base for biasing. Resistors R1 and R2 form a potential-divider across the supply, the bias for the base being taken from the junction. The values of the resistors are chosen to provide the correct bias for class A operation.

Clearly, the biasing would be disturbed should the insulation resistance of the coupling capacitor C1 decrease and as this component is commonly an electrolytic in audio stages, the polarity is also important. That is, it must be connected round the right way for the resistance to remain high, which is a point worth noting when the component is replaced.

The emitter resistor R3 is also in the base bias circuit (because the bias acts on the emitter/base circuit), but the chief function of this resistor is to avoid an increase of collector/emitter current with increase in device temperature, which could result in transistor failure or bottoming effects. As the emitter current rises with increasing temperature, the voltage across R3 rises in sympathy, an effect which reduces the base bias, thereby reducing the current. R3 is thus a 'stabilising' component.

The cathode or emitter resistor is generally bypassed by a capacitor, which merely provides a low impedance path for the signal without affecting the biasing. The value of the capacitor is thus related to the signal frequency and the impedance of the circuit generally. Audio amplifiers adopt a high value electrolytic capacitor, but higher frequency circuits can use a much smaller capacitance.

If the capacitor fails signal voltage develops across the resistor and appears at the stage input in antiphase with the source signal. We thus get negative feedback and hence a reduction in stage gain. Moreover, as the feedback is series-derived the stage output impedance rises and in some cases this can result in instability and similar symptoms.

One thing in favour of transistors is that there are only three 'electrodes' to deal with. Valves are commonly multi-electrode devices, each electrode requiring its own feed circuit. The screen grid of a pentode or tetrode requires a positive potential, as does the anode obtained in many cases from a series resistor, such as R1 in Fig. 11. Capacitor C1 is another signal bypass capacitor, for without this a signal across R1 could develop causing feedback effects, resulting in a reduction in gain and/or instability.

Look out for open-circuit screen bypass capacitors in the i.f. channel if the gain is low or when there are instability tendencies, especially during alignment when the i.f. transformers are 'peaked' (Mr. Hellyer will be dealing with alignment next month).

It is obviously impossible (within the compass of this article) to delve into all possible fault conditions and symptoms, but it is hoped that the information so far presented will set the potential receiver repairer on to the right track. I have purposely refrained from spending time on the audio section, as I shall be dealing with this later.

## ABOUT COMPONENTS

To conclude this part, however, a few words about component factors, limitations and substitution would not be amiss.

Having analysed a faulty stage the time will come when the defect has been narrowed down to one or, perhaps, two components. In some cases these can be tested **in situ** with a continuity tester or ohmmeter. However, one must adopt caution when testing like this in transistor receivers, for a shunt circuit across a resistor, for instance, may be reflected from one of the junctions of a transistor. Thus an ohmmeter connected across the resistor for value measurement would reveal the junction resistance in parallel with the resistance. Since the junction is effectively a 'diode', the resistance with the current flowing in one direction will be high and low with the current flowing the opposite way. To check on whether reading error is resulting from this the ohmmeter probes should be reversed, causing the current to flow the opposite way on the second test. If the reading differs, the more accurate would be that showing the higher resistance, but even then it might be necessary to lift one leadout wire from the circuit to make sure!

The same applies when testing capacitors for insulation resistance. In many cases, though, quite a bit of information can be gleaned about the condition of components by making **voltage** tests and then comparing these with those indicated in the service manual or on the circuit.

A speedy way of getting to know whether a transistor is behaving as it should is by monitoring the voltage across the emitter resistor and then reducing the base bias very slightly. This can be done by connecting an external resistor in parallel with R2 in Fig. 10. If R2 is, say, 47kΩ, then a resistor of similar value can be temporarily connected in parallel. This will reduce the base bias and if the transistor is working properly the voltage across the emitter resistor will fall slightly.

Eventually the time will come when to prove a fault condition conclusively a component substitution test will have to be made. The component used for this must match reasonably closely the original suspect, though it may not be necessary to make a permanent soldering job at this stage. However, at least one lead out wire of the suspect component must be lifted from the circuit (two wires, with a transistor). Try to make a substitution test only when it is pretty certain that the particular component is the cause of the trouble. Anybody can repair a radio by replacing the components at random. The craft in servicing is knowing **which** component to replace first!

Sometimes it is a job to guess the value of a faulty component, though a calculated guess might be necessary when an overload has destroyed all markings of the value (but the **type** of component should be known, see Part 1) and when a service manual or circuit of the receiver is not available. The best plan, then, is to check the value of the equivalent resistor in the circuits of similar models. If the value chosen is significantly in error, especially when the component is a resistor, other related components, notably transistors, could be destroyed.

The wattage ratings of resistors and voltage ratings of capacitors are also very important. If in doubt it is best to err towards the high side, assuming there is sufficient space for a possibly larger component. The small electrolytics used in transistor equipment come in a wide variety of voltages with short intervals between them. One would be asking for trouble, for instance, to replace a 9V electrolytic with a similar value 6V component.

Larger electrolytics used in mains-derived power supplies are endowed with a ripple current rating in addition to a d.c. voltage rating. The ripple rating is very important when the component serves as the reservoir at the h.t. rectifier output. High ripple rating is reflected in the physical size of the component, which is why we find singnificant size differences between electrolytics of the same capacitance and d.c. voltage rating. The larger ones generally have a greater ripple current rating and if we use a smaller one for replacement we can expect early failure accompanied, possibly, by an explosion due to overheating.

**END OF PART THREE**

# practically wireless commentary by HENRY

## Serviceman's Lib.

WHO'D be a radio service engineer? Once upon a time, the job was worth the candle, not all that well paid, but at least accruing some prestige. Entering the house where the ailing *Melody Maker* sat silent (or worse, noisy) on the gargantuan sideboard, one was greeted with the deference accorded to the vicar, the doctor, the village soothsayer.

One's ministrations were watched with breath-stopped awe. Every twitch of the screwdriver was vested with the significance of a witchdoctor's flourish. Shake your head and the house held its breath; smile, and the family smiled with you. At the end of a service job, one accepted the worshipping glances and palm-strewn path of one's exit as a matter of course. One was, after all, a wireless wizard.

Today, radio, television, and the mysteries of hi-fi, are part of daily life, like the 'fridge, the food mixer, the washing machine and the telephone.

The mysteries of electron action—despite a brief honeymoon of prestigitous deference when transistors first appeared—are as well known to the Lower Fifth as the functions of sex and procreation. One is likely to be challenged, when delving into the innards of a hi-fi amplifier, with a reasoned discourse on the merits of Class A operation, or, at worst, the superiority of virtual earth systems for low-level inputs.

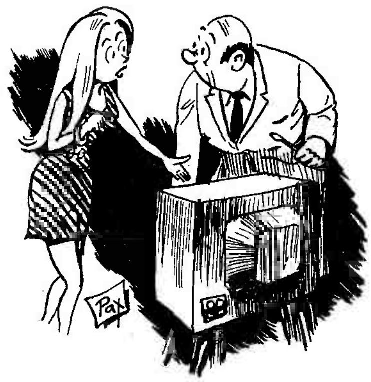

*. . . watched with breath-stopped awe.*

Integrated circuits are old hat to the youngsters of the modern technological age. Transfilters are yesterday's phenomena. It is advisable to time one's visit for the housewife's home stint—at least one has half a chance that she is not a triple honours graduate in higher mathematics.

Only half a chance, for recent service calls have convinced Henry that Women's Lib has bred a new generation of housewives who can talk as glibly of negative feedback as their husbands once did of swivel-headed back-pressure gaskets. Erudite articles in the women's magazines are today angled at the 'intelligent, active, housewife,' who is expected not to come fluttering to the man next door when the fuses blow, but to know all about thermostats and slow-blow cutouts. It takes some of the spice out of life, I can tell you!

Ian Nicholson, expounding about ICs, made his point for Mullard that the peripheral circuits were not likely to diminish as designers took advantage of stable devices (although I can tell him that from a hi-fi point of view, they have not made an integrated circuit yet that is stable and noisefree—what is the use of masses of gain when you have to apply immense negative feedback to keep the thing stable at all frequencies—even with the better compensated second-generation devices?).

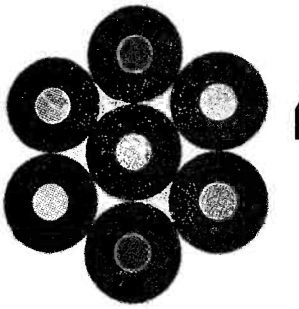
Let me say, before the flames of wrath surge round my head, that I do not dispute the IC argument—though Voltaire, or somebody else with a funny hat, would defend to the death my right to do so—but merely wish to point out that the advent of the make-and- break device has not tolled the knell of the departing serviceman. He is going to be as busy making visits to the set designer's follies, and the fact that a neat row of ICs sits along the middle of a printed board will not make his life any easier. He simply has to steel himself to break them when circumstances force him to change—or as the perceptive Mr. Nicholson rightly says, learn some new diagnostic techniques.




*She is likely to tell the calling serviceman...*

Trouble is, reverting to Henry's theme, the busy housewife plies her evening care these times at extra-mural classes on electronic maintenance, or the closer study of the atom. She is likely to tell the calling serviceman not only where the stabilising current failure originated but also why the concept of the design was erroneous. He hasn't the time to go to evening classes himself and bone up the new techniques. He is too busy nipping next door to mend the fuses for hubby who has been left at home to babysit.

One of the sources of the service engineer's information on new devices was always the Mullard lecture. Our Editor has chaired enough of these to be able to vouch for their avid reception, wherever Mr. Nicholson went. After April, lads, that's it! There are, no doubt, valid commercial reasons for dropping these lectures, but the Mullard evenings were a night out for the serviceman; a legitimate excuse to mingle with fellows of like tastes (that's Henry's story). Their cessation makes yet another inroad into the service engineer's liberty.



# pw 'PARTYGRAM'

## INCLUDING RADIO 1 & 4

THE RECORD PLAYER described in this article was designed to provide good quality reproduction with a substantial power output, coupled with the facility of a 4 speed auto-changer turntable and a simple, but effective, built-in two station radio tuner. Even allowing £12 to £15 for the auto-changer and pick-up, the overall cost in building comes to very much less than one would have to pay for a commercially made equivalent with a considerably inferior performance.

The prototype shown on the cover is housed in a cabinet which the writer more or less built around a Garrard 3000 auto-changer. The decor of the cabinet, by the way, is due to Peter Metalli, Art Editor of P.W. There is no reason why a ready made cabinet should not be used providing it is large enough to accommodate the auto-changer unit, the amplifiers and power supply, the radio tuner if used, and most important a 3, 5 or 8Ω loudspeaker capable of handling at least 6 watts (r.m.s.) audio power. The choice of auto-changer must rest with the constructor but it is worthwhile using one fitted with a ceramic pick-up cartridge. The Garrard 3000 used in the original performs very well and this is supplied fitted with a Sonotone 9TAHC stereo ceramic turnover cartridge (the output from the cartridge being paralleled for mono use).

### PERFORMANCE

Most people like to know what they are getting for their money so before going on, a few words about the electrical performance may prove useful. The power amplifiers will deliver 8 watts r.m.s. power into an 8Ω load and with reference to this the hum and noise level is −55dB. The overall frequency response is flat from about 30Hz to 30kHz extending to 20Hz and 40kHz at the −3dB points. The input sensitivity is 80mV for maximum r.m.s. output power and the input impedance is 1MΩ both of which are suitable for ceramic cartridges. The tone controls provide approximately 12dB cut or lift at 50Hz and 10kHz respectively as per the frequency response curves shown in Fig. 1.

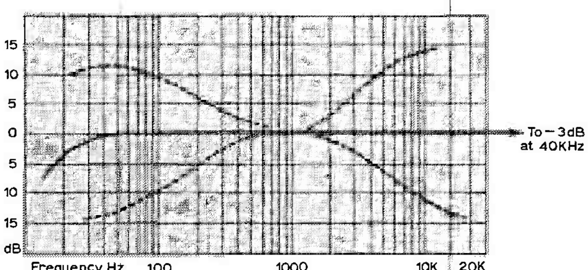



*Fig. 1: The response of the amplifier with tone controls at maximum and mimimum.*

The input sensitivity at the base of the first transistor is a few millivolts and more than adequate for the one transistor radio tuner which operates on medium waves and allows a choice of two stations such as Radio 1 and Radio 4, by pre-set tuning. Total harmonic distortion from the amplifier was found to be well below 1% at average listening levels and did not exceed 1% at the rated power output. The prototype record player was fitted with an 8Ω eliptical speaker (10 x 5in) which produced a quite satisfying bass response despite the smallness of the cabinet.

### THE CIRCUIT

The full circuit for the preamplifier, the power amplifier and power supply is shown in Fig. 2. The first stage has the requisite 1MΩ input impedance required for ceramic pick-ups so the recommended R.I.A.A. response for disc replay is produced automatically. The gain of Tr1 is limited by a small amount of negative feedback due to R5 and its output is coupled to an emitter follower (Tr2) which feeds the active bass and treble control network around VR1 (bass) and VR2 (treble) potentiometers. Further amplification by Tr3 builds the signals to sufficient level for the first stage (Tr4) of the power amplifier section which is a quite conventional d.c.

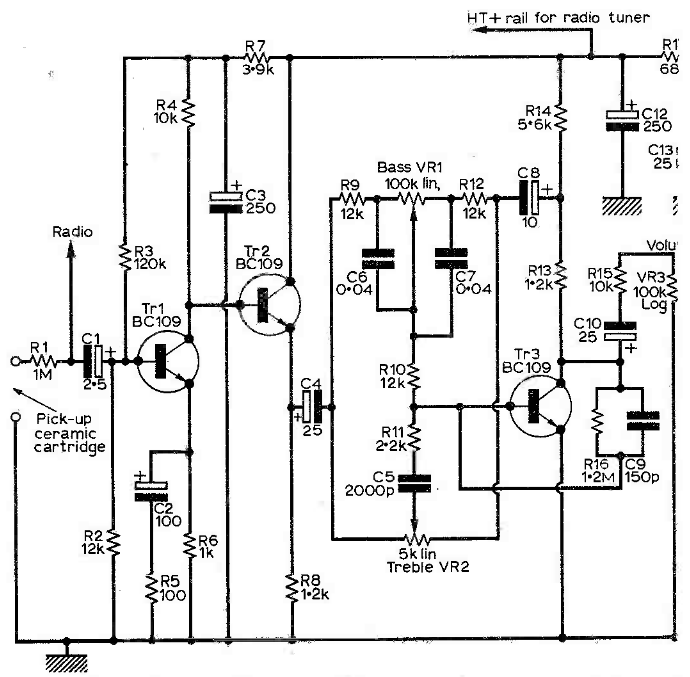
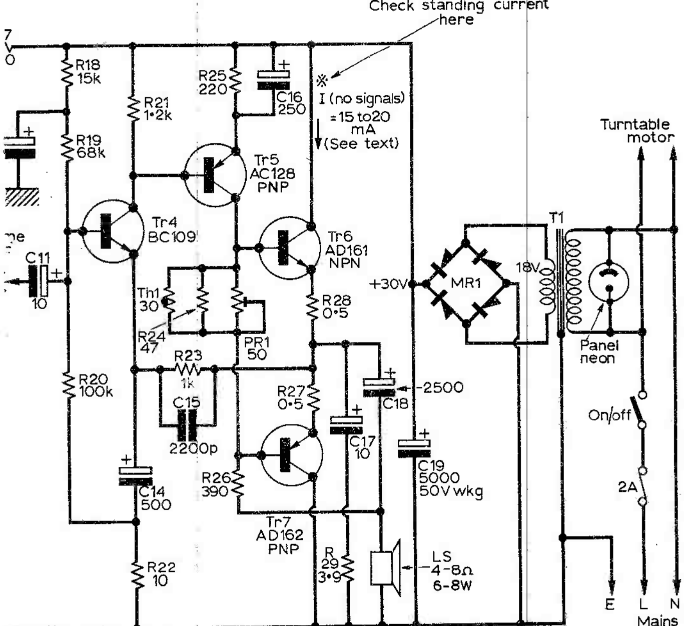



*Fig. 2: The complete circuit of the preamplifier, power amplifier and th*


F.C.JUDD

coupled arrangement using an AC128 (Tr5) driver and complementary NPN/PNP output pair (Tr6-Tr7). Protection against the effect of transients is provided by the Zobel network C17-R29 and the bias for the output pair is stabilized by the thermistor TH1. Overall negative feedback is introduced via R23 but there is additional feedback at the very high frequencies i.e., above about 30kHz, produced by C15. It has been found that audio amplifiers with responses extending well beyond 100kHz, as is quite common, are prone to direct pick-up of radio signals. Hence the reason for C15. The whole of the output stage consisting of Tr4, Tr5, Tr6 and Tr7 is basically a Mullard design, slightly modified to operate with 30V. The inclusion of a somewhat higher resistance thermistor in parallel with the fixed resistor R24 and the 50Ω pre-set PR1 was for two reasons (a) a very low resistance thermistor seemed difficult to obtain and (b) the setting of PR1 to midway position will adjust the standing current of the output transistors to approximately the right level. This might prove useful to those without a suitable testmeter. The reason for a 30V rail is that a Henry's Radio transformer type TS/18 with an LT119 bridge rectifier and 5000μFd reservoir capacitor (C19) provides almost exactly 30V when the amplifier is operating under the no signals condition. If other than the specified transformer is used it must be capable of sustaining a current drain of up to 400mA at approximately 25V which is the requirement of the output stage at maximum power output.




... power supply. The circuit for the simple radio tuner is shown separately.

## THE RADIO TUNER

The circuit is shown in Fig. 3 and consists simply of an r.f. stage and diode detector. The sensitivity of the tuner is such that Radio 1 and Radio 4 were receivable in the London area with sufficient signal from the ferrite aerial to run the amplifier to full power output. The switch shown as S1 selects either of the two 110pF trimmers (CP1-CP2) each being used to tune to the frequency of a required station. This switch is however, ganged to S2 and S3 as in Fig. 4a and all three may be a combined 3-pole, 3-way rotary switch or, as used in the prototype, a push-button unit with three buttons each operating a series of single pole changeover switches. If a push-button system is used, it must be one on which any selected button automatically cancels any other in use. The one used for the prototype was a Henry's Radio Type 42 which has more than sufficient pairs of single pole changeover switches. The connections used are shown in Fig. 5 in which buttons 1 and 2 select either of the radio tuning capacitors, whilst button 3 remains out and connects the tuner output to the amplifier. When button 3 is used the amplifier input is disconnected from the radio tuner and takes signals from the pickup via R1.

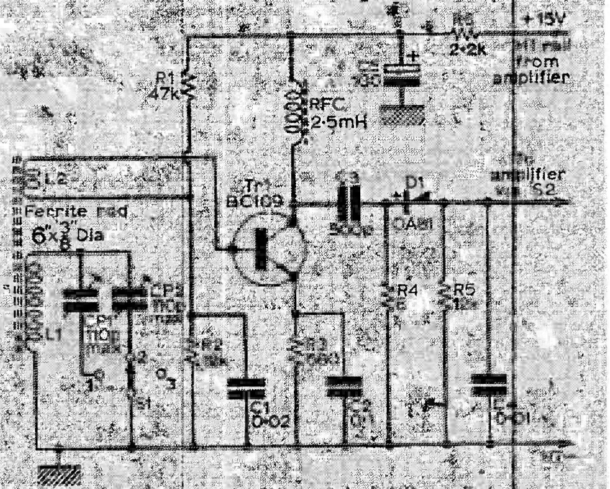



*Fig. 3: The circuit of the switched station radio tuner.*

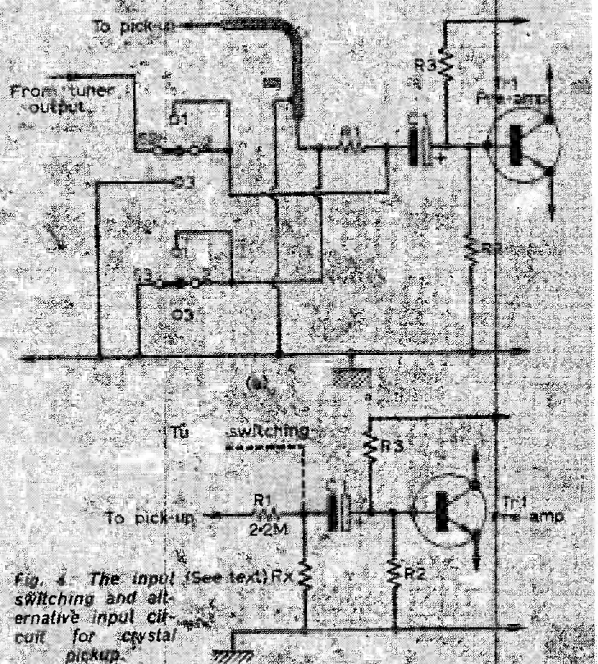



*Fig. 4: The input (See text) switching and alternative input circuit for crystal pickup.*

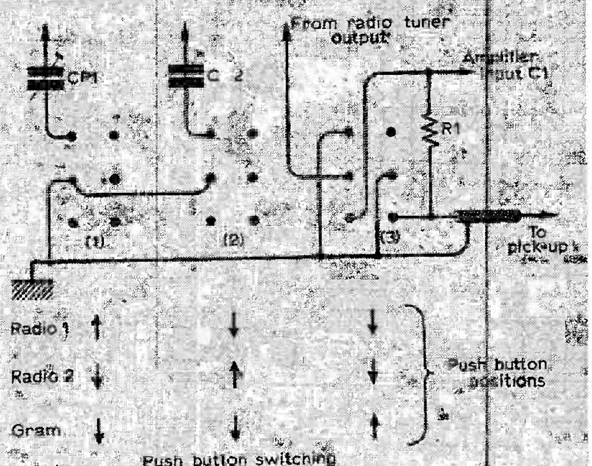



*Fig. 5: The push button switch wiring and positions.*

The radio tuner employs a ferrite aerial as shown in Fig. 6a which is tuned for medium wave reception only and is very loosely coupled to the r.f. amplifier by the three turn coil L2. The ferrite aerial should be mounted within the record player case so that it does not foul the changer mechanism and is reasonably clear of the loudspeaker. In the prototype it was mounted just to the right of the speaker and directly in front of the tuner circuit board as can be seen in the photographs.

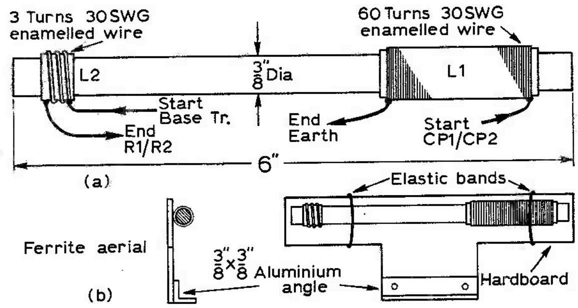
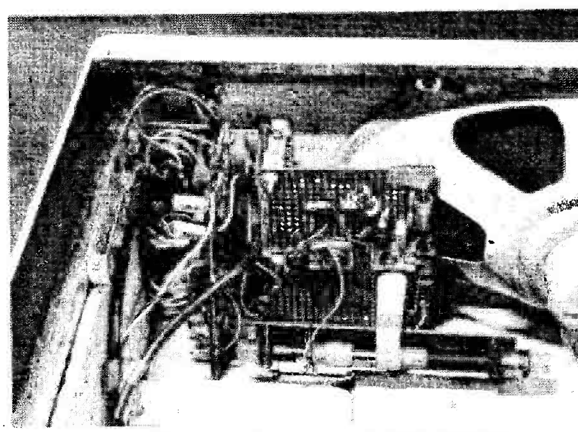



*Fig. 6: The ferrite rod constructional details.*

## CONSTRUCTION

The preamplifier was made up as a one piece assembly with the volume, bass and treble controls mounted on a small panel secured at right angles to the circuit board as shown in Fig. 7. The assembly was fitted to the front panel of the record player cabinet as shown in Fig. 7b so that the control spindles projected through. If this method of assembly is used, be sure to obtain potentiometers with long spindles. The wiring for the preamplifier is shown in Fig. 8.



*The preamplifier and radio tuner boards in the prototype.*

## THE POWER AMPLIFIER

The power amplifier wiring is shown in Fig. 9, but the assembly of the three separate sections calls for some explanation. First the output pair of transistors Tr6 and Tr7 must be mounted on a heatsink-cum-sub-chassis of the prescribed size. *Each output transistor is completely insulated from the heatsink with mica spacers and fixing bolt insulating washers.* The circuit board to the right carries the bias resistors and output network components and is secured to one side of the sub-chassis as shown in the inset. The larger circuit board carries Tr4 and the components of the driver Tr5. *It is most important that Tr5 is mounted in a small block type heatsink which is directly bolted to the main sub-chassis heatsink as shown in Fig. 9.* If the larger circuit board is mounted above the sub-chassis on pillars as shown in the inset the leads from Tr5 to the circuit board will be long enough.

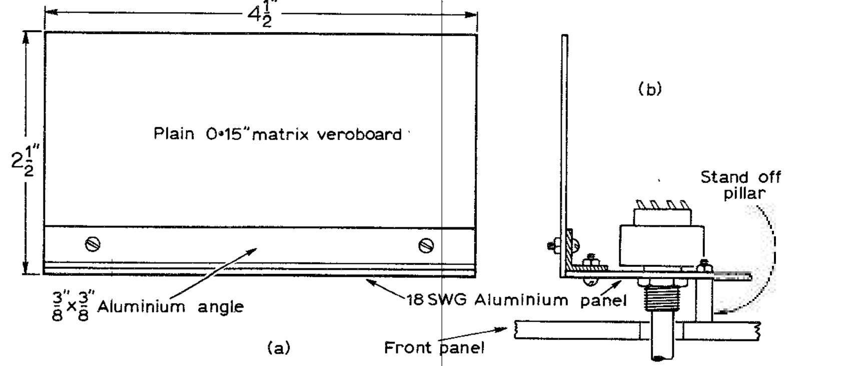



*Fig. 7: (above) The preamplifier circuit board mounting details.*

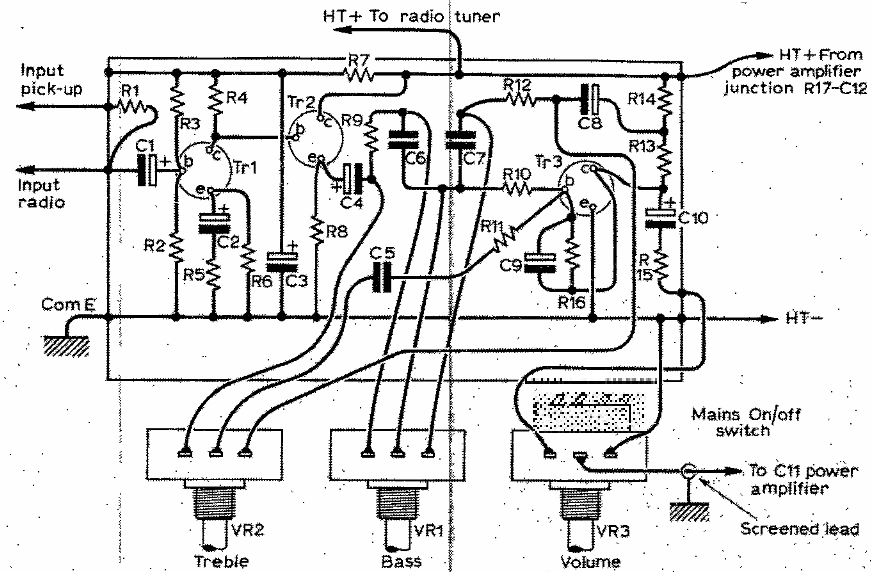



*Fig. 8 (left): The wiring details of the preamplifier and tone controls.*

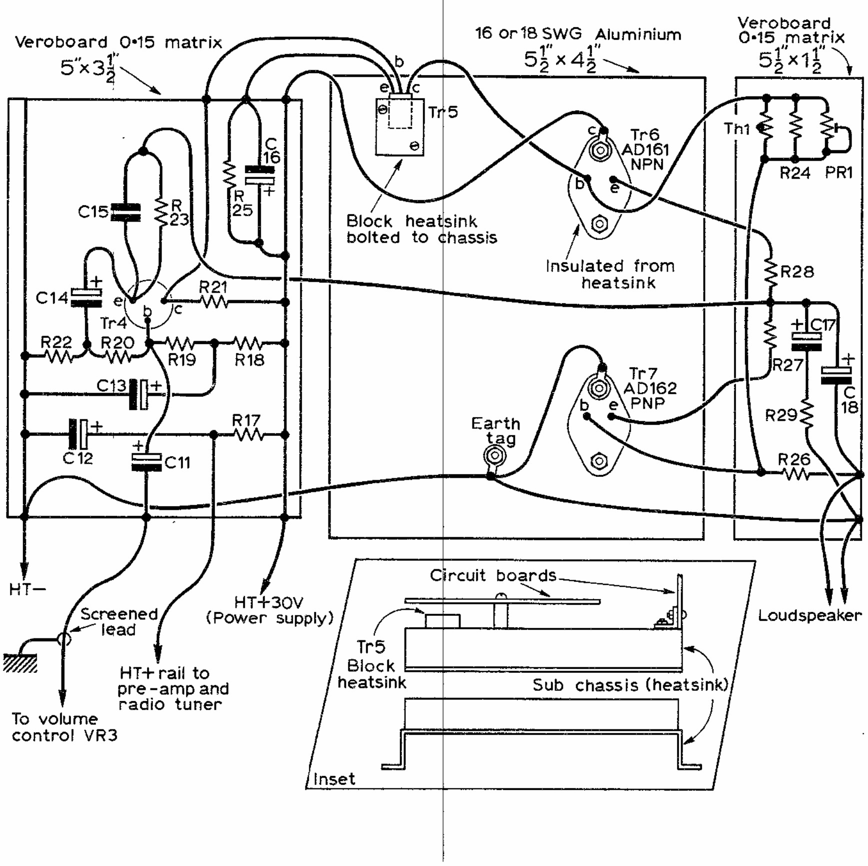



*Fig. 9 (below): The construction and wiring of the power amplifier.*

## THE POWER SUPPLY

This requires little explanation except that for the prototype the components were assembled on a small chassis about 6× 4in as shown in Fig. 10. A connecting block should be provided for the various mains supply conections i.e., those going to the on/off switch, the panel neon and the turntable motor. Use a three-cored mains cable for safety and include a fuse in one of the leads.

## THE RADIO TUNER

Mounting the ferrite aerial has already been dealt with. The wiring and layout for the circuit board is shown in Fig. 11 but the actual mounting of this board within the player cabinet is rather a matter of choice. In the prototype the radio circuit board was actually mounted on the three-way push-button frame, this in turn being secured to the front panel. Much depends on whether a push-button unit or panel mounting switch is used, but in any case the tuner circuit board must be close by to avoid long leads to the tuning presets. For the same reason the ferrite aerial must be as close as possible to the tuner circuit board.

## TESTING AND OPERATION

Those who have little or no experience of d.c. coupled output amplifiers may quite rightly be concerned about damage or destruction of the driver or the output pair through a wiring error. This is

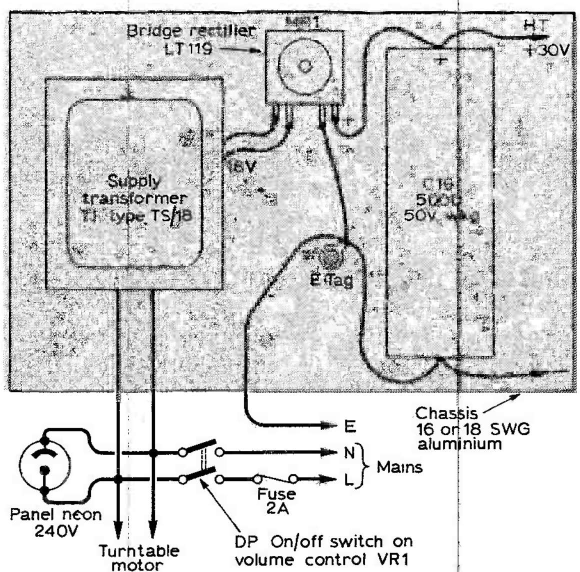
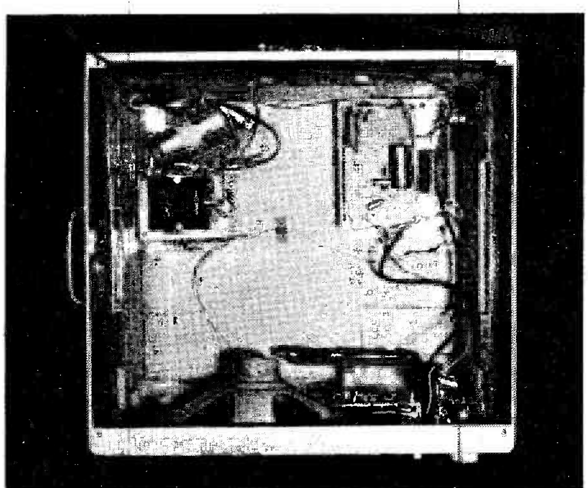



*Fig. 10: The construction of the power supply.*



*View of the prototype with the turntable assembly removed.*

always possible, of course, so first check and then recheck the wiring. To begin with, the pre-set bias control PR1 must be set to midway position which should allow the current to Tr6 collector to settle at around 20 to 30mA. This is with no signals at the input or with the volume control turned off. With a meter between Tr6 collector and the positive rail at the point indicated by a star in Fig. 2, adjust PR1 for a current reading of not less than 15mA and not more than 20mA. If no meter is available,

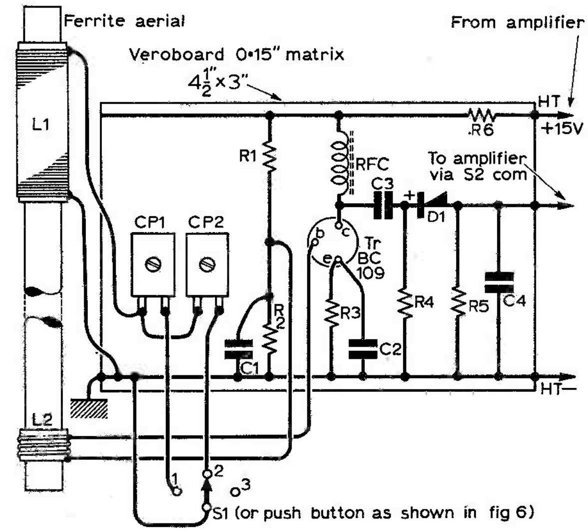



*Fig. 11: The wiring of the radio tuner.*

simply set PR1 to midway position. The reason for insulating both output transistors from the heatsink was to facilitate individual checking of the current drawn by each output transistor. It is also worthwhile checking the collector current of the driver transistor Tr5 which should not exceed about 25mA.

The supply (across C19) under the no signals condition should be almost exactly 30V which will fall to 25 to 26V when full power output is developed. Check also the voltages in the preamp section and the radio tuner.

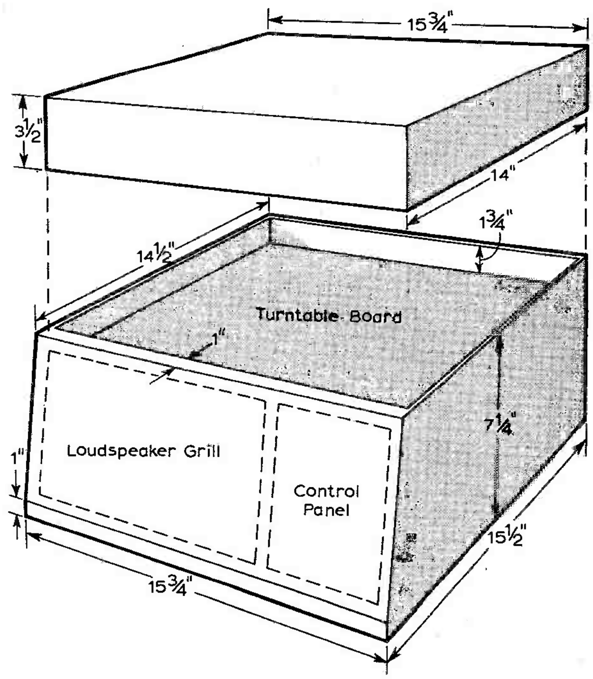



*Fig. 12: Dimensions of the cabinet used in the prototype.*

## ★ components list

**AMPLIFIER**

**Resistors**

| | | | | | |
|---|---|---|---|---|---|
| R1 | 1MΩ | R11 | 2·2kΩ | R21 | [illegible] |
| R2 | 12kΩ | R12 | 12kΩ | R22 | 10Ω |
| R3 | 120kΩ | R13 | 1·2kΩ | R23 | 1kΩ |
| R4 | 10kΩ | R14 | 5·6kΩ | R24 | 47Ω |
| R5 | 100Ω | R15 | 10kΩ | R25 | 220Ω |
| R6 | 1kΩ | R16 | 1·2MΩ | R26 | 390Ω ½W |
| R7 | 3·9kΩ | R17 | 680Ω | R27 | 0·5Ω 1W |
| R8 | 1·2kΩ | R18 | 15kΩ | R28 | 0·5Ω 1W |
| R9 | 12kΩ | R19 | 68kΩ | R29 | 3·9Ω |
| R10 | 12kΩ | R20 | 100kΩ | | |

All resistors 10%, ½W except where stated.

VR1 100kΩ linear (bass)
VR2 5kΩ linear (treble)
VR3 100kΩ log. with switch (volume)
PR1 47Ω skeleton preset (or 50Ω)

**Capacitors**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| C1 | 2·5μF | 12V | C8 | 10μF | 12V | C15 | 2200pF | |
| C2 | 100μF | 6V | C9 | 150pF | | C16 | 250μF | 6V |
| C3 | 250μF | 30V | C10 | 25μF | 12V | C17 | 10μF | 25V |
| C4 | 25μF | 12V | C11 | 10μF | 25V | C18 | 2500μF | 25V |
| C5 | 2000pF | | C12 | 250μF | 30V | C19 | 5000μF | 50V |
| C6 | 0·04μF | | C13 | 25μF | 30V | | | |
| C7 | 0·04μF | | C14 | 500μF | 25V | | | |

**Semiconductors**

| | | | | | |
|---|---|---|---|---|---|
| Tr1 | BC109 | Tr4 | BC109 | Tr7 | AD162† |
| Tr2 | BC109 | Tr5 | AC128 | TH1 | VA1077 (30Ω) |
| Tr3 | BC109 | Tr6 | AD161† | MR1 | LT119 Bridge Rectifier |

† Matched pair

**Miscellaneous**

T1 Mains transformer, 250V primary, 18V 1A secondary, Type TS/18 (Henry's Radio)
LS 10 x 5in (or similar) elliptical loudspeaker, 4–8Ω to handle 6–8 Watts.
Aluminium for chassis and heat sink, etc.
Veroboard, plain, 0·15in matrix.
3-pole, 3-way switch or 3-way push button switch.
Mains neon, panel mounting.
2A fuse and fuse holder

**RADIO TUNER**

**Resistors**

| | | | | | |
|---|---|---|---|---|---|
| R1 | 47kΩ | R3 | 680Ω | R5 | 12kΩ |
| R2 | 12kΩ | 4 | 6·8kΩ | R6 | 2·2kΩ |

**Capacitors**

| | | | | | |
|---|---|---|---|---|---|
| C1 | 0·02μF | C4 | 0·01μF | CP2 | 110pF trimmer |
| C2 | 0·1μF | C5 | 100μF 15V | | |
| C3 | 500pF | CP1 | 110pF trimmer | | |

**Miscellaneous**

Tr1 BC109
RFC 2·5mH r.f. choke.
Ferrite Rod 6 x ⅜in diameter—see text.
D1 OA81 diode or similar.
Wire for aerial.

## WIRING THE PICK-UP

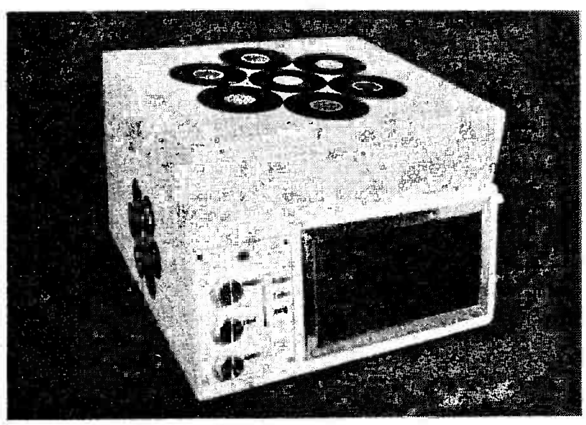
On most record turntables the pickup leads are carried through the arm to a tagboard beneath the deck. From here a screened lead must be used up to the switching and input at the preamplifier. The turntable must be earthed to the common earth of the amplifier. If the Garrard 3000 unit is used as in the original, the stereo cartridge fitted must be wired in parallel for mono operation. The input to the preamp will be found suitable for all ceramic cartridges but note that, if a high output crystal cartridge is used, the input circuit must be modified as shown in Fig. 4b. The resistor R1, which takes the place of R1 as in the circuit diagram Fig. 2 is raised in value to 2·2MΩ. The amount of attenuation necessary will depend on the output of the pickup cartridge but can be adjusted by Rx which will probably be about 390kΩ. The preamplifier is *not* suitable for magnetic cartridges which require frequency correction for the requisite R.I.A.A. record replay characteristic.

## THE CABINET

The dimensions of the original cabinet given in Fig. 12 may serve as a guide, but readers are advised that the best procedure is to build the amplifiers, tuner and power supply and then work out the cabinet dimensions in accordance with the space required, including that for the chosen auto-changer and loudspeaker. For example, there must be enough space for the projection of the auto-changer mechanism above and below its mounting board. There must also be ample space below the auto-changer to accommodate the power amplifier and power supply, which are best mounted at the bottom of the cabinet. The front area of the cabinet depends somewhat on the size of the loudspeaker and the space required for the preamp and radio tuner. The material for the cabinet may be plywood or blockboard and joints should be glued and screwed for strength. The auto-changer mounting board should be fitted so that it can be removed from the cabinet complete with the auto-changer and with the leads to the motor and pick-up long enough to allow the changer to be operated outside the cabinet. This greatly facilitates final testing and servicing.

The general design of the cabinet can otherwise follow that shown in Fig. 12 with the opening for the loudspeaker on the left and space for the preamp and radio tuner and their respective controls on the right. The lid for the prototype was made so as to be completely detachable but deep enough to allow operation of the auto-changer when placed on the cabinet. Retaining catches were fitted to secure the lid during transportations.

A ready made cabinet may well look large enough but to avoid the disappointment of finding it just that little bit too small when it comes to fitting anything into it, the writer again suggests the procedure of first building the amplifiers, etc., and procuring the auto-changer and loudspeaker. Then work out the required cabinet dimensions and look around for something suitable. ■



# I.C. OF THE MONTH

L.A.J. IRELAND

## Number 21 — Signetics NE561B Phase-Locked Loop Systems

ELECTRONICS enthusiasts will be aware of a new technical term appearing in books and journals recently and the concept it represents may well have the greatest innovating effect in communications systems design since the superhet principal was introduced. Therefore, although few readers will probably use it in the immediate future, it was considered rather important to devote this month's column to the phase-locked loop circuit and in particular to mention the series of i.c.'s recently released by Signetics Corp. of Sunnyvale, California, and marketed in the U.K. by Semicomps. Ltd., The Square, Kelso, Roxburghshire, and LST Electronics, 7 Coptfold Road, Brentwood, Essex.

### Operation

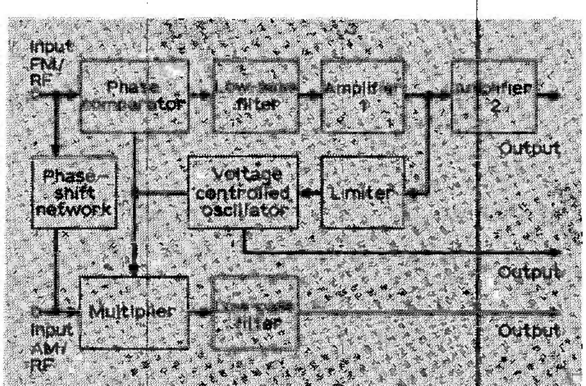
First, an outline of the method of operation whereby a PLL selects and tracks a signal in the presence of undesired components or noise. The heart of the circuit is a relaxation oscillator, that is one whose operating frequency is determined by non-inductive components. It is therefore unnecessary to employ a tuned transformer or coil in a PLL system. Such an oscillator can be designed so that the operating frequency can be varied over a limited range by the application of a d.c. bias voltage.

If the bias voltage is derived from a phase comparator, which produces an output determined by the deviation in frequency and phase of the local oscillator from a desired input signal, the local oscillator will track the input signal. There is then a strong continuous signal produced, whereas the input may be discontinuous or noisy. The reader will be aware of the complexity of the electronics required to perform this series of functions, so it becomes clear why the introduction of microelectronic techniques was necessary before its application could become widespread.

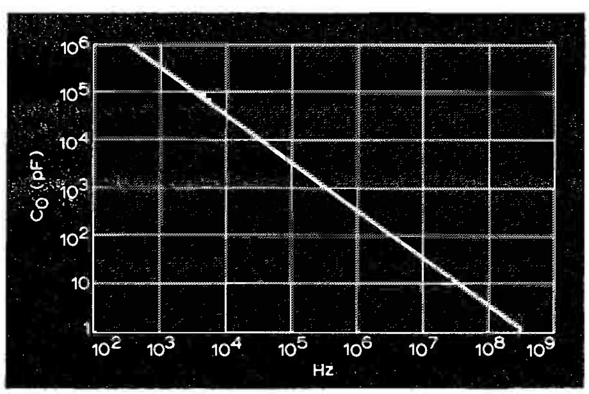
### Applications-Synthesiser

Now to consider a few of the applications for which PLL methods are being investigated and which lend substance to the claim that the innovation may rival the superhet. In transmitter applications, it is the basis of the frequency synthesiser, increasing in popularity as a transmitter master oscillator, in that a large number of output frequencies are available, each with the stability previously attainable only with a single frequency crystal oscillator.

In a synthesiser, a fixed frequency crystal oscillator supplies the input signal to the phase comparator section of the PLL. Meanwhile, the local oscillator generating the output signal of the synthesiser also drives a digital divider, the output of which also enters the phase comparator. The d.c. bias produced, fed back to the local oscillator, locks it to the selected harmonic of the crystal signal. Digital dividers of any desired ratio are freely available as a result of computer developments—all that is needed is a series of appropriately connected bistable multivibrators—and for a multi-channel synthesiser appro-



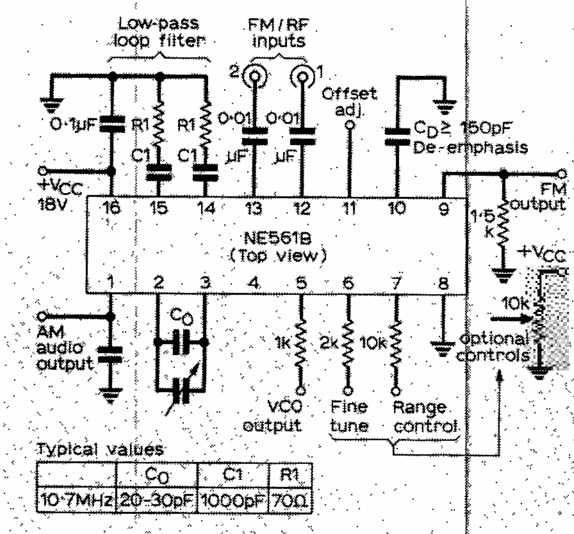

*Block diagram of integrated filter/demodulator for NE561B*




*Dependence of oscillator frequency on $C_0$. (D.C. bias from comparator = O)* priate switching is incorporated. Obviously, too, the system output has the same stability as the reference crystal oscillator.

## FSK

The device is also very useful for telegraphy transmission by f.s.k. (frequency shift keying—also used in telemetry and teleprinter operation). In this alternative to c.w. telegraphy, the carrier alternates between two frequencies, while the phase comparator in a PLL used for decoding transforms this into a variation in the d.c. bias applied to the local oscillator. In the U.S., its application to decoding




*Connections to NE561B as FM demodulator.*

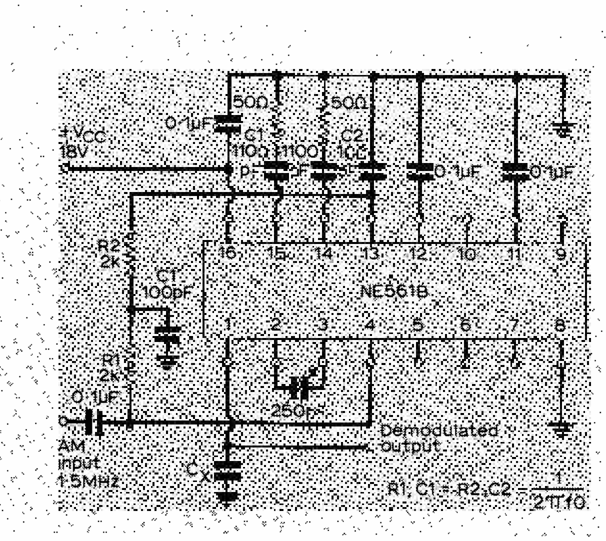
telephone dialling tones is being investigated. From the amateur's point of view, these commercial applications are of interest because only the massive demand for PLL units which they represent can bring the price into the range which he can afford. When that is achieved, though, it will be the f.m. and a.m. detector capabilities of the system which he will exploit in the main. Circuits for these applications are illustrated.

## FM

The principle of f.m. demodulation is obvious; the modulation system involves a shift of carrier frequency proportional to the instantaneous level of the audio signal. Within the phase comparator section of the PLL, an output signal is obtained dependent on the carrier shift. Whereas this normally is used as the d.c. feedback bias to the local oscillator, there it also represents the audio output of the demodulation system. A hidden advantage of this circuit is its automatic frequency control (a.f.c.) characteristic; if the receiver is slightly mistuned, the feedback to the local oscillator results in a compensating frequency shift.

## AM

An extra element is required for a.m. detection and this is incorporated in the Signetics type NE561B. It is essentially a multiplier of the type described in December 1970 in these notes and its operation can be understood as follows. In an a.m. superhet, the mixer (a form of multiplier) produced an amplitude modulated intermediate frequency signal, the frequency being the difference between that of the incoming signal and that of the local oscillator. In a PLL the local oscillator produces a frequency identical to the incoming signal; the difference frequency is zero, i.e. d.c., and an amplitude modulated d.c. is simply an audio signal. (In the 1930s, experiments on this principle were referred to as the "homodyne" method.) Among the interesting possibilities opened up now is a completely inductorless superhet receiver, but it may confidently be

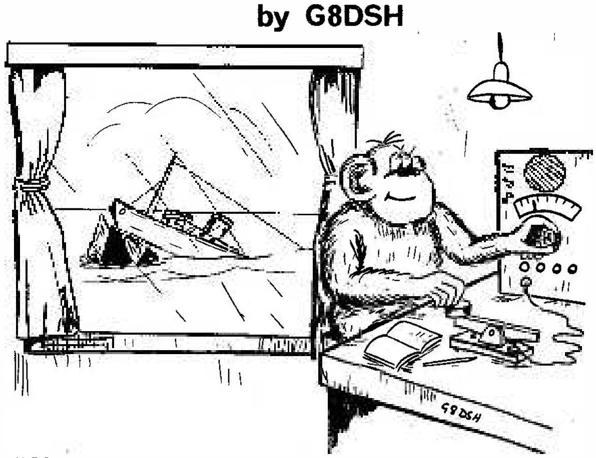



*Wiring of the NE561B for AM demodulation.*

expected that serious innovations will be extensive. This only awaits the inevitable price drop, from its current level of about £12 per unit.

# MAXWELL

**by G8DSH**




*"Okay—okay—we'll QSL if you'll call the coastguard."*

# THE MW COLUMN

EVEN in midsummer there is plenty of DX on the medium waves. As darkness approaches listen for Baghdad on 760kHz and Omdurman Sudan on 960kHz. Programmes are similar with Arab music and singing and Omdurman is now on extended schedule until 2200hrs GMT. The Holy Koran station in Beni Suef Egypt has been heard on 1155kHz while Ahwaz Iran is on 1390 until 2130hrs. Enugu Nigeria 1320kHz often peaks up during the last half hour before news in English at 2300hrs and close down. Shkodra Albania which is on 1394 with its foreign service until 2230hrs GMT, has a distinctive trumpet call as an interval signal. This station has verified to the writer with a QSL card.

At 2300hrs GMT many Europeans sign off. This is the time to look for two West Africans—Dakar Senegal on 764kHz and Conakry Guinea on 1403—each with African style music and French announcements. Tenerife in the Canary Islands in Spanish is strong on 620kHz until 0100hrs though there is often QRM from Batra Egypt until 0030hrs. A loop will separate the two. Baghdad 908kHz can be heard after BBC4 goes off, Tunis is on 962, Algiers on 980, Tangiers on 1232 and Tripoli Libya on 1250. Pyrgos Radio, a commercial Greek station, is now on 1349kHz until 0300hrs. It has English programmes at midnight on Saturday and Sunday and a DX programme on the last weekend of the month.

Large numbers of British holidaymakers go abroad every year, while a few medium wave stations in Italy, Portugal and Spain cater for them with occasional programmes in English. MW DXers among these tourists have the opportunity to try the band from a new location and perhaps hear and even visit stations that would be classed as rarities at home. Spain is particularly interesting for as well as having the official RNE high power networks there are five chains of low power commercial outlets with a total of well over 100 MW stations. Typically, in Majorca there is EAJ13 Radio Mallorca on 1475, EFJ45 Radio Juventud Palma on 1385kHz and EAK18 Radio Popular Mallorca on 1268kHz. On 1502 there is EAK24 R. Pop. Ibiza. Radio Ceuta (pronounced Thay-ootah) 1106kHz, located in the Spanish enclave in Morocco is a noisy signal during daylight on the Costa del Sol. Another rarity from this area is Radio Gibraltar 1484 kHz which signs off at 2300hrs GMT. North Africans are prominent in Spain, many low power stations normally drowned in QRM at home can be logged, such as Rabat on 818kHz which has been heard in English. A short length of wire as an aerial will help with dx-ing after dark. Last year Amphissa Greece on 1610kHz, AFRTS Athens in English on 1594, Conakry on 1403 and Pyrgos on 1480 (now on 1349), plus a large number of 'locals' were heard on a transistor portable. On the long waves Azilal Morocco is on 209kHz while BBC2 on 200kHz can be pulled in after dark.

Two new Africans to add to last months list are The Voice of Kenya on 953kHz and Kinshasa Congo on 692kHz. Look for them between 0200hrs and sunrise.

CHARLES MOLLOY

# ON THE SHORT WAVES

## MONTHLY NEWS FOR DX LISTENERS

# THE BROADCAST BANDS

Malcolm Connah

**Frequencies in kHz ● Times in GMT**

WE start this month with news of a DX Convention which will take place at Pembroke College, Cambridge from the 2nd to the 4th of July, 1971. The Convention is being jointly organised by the World DX Club and the Medium Wave Circle. The Convention fee is £7·50 which includes bed, breakfast and evening meal for two days.

The Convention will cover all aspects of broadcast band listening together with some aspects of amateur band listening and TV DX. Further details can be obtained from Malcolm R. Peddar, 53 Garland Street, Bury St. Edmunds, Suffolk.

Details of membership of the World DX Club can be obtained from the Secretary at 11 Wesley Grove, Portsmouth, PO3 5ER. Membership details of the Medium Wave Circle can be obtained from the Secretary at 7 The Avenue, Clifton, York, YO3 6AS.

A record number of reports has been received this month the first being from **Graham Close** of Diss who is now using a modified Ever Ready 'Skylord' chassis and a 50 foot antenna enabling him to hear:

4800 *YVMO Radio Lara* in English at 0350
4880 *YVMS Radio Universo*, sign off in English at 0400
4900 *YVNK Radio Juventud* in English at 0355
4970 *YVLK Radio Rumbos*, sign off at 0500
4990 *YVMR Radio Barquisimeto* at various times
7160 *Radio Amman*, Jordan in Arabic at 2100
9670 *Radio Damascus*, Syria in English at 1930
11735 *HCJB*, Quito, Ecuador in English at 1945
21680 *ABC*, Australia in English at 0905

I think that we will have to start a special Australasian section as we have two reports from that continent this month, the first being from **John H. Saunders** of Paekakariki in New Zealand.

4725 *Rangoon*, Burma with Burmese programme at 1240
4770 *ELWA*, Monrovia with BBC News at 0700
5030 *YVKM Radio Continente* heard at 0900
5075 *HJGC Radio Sutatenza*, Colombia s/on at 0900
6135 *Warsaw*, Poland opens to Europe at 0600
6135 *Papeete*, Tahiti now received with strong signals at 0745, sign off at 0800.
7200 *Omdurman*, Sudan (// 9508, 11835) at 1900
9485 *Karachi*, Pakistan news in English at 2018
9515 *Ankara*, Turkey heard opening in Turkish at 0335
15280 *KGEI*, San Francisco at 2230 to 0300

The second comes from Perth in Australia and is the log of **Craig Tyson:**

4820 *Radio Gambia* at 2130
7120 *Radio Kiev*, Ukraine in English at 1930
7165 *Radio Nepal* at 1250
7200 *Radio Afghanistan*, English at 1800
7235 *Solomon Islands*, English at 0800
9510 *Radio Algiers* in Arabic at 0600
9525 *Radio Havana*, Cuba at 0100
11880 *RAE*, Buenos Aires in English at 2300
15265 *FEBC*, Seychelles at 1230
15435 *Radio Tanzania* at 1600

Back to the U.K. for the next report from **Robert J. Dinning** of Glasgow whose equipment consists of an HRO MX receiver, a 60 foot vertical antenna and a Joystick antenna.

4890 *YVKB Radio*, diff. Venezuela at 0320
4905 *Radio Relogio*, Brazil at 0320.
4910 *YVPN Radio*, Radiofonicas noted at 0330
4911 *Lusaka*, Zambia at 0330
4965 *HJAF Radio Santa Fé* at 0310
4980 *YVOC*, Ecos del Torbes, good at 0300
5075 *Radio Sutatenza* with good signals at 0300.
11620 *Karachi*, Pakistan at 1845
11650 *Dacca*, Pakistan in English at 1910
11715 *Algiers* noted in French at 1830
11735 *R.T. Marocaine* in English at 1700-1800.

A new reporter this month is **Andrew Dyer** of Stansted who used his Astrad Auriga receiver and 50 foot long-wire to hear:

6620 *Radio Peking* noted at 2110
9715 *Radio Nederland* at 0900
9912 *All India Radio*, Delhi at 2030.
15165 *Radio Damascus*, Syria at 2050
15300 *HCJB*, Quito Ecuador at 1046.

Another new reporter is **Stephen John Mathews** of Hull who heard the following stations:

6005 *RIAS*, Germany in German at 2000
6010 *RTB*, Belgium in French at 1500
6160 *VOA*, Tangiers, Morocco at 2355
9530 *HCJB*, Quito, Ecuador in English at 0430
9705 *RSA*, South Africa in English at 2340
9725 *IBA*, Jerusalem in English at 2105
11815 *TWR*, Bonaire in English at 0020
11820 *BBC Atlantic Relay*, Ascension Island at 1905
11955 *BBC Far East relay*, Malaysia at 1815

DX News items have been contributed this month by **Roy Patrick** of Derby (RP) and **Anthony Harding** of Southampton (AH).

*Canada* Radio Canada has been heard using the following new frequencies during its transmissions to Europe: 11675 and 15535 since March 21st. (RP)

*Netherlands* Radio Nederland has moved from 15380 (Bonaire) to 6020, 6085 and 9715 (Hilversum) at 2000. (AH)

*Norway* Radio Norway has started a DX programme every first Sunday of the month. (AH)

*Swaziland* Trans World Radio has received permission to build and operate a missionary station from that country. The station will consist of one medium wave and several short wave transmitters. This news was received from the TWR office in London. (RP)

Reports should arrive by the **15th of the month** and be addressed to the author at **5 Ranelagh Gardens, Cranbrook, Ilford, Essex.**

# ON THE SHORT WAVES

## THE AMATEUR BANDS

**David Gibson, G3JDG**

**Frequencies in kHz • Times in GMT**

TOPIC of the month is undoubtedly the ten metre band. Now that the sunspot maximum has passed the band will slowly go down, but it will be an extremely interesting period in which to listen. When it does open up, it really does it in style. This last stir on ten let all sorts of things through at almost unbelievable signal strengths. Stations like HK6, YV, W5, ZP, ZS and 9X romped in at 5 and 9 plus and this was on a simple superhet with no frills and a length of wire to an a.t.u.

**C. Manuel** (Orpington), has recently moved into an outdoor shack (wait until the winter, mate!) and sends in a log carefully constructed "... early mornings, before, and after my paper round." Hallicrafter SC and 14ft. vertical are alive and well after hearing HBØXKZ, OE6BWG/P, OE9HFI/P and PAØPN all on 160 metres s.s.b.

A sneaky sniff round 80 about early morning paper delivering time winkled out; EA6BN, ELØK/5A1, ET3JH, FO8BS, HK1AHV, HK6BRK, HR2HHP, JW1FH, JX4GN, K1KTH, K2AEV, K3HXF, K4DOY, K5JFL, K6NA, K8GMR, K9LIH, KZ5MU, MP4BLV, OD5BA, OX3WX, PY3APH, TAIAN, VE1ABV, VE3BMV, VP2AA, W5ILR/TF, W5KFD, XE1KB, YV5BVQ, ZC5IK, ZL2BT, ZL4OL/A (Campbell Island), ZP4JW, 3A2EE, 4X4KT, 4Z4TX and 6W8DY.

**S. Kaye** (Whitney) is 14 and uses different colour ink on different pages. He also uses an AR88D (never lift one, it could prove fatal) and a length of wire in a sort of end-fed loop. Stations lassoed with this antenna on 80 metres s.s.b. include; EA6BN, EA8HA, HI8LC, IC1AA (San Peter Island), K3JH, LX1BW, VE1IE, VE2XF, VE3AAW, VO1AM, VO2PG, VP9BO, W1DIT, W5ILR/TF, W8LRE, ZC4TR and 4X4NJ. Stephen complains about the types who QRM DX stations. His words on the subject are not only unprintable but unpronounceable but I agree with his remarks.

**R. Dinning** (Glasgow) has a "modest" 60ft. vertical and HA350, PR30X and R10. (That's nice, I don't like it when the gear is boasting all the time.) Twenty metres s.s.b. from the modest equipment included: CR4BC, DU3ZAE, EA8HA, EL2CH, EL8I, ET3ZU, FG7XT, FP8AL, HI3XAM, HL9TZ, JW8IL, JY9AB, KR6NZ, KS6BT, KZ5EU, LI1ER (no QTH but says QSL via AP1RIL). M1D, M1T, (what about MOT?), MP4BHH, PJ3TX, PJ9JR, PX2DHM, PX3BXW, PZ1DF, TI2CF, VK6FD, VP2VAG, VP6HS, VU2KB, ZE2JE, ZL1AGZ, ZL1ASB, 4S7SM and 6Y5AR.

"This is my first entry to your excellent column", writes **J. Owen** (Lower Heyford) admitting at the same time to owning a Lafayette HA700 hotted up (must keep it in the oven?) a.t.u., and a variety of antennas including two end-feds—one 150ft. N/S and the other 200ft. NNW/SSE. Most of the 14MHz DX was heard after 2200; CE6EZ, CT2BB, CX9BP, EA8EJ, HC2GG/P1, HK5BTN, IRØWX, JA8AA, K2KQQ/P/TF, PJ6AA, PJ9JR, PY2ERS, TF3EA, TI2J, VK3BNK, VP5JA, VR2RM, ZE1DL and 6Y5GB.

If you are ever in the vicinity of Corkhampton Road, Bournemouth, be on the lookout for 132ft. of wire at 20ft. follow it carefully and it will lead you to a P.W. general coverage receiver (P.W. March/April 1970). If it has additional bandspread for the amateur bands then it is almost certain that the paws on the controls will belong to fourteen year old **Michael Ayling.** Mike's best for twenty s.s.b. were; ET3DS, TA3GB, VK2AGR, VK3TG, VO1CB, YV4UA, ZE8JW, ZL3MN, ZL3NS, ZL4BE, ZS6MP, 4X4IH and 9K2AL.

**R. Impey** (Brentwood) put on a mast and robbed his piggy bank to the tune of a new HA600. A 55ft. end-fed and a.t.u. completes the spoils. Goodies bagged with the loot on 21MHz s.s.b. are; CO2FA, CP6UH, CR4DA, CR6JI, CT2BB, HK7AYT, JA6BSM, LU4DOM, PY8KD, TI2LCB, TY1ABE, VP2GJC, VU2HLU, YV4TV, ZB2A, ZS6GF, 6W8AL, 7Q7LA, 7XØEC and 9Q5JD.

**L. Reynolds** (London, E.2.), SP 600, 35ft. inverted 'V' heard these between 0710 and 0830 on 21MHz s.s.b.; CN8BF, CT2BB, ET3USA, JY9AA, XE1VV, ZB2BV, ZP9BG, 4X4HT, 6W8AL and 9Q5GC. Lee asks if 432MHz logs would be appreciated—yes, they would.

**S. Lamprey** (Cardiff) has a 9R-59D receiver. Antenna is 47ft. of wire which disappears and terminates in a Joystick. Net result on 15 metres s.s.b. was; ET3ZZ, IC1SEZ (San Peter Islands), IT1PSG, JY9AA, JY9AB, KP4DKI, MP4BIN, OD5EP, OD5GQ, TA3GB, YBØAAN, ZB2BV, ZS6BLA, 4S7PB, 4V4AB, 4X4WP, 5H3KA, 9H1AF and 9H1BX.

**J. Huffington** (Ilford) says that for the first time in his listening experience ten metres opened up although his log for 15 metres shows that this band wasn't so quiet either; AP2KS, CT1OF, CT2BB, EA3BG, EL2TR, EL8TQ, ELØHN, EP2FB, ET3DS, IS1VHV, JA1DJL, JA4CRI, JA8EDU, JHØEIG, JY9AA, KP4AF, KR6HS, KR6JU, KV4CF, LU4DM, LU5DBS, M1D, MP4BIO, MP4TDT, OD5GQ, PY2DFR, PY6OA, TL2ZZM, UA6NH, UD6BD, UF6XG, UK6FAA, UW9AF, VE2IE, VK5JB, VP2AA, VP2EZ, W3GMM/P/9, WA4YNM/MM, W5TTL, W6DHQ/MM/2, W6DLE/4X4, YB1AK, YBØAAN, ZC4JW, ZE1JL, ZP9AC, 4X4FQ, 4Z4IK, 5H3JR, 5Z4MO, 7X2HS, 9F3USA, 9G1BF, 9H1R, 9K2AL, 9M2BO and 9N1MM.

Happenings for the month of June/July include: June 5-6, National Field Day; 5-7, CHC-FHC phone/c.w. contest; 20, WAB v.h.f. phone contest; 20, microwave contest—1·3GHz and above; 27, 4 metre portable contest; July 3/4, Topband contest, 3/4 two metre contest; 3/4 two metre listeners contest; 10/11, HP FD.

*Logs, in alphabetical order please, to arrive by the 15th of the month to:*
**12, Gross Way, Harpenden, Herts.**

# LETTERS...

*The Editor does not necessarily endorse the views expressed by correspondents*

## Anyone Help?

We have received a letter from one of our readers, Mr. Cecil W. Lewis, who is severely handicapped due to an accident some years ago.

He would be pleased to receive books on amateur radio topics and is also interested in a secondhand amateur receiver. He is under the care of the Devonian Orthopaedic Association, 59 Wonford Road, Exeter, Devon, and his home address is: 6 Grosvenor Mansions, Belle Vue, Bude, Cornwall.

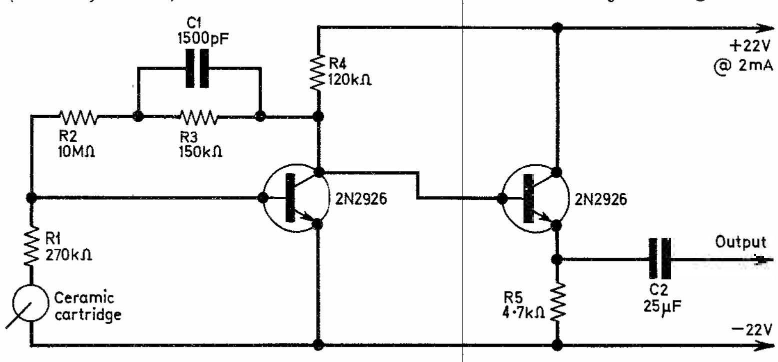
## My Preamp

Having for a time experimented with the excellent preamplifier suggested by Mr. Judd in his 25W Stereo Amplifier (Practical Wireless November 1970) I have come up with a circuit that I consider might be of use to those readers who for some reason are limited to the use of a good quality ceramic cartridge. The supply voltage is the same, in that this circuit would directly replace the first two stages of Mr. Judd's design.

Depending on the output of the cartridge used, the 68kΩ resistor between the output capacitor C9 and the stereo balance control can be left out and the capacitor C2 in my design connected directly to the balance control.

The advantages gained by this circuit are (i) more realistic sound on string instruments, with a ceramic pickup (ii) less noise—I claim 70dB for the preamp fitted with this circuit.

I hope that this circuit will be of some use to those readers who like me strive for perfection with what little I have. — B. Frost *(Exeter, Devon)*.




## K7BGS-W7TNA

Perhaps you would care to inform amateur radio operators that a unique hydrofoil stabilized sailing trimaran set out from Rio, South America on April 3, to sail to Baltimore, Co. Cork, Ireland, being due this month. She has two short wave radio receiver/transmitters aboard.

They have a confirmation contact card which illustrates their yacht. The call sign data is K7BGS and W7TNA Rig—Two Transceivers FT-DX-100 — One Linear Amplifier FL-1000 can operate 80, 40, 20, 15 and 10 m SSB/CW Sked each day 0100 G.M.T. 21,390±5 with WG-CH.

Accompanied by his Irish born wife Mary, the skipper is Commander Charles M. Sturkey, Jr., U.S.N. Retd.

They are both keen amateur radio enthusiasts and would doubtless enjoy hearing from readers. Neither the Hydrofoil & Multihull Society, nor Erick Manners, the designer, possess short wave radio, but would very much appreciate hearing news of these gallant sailors on their present lonely 6,000 mile vigil via the Azores.—**P. P. Cheney** *(Hydrofoil & Multihull Society, 31 Riverside, Martham, Gt. Yarmouth, Norfolk)*.

## Letter to "Henry"

It would seem that the day of valve circuits is over and that such things as quality radiogram circuits for stereo will never appear again in *P.W.*

Many amateur constructors are left with some first class transformers for h.t. etc., and chokes which are really too good to follow valves into the dustbin.

Do you think there will ever be any use for them in the future for any type of receiver?

Some comment on this in one of your monthly articles would be appreciated.—**D. Welford** *(Ilford, Essex)*.

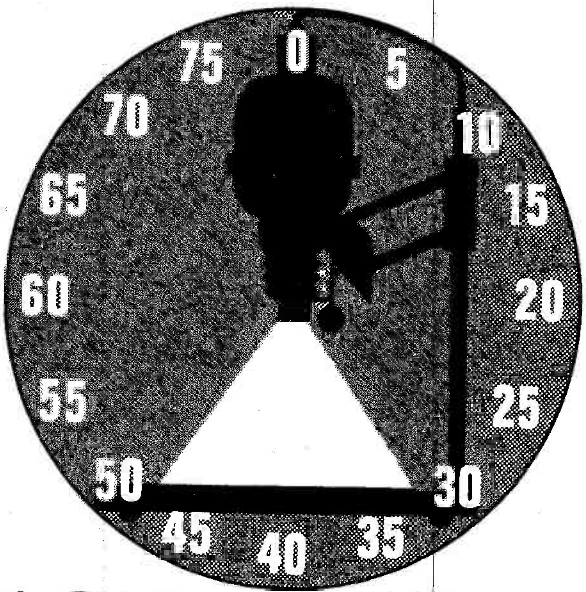
*There seems no reason at all why we should throw away all our good transformers and chokes just because the transistor revolution has overtaken us.*

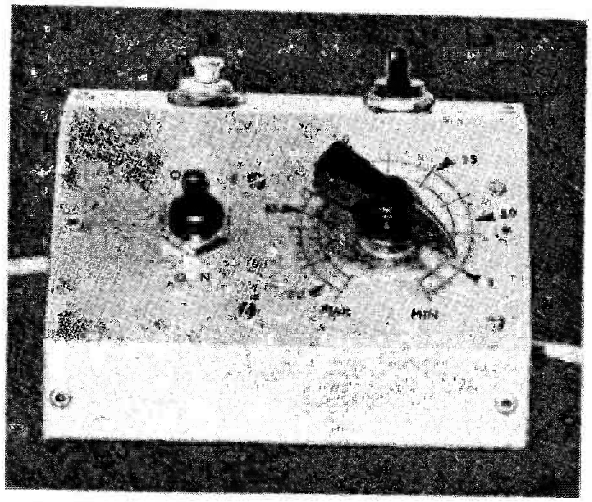
*I am not even convinced that the transistor revolution has made such a drastic difference to my own standards, even though it has made a very drastic difference to my working life. As I get older and presumably my eyesight gets less keen I am called upon to exercise it even more stringently.*

*I do not go along too much with the high quality radiogram circuit, as in my experience there are so few of these really high quality circuits around that the answer would ultimately be units built into a single cabinet, and then it is an absolute crime to use a record playing deck in the same cabinet as other equipment is housed, or at least, as any loudspeaker is housed. The transistor revolution has brought us a terrible amount of very poor solid state amplifiers, any one of which can be beaten hands down by a well-constructed class A valve amplifier, and many of the higher class transistor amplifiers still find it difficult to compete with the Williamson circuits and others of that nature. But it is a fact that the better class transistor amplifiers are superior in ways that the valved amplifier cannot quite reach. In this respect transistors are best all along the line and of course their other advantages make them very desirable.*— "Henry" *(no fixed abode)*.

## MOBILE RALLY DIARY

| | |
|---|---|
| Jun 13 | GW2OP's Bucket and Spade Party. |
| Jun 13 | Elvaston Castle, Derby. |
| Jun 27 | Echelford, Hanworth Airpark. |
| Jun 27 | Anglian, Suffolk Show Ground. |
| Jun 27 | Longleat Safari, Warminster. |



D. SMITH

# SOLID STATE ENLARGER TIMER

THE timer described in this article has all the advantages normally associated with timers costing very much more: it is very stable and its repeat accuracy is better than 0·25 seconds in 1 minute. The main advantage of this timer is that it is relayless and suffers from none of the disadvantages of relay timers such as welding relay contacts and sluggish action. It is entirely solid state, the switching of the lamp being controlled by a TRIAC.

No doubt, most constructors are familiar with the operation of the thyristor in switching applications and the TRIAC operates in basically the same way. It is different, however, in that it can conduct on both half cycles of the mains current, therefore no bridge rectifier is required to obtain full wave control.

It is intended primarily as a darkroom enlarger timer, but could be adapted for many other uses where good repeat accuracy is essential. The unit has one range covering 1 to 80 seconds, but this may be altered to suit individual requirements by selecting different values of R2, VR1 and C1, or a two-range version may be constructed by reducing the value of VR1 to 250kΩ and switching a 220kΩ resistor in series with VR1.

## Circuit Description

As can be seen from the circuit diagram (Fig. 1) Tr1/Tr2 form a complementary Schmitt trigger. The emitter of Tr1 has a very high input impedance, up to 1,000MΩ. Tr3 is simply an inverter to apply the timing signal to Tr4 in the correct sense. Tr4 is the driver transistor to provide the gate current to the TRIAC. A smaller TRIAC could be used providing the current consumption of the enlarger lamp does not exceed the ratings of the TRIAC.

The power supply is derived from a 6V transformer and rectified by D1-D4 in a bridge configuration, ZD1 is a 5·6V zener diode that compensates to some degree for fluctuations in mains voltage and also saves the need for large and cumbersome smoothing capacitors.

None of the component values specified are critical to the operation of the circuit, but differences may affect the range of the timer to a small extent. However, it is recommended that no economies are made to the power supply circuit, as ripple on the positive rail may cause the lamp to flicker before it goes out, due to spurious triggering of the TRIAC.

## Working Description

The circuit functions in the following manner: when the push-button switch is operated, C1 discharges through R1. Upon releasing the push-button, the voltage at Tr1 emitter falls immediately to the zero voltage rail, switching off Tr1/Tr2. This action removes the positive potential from Tr3 base, causing its collector to rise to almost the full positive rail. Upon receipt of a positive signal on its base, Tr4 conducts heavily, passing a positive gate current to the TRIAC. This then turns on, supplying current to the enlarger lamp.

Meanwhile C1 is charging at a rate determined by the setting of VR1. When the charge on C1 reaches 0·7V above the base voltage, determined by R3/R4, Tr1/Tr2 rapidly turn on, presenting Tr3 base with sufficient current to cause it to conduct. Tr3 collector then falls, removing the base supply to Tr4, this in turn removes the positive gate current from the TRIAC and turns off the lamp.

The switch SW1 simply short circuits the TRIAC, enabling the lamp to be focused without the need for continually resetting the operating button.

## Construction

The complete unit is housed in an 16 s.w.g. aluminium box measuring 3in×3in×5in with a sloping front. First the sides are cut and bent as shown in

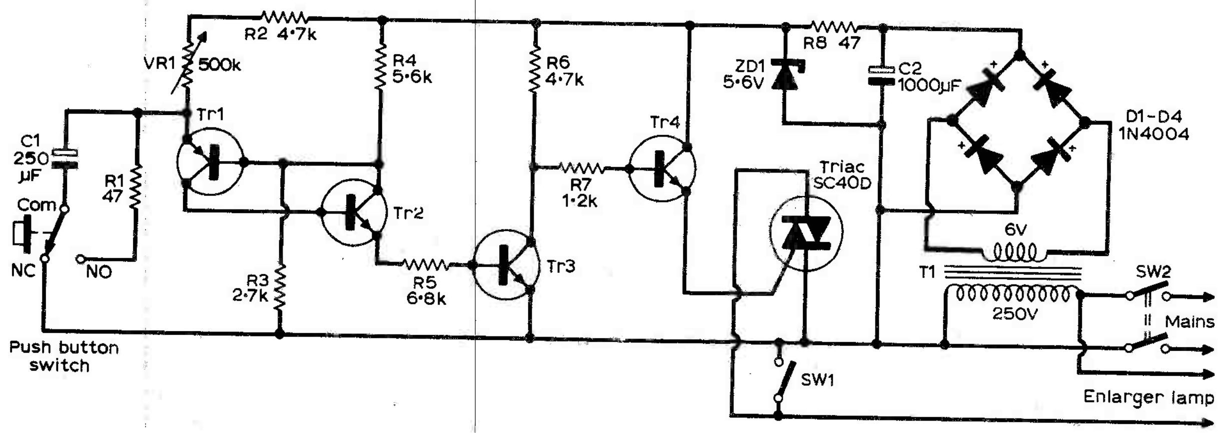



Fig. 1: The complete circuit of the solid state enlarger timer.

## ★ components list

**Resistors**
R1 47Ω — R5 6·8kΩ
R2 4·7kΩ — R6 4·7kΩ
R3 2·7kΩ — R7 1·2kΩ
R4 5·6kΩ — R8 47Ω
All resistors 10%, ½ watt types.
VR1 500kΩ linear potentiometer.

**Capacitors**
C1 250μF 12V C2 1000μF 12V

**Semiconductors**
Tr1 2S301 — D1–D4 1N4004 diodes, or similar.
Tr2 2S703 — ZD1 5·6V, 1·5W Zener Diode.
Tr3 2N696 — TRIAC SC40D (400V, 6A)
Tr4 2N696

**Switches**
SW1 Single pole, one way toggle.
SW2 Two pole, on/off toggle.
Push/button Single pole, two way.

**Miscellaneous**
T1 Mains transformer. 250V primary, 6V (at minimum of 100mA)
Printed circuit board and cabinet—see text.

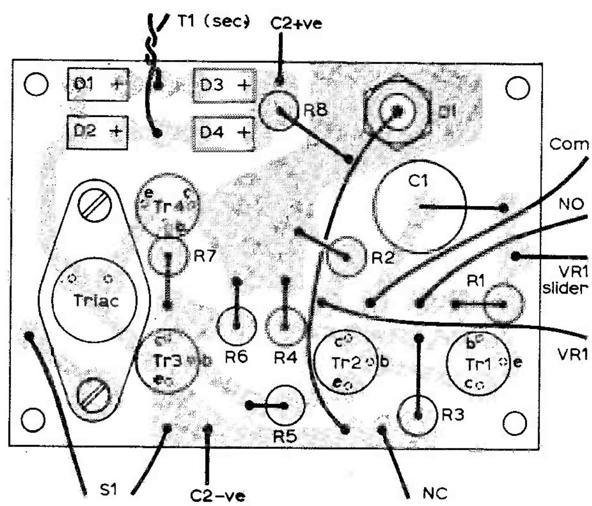



Fig. 3 (above): The component layout and the printed circuit pattern.

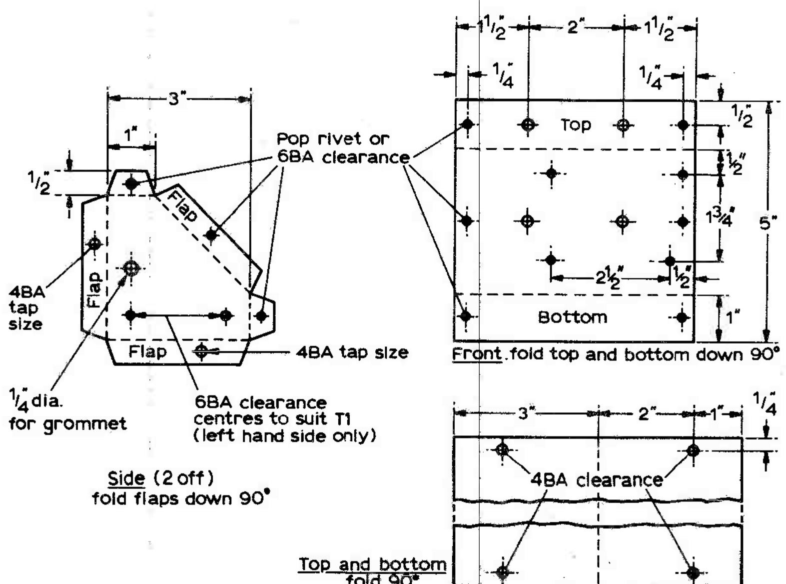
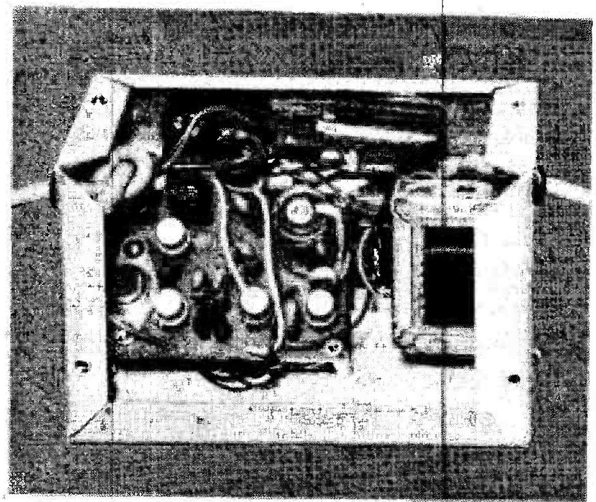



Fig. 2 (left): The metalwork dimensions as used in the prototype. Note that the case must be earthed for safety.

Fig. 2, then the front is cut and shaped and "pop" riveted or bolted to the sides. Finally the holes are drilled to take the larger components and the wires. The back and bottom cover are made in one piece from a rectangular sheet of aluminium and fixed by means of four screws, thus allowing for access to mount components and wiring.

Next the printed circuit is etched and drilled as shown in Fig. 3. All the small components are then mounted and soldered to the printed circuit board as shown. The reservoir capacitor C2 is mounted on the print side of the board and lies between SW2 and VR1.



*An internal view of timer.*

The short connecting leads are soldered to the board ready for connection to the controls; the board is then ready for mounting. It is mounted on four 6BA×1in screws and spaced from the front panel by means of ½in-polythene spacers, cut from small bore polythene tubing. Great care must be taken when mounting the printed circuit board as it must be remembered that it is at mains potential, the case must be properly earthed, and a final check made on the clearances of all the components before connecting to the mains.

## Testing and Calibration

After completion, a continuity check is made between the earth pin on the mains plug and the case of the timer, also a check is made between the earth pin and the other two pins to make sure no leaks to case are present. A 250V 100W lamp is then connected to the enlarger lamp lead and the timer plugged into a 240V supply.

VR1 is rotated to the minimum resistance end of its travel and the push-button switch operated. The lamp should come on and extinguish after about a second. If it stays on longer the value of R2 should be reduced, if the interval is shorter, then its value is increased. VR1 is then set to the maximum resistance end of its travel and the push-button again operated, this time the lamp should stay on for about 80 secs.

The value of C1 should be reduced if a shorter time range is required, or increased, to lengthen the range. VR1 is then set to various positions and the scale marked with the appropriate times, using a stop watch to check the "lamp on" time. It will be found that the scale is not exactly linear as C1 charges exponentially.

## Operation

Operating the unit is perfectly straightforward, the time interval required is set on VR1 and the push-button is held in for 1 or 2 seconds then released. The lamp will not light until the push-button is released, this overcomes any ambiguity of when the timing cycle actually starts. It must be pointed out that unless the button is held in sufficiently long to allow C1 to fully discharge, the repeat accuracy will be impaired. ■

# Electronotes..

**S. GINSBERG**

It is a strange fact that the very simple, basic things which have been around us for centuries should often, quite suddenly, appear to be a major feature in science. Considering the growth of semiconductors as an example, who would have thought that glass, or silica, a substance found in great abundance on most seaside beaches, should prove to be a technology all of its own?

But it doesn't stop with transistors, the silica story continues as more uses are discovered. Ovinsky found that a simple bead of glass could be used as a switch. It had a very high resistance but when a certain voltage level was reached, the bead switched immediately from a high state to a low one. Now, this principle is being used to manufacture integrated circuits for computers. One company has introduced a 256-bit memory. It uses the ovonic glass bead principle and is located on a chip 119×120mm. One of the problems with some semiconductors memories is that when the power is switched off, the memory will not retain the information stored in it. Thus if power was accidently removed etc., all the information would be lost. This does not happen with the ovonic memory and if power is switched off, indeed the device can be removed from its 40-pin dual in-line socket, but when things return to normal, all the information is still there just as if nothing had happened.

Another problem with some forms of semiconductor memories is the difficulty in wiping the memory clean ready for reprogramming. Again, the ovonic memory does not have this trouble and reprogramming is a comparatively simple procedure.

With computers being persuaded to go faster and faster the question of speed arises. The figures for one American manufacturer's device gives the read access time as 50nS, a nanosecond being $10^{-9}$ second or 0·000000001 of a second!

The individual cells are easily read out since they are essentially in one of two states, either high or low resistance. Thus by simply applying a constant current to them and measuring the voltage the cell is read without changing its state and this is what allows it to retain the information even if the power is removed and/or the whole memory chip removed from its socket and then replugged.

There is no doubt at all that we haven't heard the last of glass. Note how it has featured in delay lines in colour television receivers. Space has run out, so we'll have to wait until another time to discuss the liquid crystal cell, a phenomenon which could make thin flat screen television tubes a practicality. Read-out displays are already being shown using this principle so this is no pipe dream.

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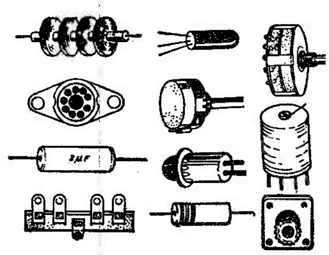

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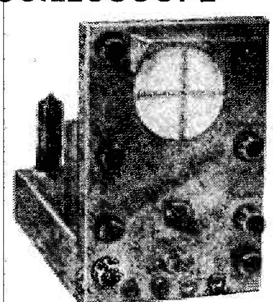

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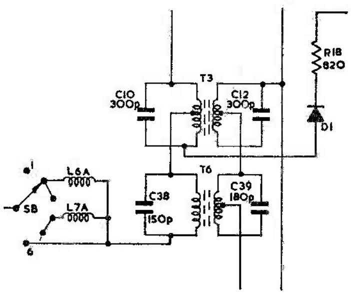
**UNDERSTAND CIRCUIT DIAGRAMS**

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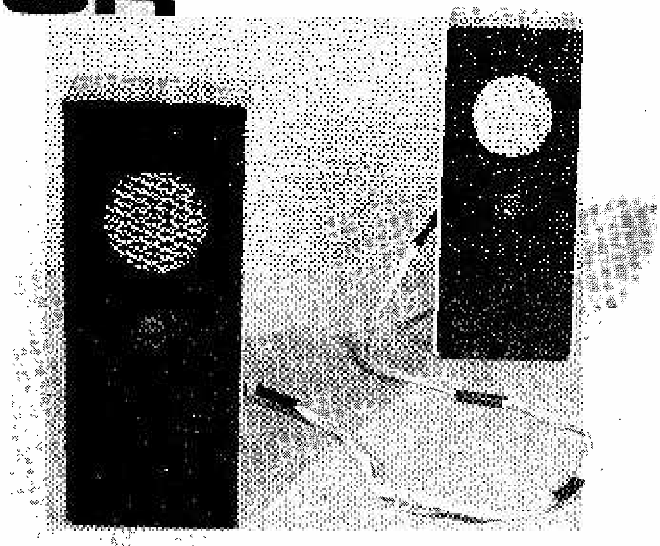
# TRANSISTOR INTERCOM

E. BUCKLAND



THERE are few homes that can't make use of an intercom system. The traditional "shack" can be connected to the house to save a long-suffering wife from perpetually trudging down to fetch you. Those without a companion may wish to hear the telephone or front doorbell when in the "shack" and those who are blest with offspring, whose cries cannot be heard over the TV, can use an intercom to monitor the noises of the nursery. Even communication from one room to another can be an advantage.

Commercial intercoms, usually imported from the Far East, are widely available and are inexpensive and this article is not meant to underestimate the advantages of buying such a unit. However intercoms are inexpensive to build, are suitable projects for the beginner and can often persuade other members of the family that they can gain at least something from your hobby.

The intercom described here is extremely simple—no transformers are used and all the problems of switching have been greatly simplified. Commercial designs usually incorporate a calling system, that is one that causes the remote end to sound rather like a buzzer. Such a facility is important if the output level is low but in the unit described here the sound level is high enough to allow such a calling device to be left out.

Construction has been kept very simple and is based on standard sized aluminium boxes which, when covered in plastic self-adhesive sheet, look quite attractive. The finished product will, after all, be in your home and messy lashups are not usually acceptable to other members of the family.

The intercom described here is a 2-station one; that is, parties at either end can call the other. The simplest theoretical way of building such a unit would be by having a microphone feeding an amplifier whose output was fed to the loudspeaker at the remote end. In this case the switch would simply apply battery volts to the amplifier. However such a system would need two microphones, two amplifiers and two loudspeakers.

The transistor intercom here only requires one amplifier and two loudspeakers and operates just as efficiently as the theoretically simpler version just described; the simple act of switching at either end converts the circuit to perform either way around.

## THE CIRCUIT

The complete circuit of the intercom is shown in Fig. 1. On the left is shown the sub-unit or slave unit as it is sometimes called. This comprises a miniature loudspeaker (2¼in diameter), a PP3 battery and a switch. Although the sub-unit has only these few components it has exactly the same facilities as the other which contains the amplifier.

A three-way cable runs to the other unit, this is shown as the encircled dotted line between the two units.

SW1 and SW2 are the controlling switches. Each of these are spring loaded push-button types and their positions shown in the circuit are "off" since this is their 'at-rest' position.

When SW1 is made, the battery in the sub-unit is connected via the interconnecting wire to the amplifier at the remote end. The "at-rest" position of SW2 means that the loudspeaker in the sub-unit is connected to the emitter of Tr1, acting as a microphone.

Not all miniature loudspeakers are suitable for use in this circuit as the impedance must be over 35Ω and miniature types are available with this, or higher impedance, the most common being 75Ω or 80Ω types.

Tr1 is connected in the common base mode. The base is connected to the negative line via C1, a 10μF capacitor, the bias is provided by R1 and the collector load by R2.

The characteristics of a common base amplifier are low input impedance, high output impedance and high voltage gain. The typical input impedance of this configuration is 50Ω at the emitter and this provides a very good match with the loudspeaker at the remote end, which is, of course, acting as a microphone.

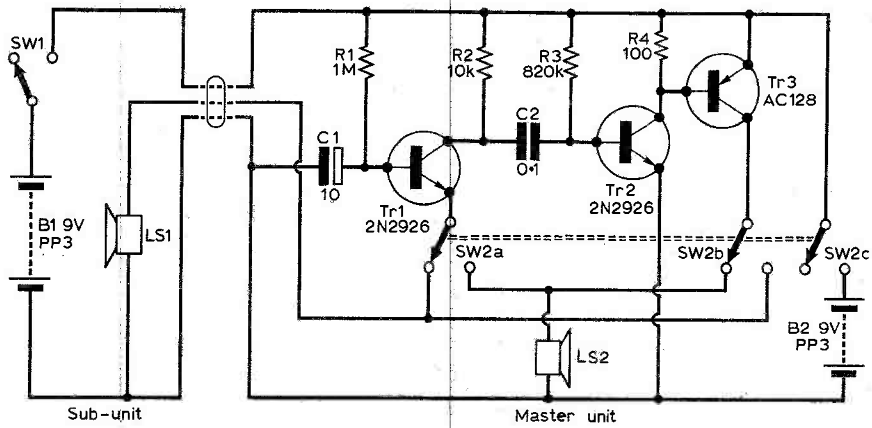



*Fig. 1: The circuit of both the master and sub units. The switches are shown in the 'at rest' positions*

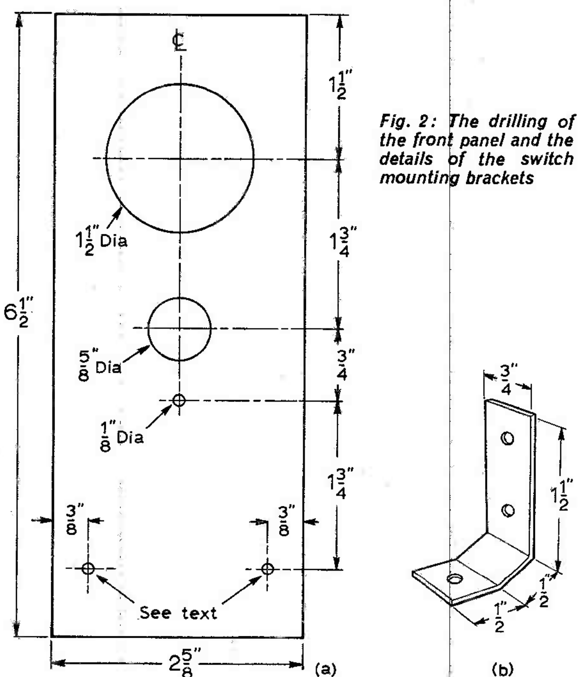
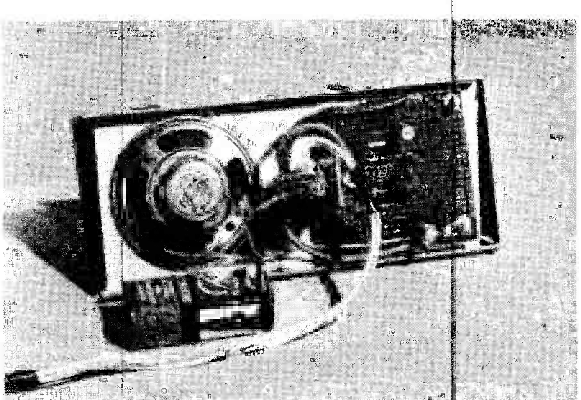



*Fig. 2: The drilling of the front panel and the details of the switch mounting brackets*



*An internal view of the master unit*

The output of the first stage is connected via C2 to Tr2 which further amplifies the signal, this time in common emitter mode. The base bias is provided by R3 and the collector load by R4, a 100Ω resistor.

Both Tr1 and Tr2 are high gain silicon N-P-N plastic encapsulated transistors type 2N2926. Tr3 however is an inverted P-N-P germanium type AC128.

## ★ components list

**Resistors**

| | | | |
|---|---|---|---|
| R1 | 1MΩ | R3 | 820kΩ |
| R2 | 10kΩ | R4 | 100Ω |

All ¼W, 10% types.

**Capacitors**

| | | | |
|---|---|---|---|
| C1 | 10μF 12V | C2 | 0·1μF |

**Transistors**

| | | | |
|---|---|---|---|
| Tr1 | 2N2926 | Tr3 | AC128 |
| Tr2 | 2N2926 | | |

**Miscellaneous**

| | |
|---|---|
| SW1, SW2 | Push button types, Henry's Radio (see text) |
| LS1, LS2 | High impedance miniature loudspeakers (see text) |
| B1, B2 | PP3, 9V batteries |
| Veroboard | Plain, 2¼ x 2¼in. |
| Chassis | H. L. Smith (see text) |

The emitter is at positive potential and the base is d.c. coupled to the collector of Tr2. This arrangement is a very suitable one as one connection of both the microphone (or rather loudspeaker coupled as a microphone) and the loudspeaker are at negative potential. The amplifier design is also rather efficient with a low quiescent current—about 7mA, yet the output reaches about 200mW. LS2 is coupled directly in the collector circuit of Tr3.

When the master unit wishes to call the sub-unit, SW2 is thrown. This applies battery to the amplifier, SW2a converts the local loudspeaker into a microphone and SW2b applies the output of Tr3 to the remote loudspeaker which in the previously described function was of course the microphone.

If SW1 and SW2 are both pressed the master unit overrides the sub-unit and both batteries are applied to the amplifier; no nasty effects take place.

### *CONSTRUCTION*

The push button switches used in the prototype, and highly recommended to anyone building the unit, are available from Henry's Radio and are listed in their catalogue as 'Single Button, Push Button Switch, Type 15.' These are latched types but if desired the latching mechanism can be removed (the way to do this is difficult to explain but will become immediately apparent on looking at it). For use as a baby alarm one of the switches can be left with the latching mechanism intact while removing the other. This will enable one of the units to be left on continually.

Both the master and the sub-units were built into small aluminium boxes sized $6\frac{1}{2} \times 2\frac{5}{8} \times 1\frac{7}{8}$in, avail-

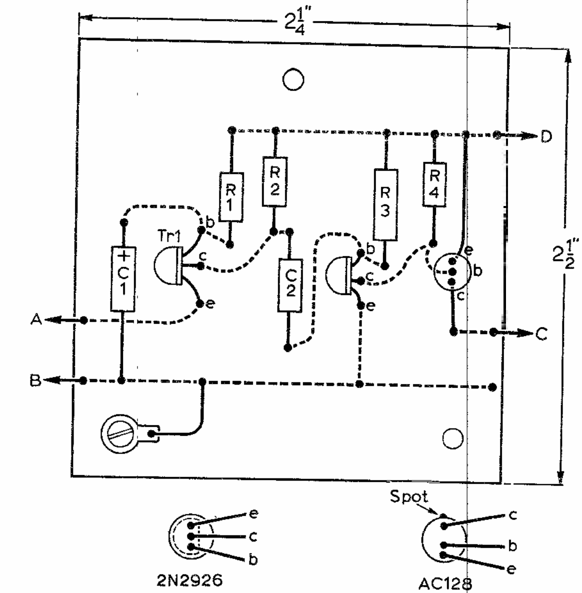



*Fig. 3: The layout on the circuit board viewed from the component side*

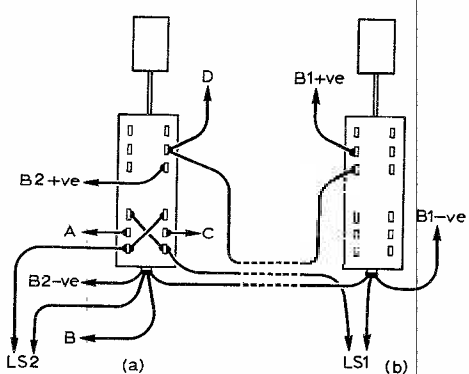



*Fig. 4: The switch wiring of (a) the master unit and (b) the sub unit*

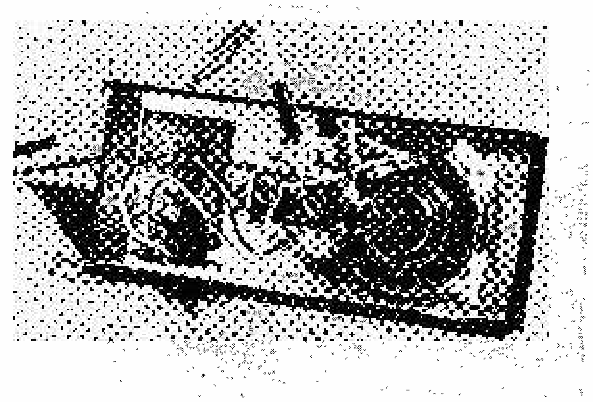
able from H. L. Smith Ltd., 287 Edgware Road, London W.2. The components are mounted on the lids in both cases and these should be drilled as shown in Fig. 2a.

The switches require rather a special bracket to mount them and this is shown in Fig. 2b. To avoid fouling a spring on the switch itself two spacers are needed between the bracket and the switch, in the prototype 4BA nuts were used.

The amplifier components are mounted on a small piece of plain Veroboard, $2\frac{1}{4}$in square and mounted below the switch of the main unit.

Three mounting screws are needed to hold this securely and while one is the extended part of the switch bracket mounting screw, the other two holes shown in the diagram are only needed on the master unit.

The components layout and transistor base con-



*An internal view of the sub unit*

nections, viewed from the lead ends, are shown in Fig. 3.

Only four connections are made to the board, but note that the chassis is connected to the negative line by a solder tag, wired to the battery negative on the component board which is trapped under one of the mounting nuts. The connections A, B, C and D, on the component board all run to the switch whose wiring is shown in Fig. 4. Both switches are shown and this drawing can be taken as the main wiring diagram.

The loudspeakers in the prototype were glued to the chassis lids behind an expanded metal grill; this method saves a lot of problems associated with miniature loudspeaker mounting.

Once completed there is no setting up procedure except that if Tr3 is found to get warm in operation over a period of time, a heat sink should be fitted over the body. A volume control is not necessary on this type of equipment and operation of either SW1 or SW2 should make the unit operate immediately. ■


TAKE 20. No. 24. April Issue.
Tr2 is incorrectly labelled Tr3 and vice versa; the circuit and other wiring details are correct.

**HI-FI SIGNAL GENERATOR. May Issue**
Fig. 1 and Fig. 3. R9 is shown as connecting to the wrong side of the thermistor in both cases. *Successful operation is not possible without this modification.*

**TAKE 20. No. 25. May Issue**
The connections of the 2N2926 are shown incorrectly. This month's Take 20 shows the correct ones.

**10 WATT AMPLIFIER. May Issue**
Fig. 1. The base connections of Tr1-2 are not correct. Reading down these should be e,c,b and *not* e,b,c. Fig. 5. VR2 and VR3 are labelled the wrong way around and the capacitors on VR3 should read C6 and C7 (not C7 and C8). C13 should connect between the slider of SW2 and the connection which runs to point J on the board. The circuit diagram is correct.

**ELECTRONIC IGNITION SYSTEM. June Issue**
Fig. 1. The connections to the SCR are incorrect. The gate connection (the 'angled' one) should go to chassis while the cathode should connect to D5. This means reversing the connections at the bottom of the SCR.

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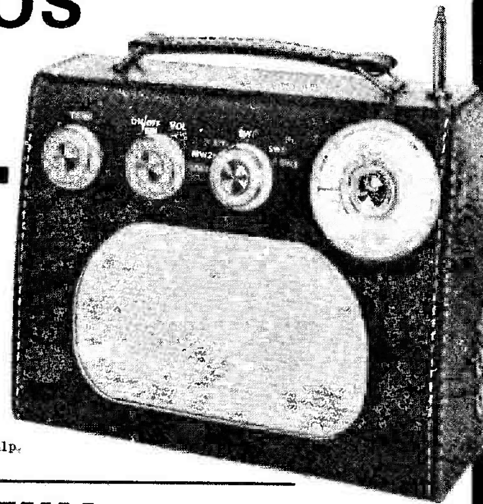

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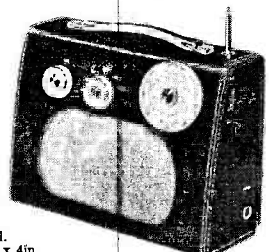

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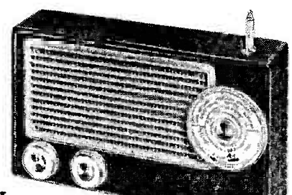

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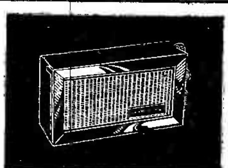

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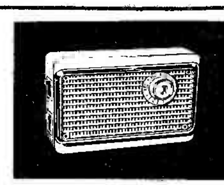

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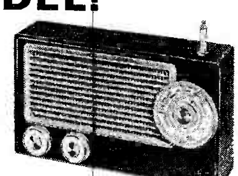

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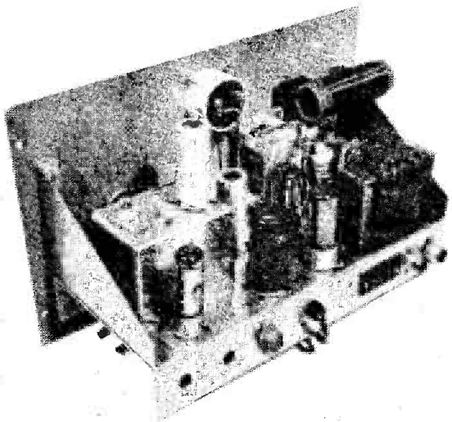

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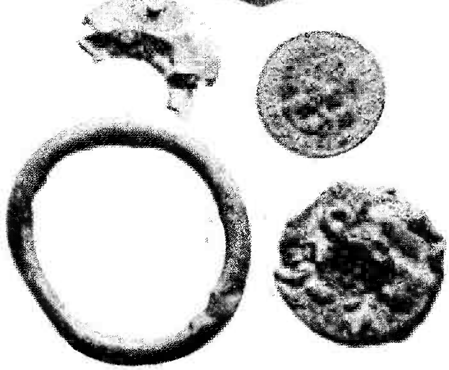

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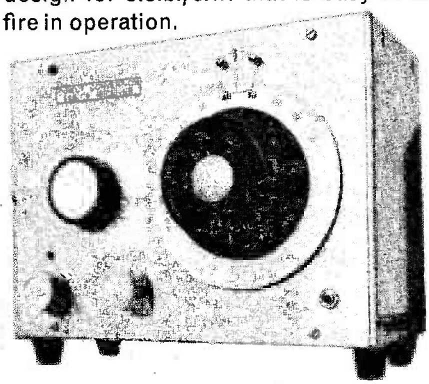

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# GOING BACK...

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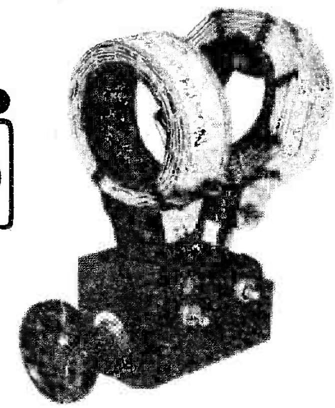


COLIN RICHES
ARTHUR DOW

IN the October 1948 issue of the American amateur radio magazine QST a short report appeared concerning the Bell Telephone's new "transistor" following the successful demonstration of a broadcast superhet receiver using these devices. However, the interesting part of the report was contained in the last paragraph. . . "It doesn't appear that there will be much use made of transistors in amateur work, unless it is in portable and/or compact audio amplifiers. The noise figure is said to be poor compared to that obtained with vacuum tubes. . .".

Don't worry, "Going Back" is not going solid-state, not yet, anyway! The object is to point out the similarity of attitude that obtained when the first of the thermionic triodes appeared. When De Forest stuck a third electrode into a Fleming diode in 1907 very little was made of this development for some time. This new triode could not only detect and amplify but also oscillate. However the poor vacuum techniques of the day resulted in the production of valves no two of which had the same characteristics.

When used in amplifiers the triode would often break into oscillation which was looked upon as a severe drawback and it was not until 1913 that this capability of the triode was put to good use by Meissner in an oscillator circuit with controlled feedback.

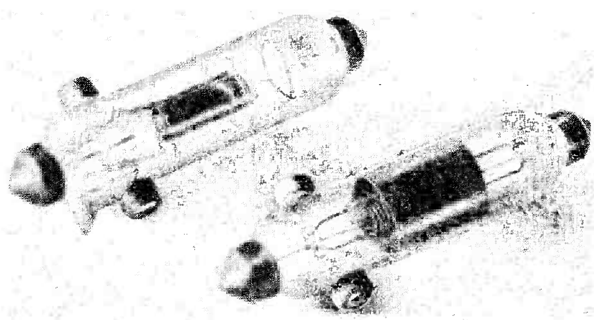
These valves were 'soft', that is they contained a certain amount of residual gas, and in consequence ionisation occured at quite low anode voltages. Round, of the Marconi Co., developed a triode which had a controlled amount of softness and a cylindrical metal anode that was the forerunner of modern types. Round, at one time, was personal assistant to Marconi himself and was, likewise, a prolific inventor with well over 100 inventions to his name. Captain Henry Joseph Round, M.C., A.R.C.Sc., as he became, died as recently as 1966 at the age of 85 after a lifetime of pioneering achievements in wireless communication.

The appreciation of the triode as an oscillator makes one wonder if any of the "undesirable" features of the modern transistor will one day be seen as advantages and put to good use.

To continue the story of the development of the triode . . . . when it was realised that residual gases were not a necessary requirement for the efficient operation of a thermionic valve the technique for obtaining a high vacuum advanced rapidly.

Armstrong, later to become famous for his development work on receiver circuits, produced a paper dealing with the many applications of the hard valve. At last valves were obtainable with repeatable and stable characteristics. The French military authorities were responsible for the development of the 'French' valve in 1915 which was used by the Allied armies and copied by the Germans. The British equivalent was the 'R' valve. The straight tungsten filament was surrounded by a helical grid and a cylindrical nickel anode although this type of construction led to problems with microphony.

The importance and the limitations of inter-electrode capacity was recognised and in some valve types the capacity was reduced by bringing out the anode and grid connections to separate horns or caps. This was done by Round in 1916 with his 'Q' valve.



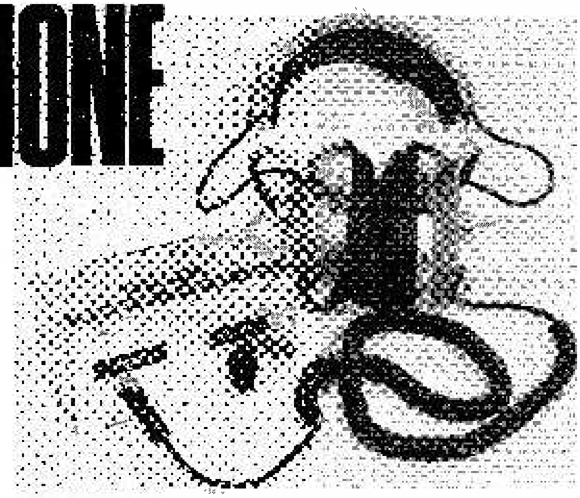
*Examples of the 'Q' and V24 valves.*

The tubular glass envelope was a close fit about the anode with the filament stretched between the end caps. One feature of the design was the considerable reduction in microphony. The Marconi V24 was somewhat similar although the inter-electrode spacings were smaller than those of the 'Q' valve.

German valve development flagged somewhat during the 1914-18 war and even in 1918 their Army still did not possess any valved transmitters although the French had fitted such equipment to aircraft and had supplied many to their Army.

The pure tungsten filaments consumed a fair amount of power, typically 3 watts for the 'R' valve, so research went on to find a suitable alternative which would have sufficient emission at lower

# STEREO HEADPHONE LISTENING



F. C. JUDD

STEREO reproduction via high quality stereo headphones is not just a matter of connecting the headphones to the loudspeaker terminals of a hi-fi amplifier. This could damage the headphones or almost deafen the listener, even at an average setting of the amplifier volume control. On the other hand if the volume control is low enough to ensure a comfortable level of sound from the headphones, there remains the hum and noise from the output stages of the amplifier which could be audibly quite high in sensitive stereo headphones.

Modern stereo amplifiers equipped with a socket for stereo headphone listening usually include suitable attenuation for the headphones. This automatically brings the hum and noise of the output stages down to the same level as would be reproduced by the loudspeakers and allows the amplifier volume control to be used at *average* settings, i.e., at volume levels that would normally be used for loudspeaker reproduction. Arrangements are also made, via the stereo headphone socket, to disconnect the loudspeakers when the headphone plug is inserted. Owners of stereo amplifiers so equipped can normally expect to use stereo headphones with (a) a suitable amount of attenuation provided within the amplifier to balance the signal-to-noise levels and (b) the loudspeakers automatically switched off. The latter condition also assumes that the output stages will be left working into a matched load which the headphones would not otherwise provide.

High quality stereo headphones are expensive (the PRO/4AA pair shown in the photo are made by Koss and retail at £28) and unless they are to be used with an amplifier equipped for direct connection of headphones as outlined, they most certainly deserve the relatively small expenditure necessary for a simple switching and matching system like that shown in Fig. 1. This provides for suitable attenuation for the headphones, suitable loading for the amplifier output stages and switching from loudspeakers to headphones or vice-versa. The circuit is quite simple and can be assembled in any small box, metal or otherwise, like that shown in the photo. The components required are a 4-way 2-pole switch (S1, S2, S3 and S4), input and output terminal strips or sockets for the loudspeakers, the three-way (sleeve, ring and tip) headphone jack socket and the matching resistors. The load resistors may be wire-wound 10Ω 10W and these will cater adequately for transistorised or valve output stages of 5 to 15Ω running at average listening level power. The two series resistors (R) are ordinary ¼W carbon types and will be about 200Ω. With the amplifier running on the loudspeakers, set the volume control to average listening level, which should be about one-third to half its travel from zero. The relative volume in the headphones should be about the same. If not, increase or decrease the value of each R accordingly. Make sure that the polarity of the speaker connections is carried through the matching unit. The usual connections for a three-way (sleeve, ring and tip) jack plug are shown in Fig. 2. Nearly all stereo headphones are supplied with this type of plug.

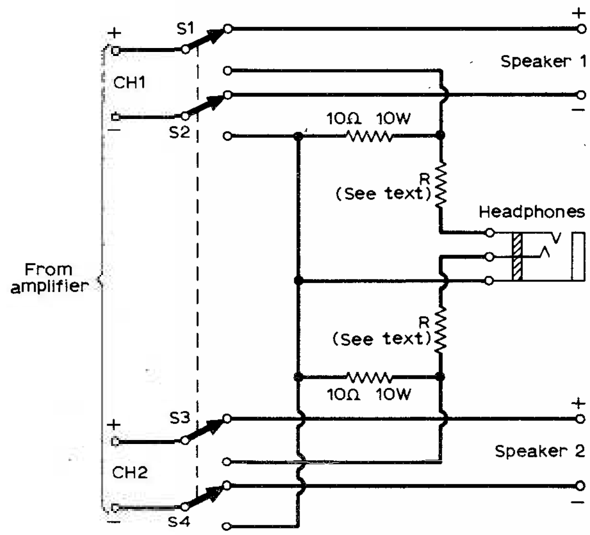



*Fig. 1: The basic stereo headphones listening circuit.*

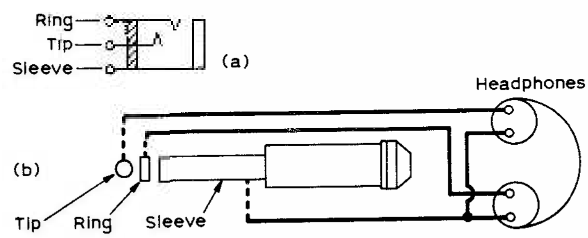



*Fig. 2: The usual connections for a three-way jack plug.*

A similar circuit is given in Fig. 3 and this employs potentiometers for setting the signal level to the

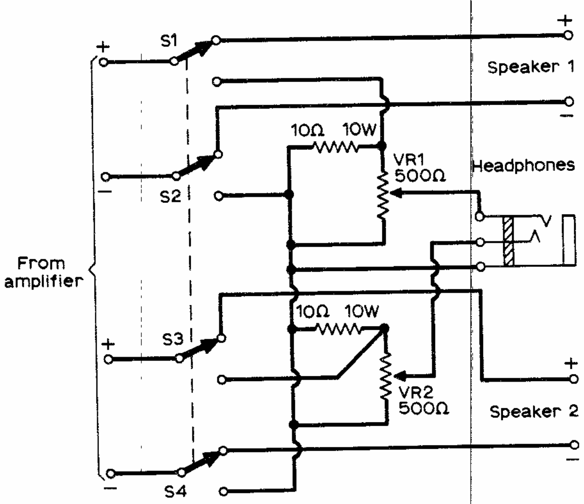



*Fig. 3: An arrangement employing potentiometers to set the audio level.*

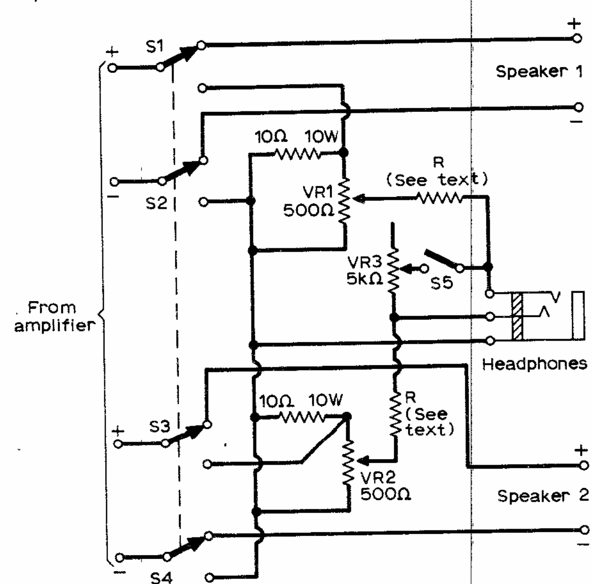



*Fig. 4: A more sophisticated arrangement allowing for individual balance and "width" control.*

## Suitable components

| | | |
|---|---|---|
| Changeover Switch S1, S2, S3, S4 | 4-way 2-pole | Home Radio Cat. No. WS12 |
| Potentiometers 500Ω WW | Colvern 1 Watt | Home Radio Cat. No. VR85G |
| Potentiometer 5000Ω WW | Clarostat with switch (S5) | Home Radio Cat. No. 44S |
| Loudspeaker 4 terminal connection strips | — | Henrys Radio Cat. No. TS64 |
| Jack Sockets (sleeve-tip-ring) | — | Henrys Radio Cat. No. M4023 |

headphones. The potentiometers (VR1, VR2) should be small wire-wound types which are more reliable than carbon track pre-sets. Each potentiometer is adjusted for a comfortable listening level with the amplifier volume control set at about one-third to half travel. This is best done with the amplifier running on mono, i.e., with both channels connected together in which case balance will be obtained when the sound is audibly central.

The circuit given in Fig. 4 is a rather more sophisticated arrangement allowing individual adjustment to each headphone via the potentiometers VR1 and VR2 which are pre-set for balance, etc., as described above. The third potentiometer VR3 is panel mounted next to the changeover switch and is wired in series with a switch (S5). The switch may be integrated with the control or a small separate panel mounted type. The object of VR3 is to provide control over stereo "width." The smaller the resistance, the narrower will be the stereo spread in the headphones.

There is no reason why the headphone socket should not be duplicated for the simultaneous connection of two pairs of headphones. No adjustment to the settings of series resistors (R) or pre-set potentiometers except as given above will be necessary. ■

**GOING BACK** *continued from page 250*

operating temperatures. The LT1 valve by Marconi-Osram in 1921 used a thoriated tungsten filament that needed only 0·6 watts, a considerable improvement.

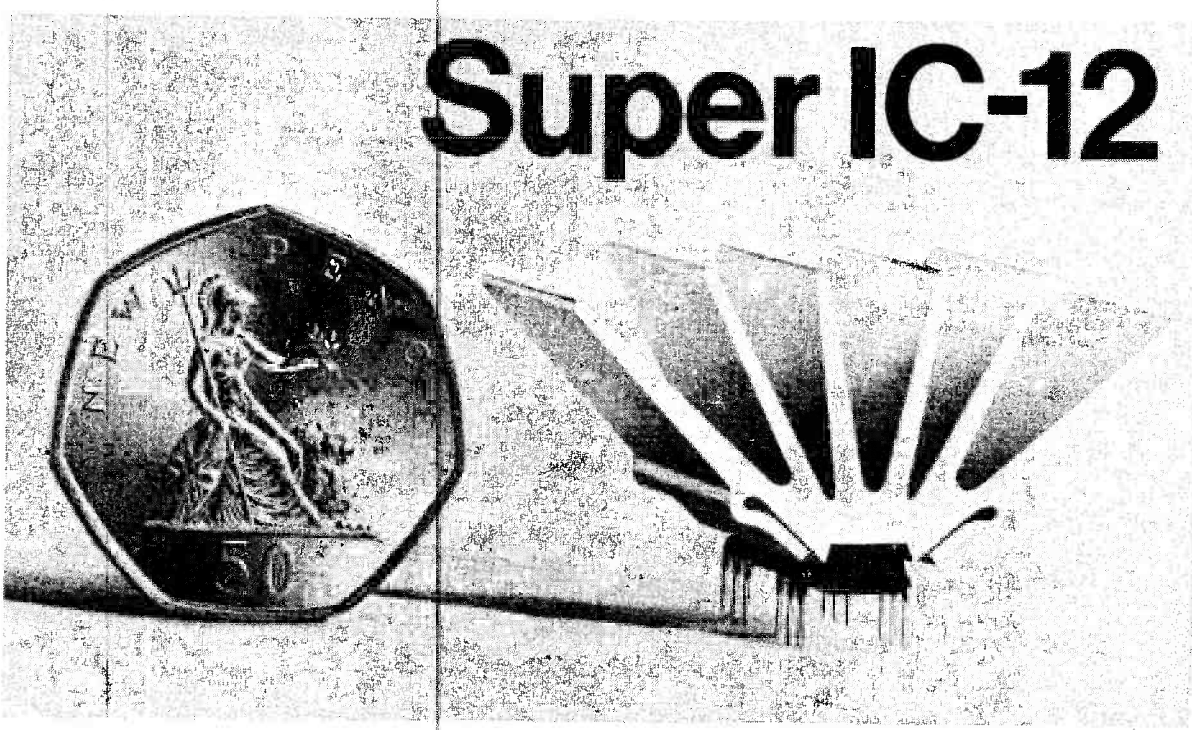
Another noteworthy advance in valve construction was the use of a magnesium 'getter'. A pellet of magnesium was fixed inside the valve and when the construction was finished the getter was flashed causing the familiar 'silver' inside the glass envelope. Any gas that might be subsequently released from the electrodes was absorbed by the getter.

Oxide coated filaments were also developed, using barium compounds, which generally replaced the thoriated types in low power applications.

The desirability of using mains-derived power supplies for the filaments led to the introduction of the indirectly heated cathode in 1922 consisting of a barium-oxide coated nickel cylinder with a tungsten wire heater inside it. Round had patented a similar idea in 1915 although he had proposed using a carbon filament inside a platinum tube. It was not until 1927 that the indirectly heated cathode became a commercial proposition. Further developments were mainly concerned with the introduction of additional electrodes such as grids and diodes.

# new

# Super IC-12



## High fidelity Monolithic Integrated Circuit Amplifier

Two years ago Sinclair Radionics announced the World's first monolithic integrated circuit Hi-Fi amplifier, the IC.10. Now we are delighted to be able to introduce its successor the Super IC.12. This 22 transistor unit has all the virtues of the original IC.10 plus the following advantages:

1. Higher power.
2. Fewer external components.
3. Lower quiescent consumption.
4. Compatible with Project 60 modules.
5. Specially designed built-in heat sink. No other heat sink needed.
6. Full output into 3, 4, 5 or 8 ohms.
7. Works on any voltage from 6 to 28 volts without adjustment.
8. NEW 22 transistor circuit.

**Output power** 6 watts RMS continuous (12 watts peak).
**Frequency Response** 5 Hz to 100KHz ± 1dB.
**Total Harmonic Distortion** Less than 1%. (Typical 0.1%) at all output powers and all frequencies in the audio band.
**Load Impedance** 3 to 15 ohms.
**Power Gain** 90dB (1,000,000,000 times) after feedback.
**Supply Voltage** 6 to 28 volts (Sinclair PZ-5 or PZ-6 power supplies ideal).
**Size** 22 x 45 x 28 mm including pins and heat sink.
**Input Impedance** 250 Kohms nominal.
**Quiescent current** 8mA at 28 volts.
**Price:** including FREE printed circuit board for mounting. **£2.98** Post free

With the addition of only a very few external resistors and capacitors the Super IC.12 makes a complete high fidelity audio amplifier suitable for use with pick-up, F.M. tuner etc. Alternatively, for more elaborate systems, modules in the Project 60 range such as the Stereo 60 and A.F.U. may be added. The comprehensive manual supplied with each unit gives full circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include car radios, oscillators etc. The very low quiescent consumption makes the Super IC.12 ideal for battery operation.

Sinclair Radionics Ltd., London Rd, St. Ives
Huntingdonshire PE17 4HJ
Telephone St Ives (048 06) 4311

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# 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.

| | System | The Units to use | together with | Cost of Units |
|---|---|---|---|---|
| A | Simple battery record player | **Z.30** | Crystal P.U., 12V battery volume control | **£4.48** |
| B | Mains powered record player | **Z.30, PZ.5** | Crystal or ceramic P.U. volume control etc. | **£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. | **£23.90** |
| 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. | **£26.90** |
| E | 40+40W. R.M.S. de-luxe stereo amplifier | **2 x Z.50s, Stereo 60 PZ.8, mains trsfrmr** | As for D | **£34.88** |
| F | Outdoor P.A. system | **Z.50** | Mic., up to 4 P.A. speakers controls, etc. | **£5.48** |
| G | Indoor P.A. | **Z.50, PZ.8, mains transformer** | Mic., guitar, speakers, etc., controls | **£19.43** |
| H | High pass and low pass filters | **A.F.U.** | C, D or E | **£5.98** |
| J | Radio | **Stereo F.M. Tuner** | C, D or E | **£25.00** |

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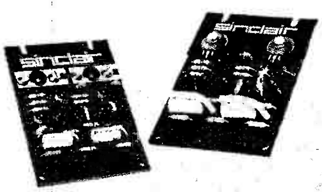
# Sinclair Project 60

## 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** ***(Z50 units are inter-changeable 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 ±1dB.
**Distortion**: 0.02% into 8 ohms.
**Signal to noise ratio**: better than 70dB un-weighted.
**Input sensitivity**: 250mV into 100 Kohms.
For speakers from 3 to 15 ohms impedance.
Size $3\frac{1}{2}$ x $2\frac{1}{4}$ x $\frac{1}{2}$ in.
**Z.30**
*Built tested and guaranteed with circuits and instructions manual* **£4.48**
**Z.50**
*Built, tested and guaranteed with circuits and instructions manual.* **£5.48**

## 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 stablised supply is essential.
**PZ-5** *30 volts unstabilised* **£4.98**
**PZ-6** *35 volts stabilised* **£7.98**
**PZ-8** *45 volts stabilised (less mains transformer)* **£7.98**
**PZ-8** *mains transformer* **£5.98**

## 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

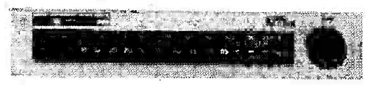
Designed for the Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate 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 ± 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 + 15 to –15dB at 10KHz: BASS + 15 to–15dB at 100Hz.
**Front panel**: brushed aluminium with black knobs and controls.
**Size**: $8\frac{1}{4}$ x $1\frac{1}{2}$ x 4 ins.
*Built, tested and guaranteed.* **£9.98**

## Active Filter Unit

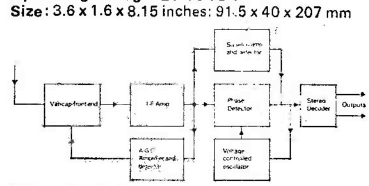
For use between Stereo 60 unit and two Z.30s or Z.50s, and is easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and 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 28kHz 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* **£5.98**

## 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**: 2μV for 30dB quieting: 7μV for full limiting.
**Squelch level**: 20μV.
**A.F.C. range**: ±200 KHz
**Signal to noise ratio**: >65dB
**Audio frequency response**: 10Hz—15KHz (±1dB)
**Total harmonic distortion**: 0.15% for 30% modulation
**Stereo decoder operating level**: 2μV
**Pilot tone suppression**: 30dB
**Cross talk**: 40dB
**I.F. frequency**: 10.7 MHz
**Output voltage**: 2 x 150mV R.M.S.
**Aerial Impedance**: 75 Ohms
**Indicators**: Mains on: Stereo on: tuning indicator
**Operating voltage**: 25-30 VDC
**Size**: 3.6 x 1.6 x 8.15 inches: 91.5 x 40 x 207 mm




**Price: £25** built and tested. Post free

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for which I enclose cash/cheque/money order.

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# Sinclair Q16/Micromatic

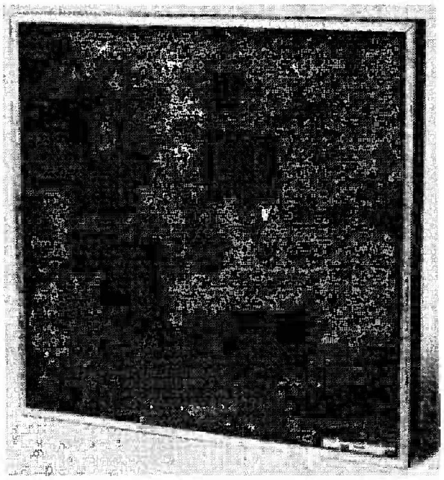
### Q16 High fidelity loudspeaker

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 without loss.

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 RMS.
**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 special cone suspension for excellent transient response.
**Size and styling:** 9¾ in. square on face x 4¾ in. deep with neat pedestal base. Black all over cellular foam front with natural solid teak surround.
**Price £8.98.**



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### 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 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 (1.8 x 1.3 x 0.5 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 KHz).
**Earpiece:** Magnetic type.
**On/off switching:** By inserting and withdrawing earpiece plug.
Kit in pack with earpiece, case, instructions and solder **£2.48.**
Ready built, tested and guaranteed, with earpiece **£2.98.**
*Two Mallory Mercury batteries type RM675 required from radio shops, chemists, etc.*


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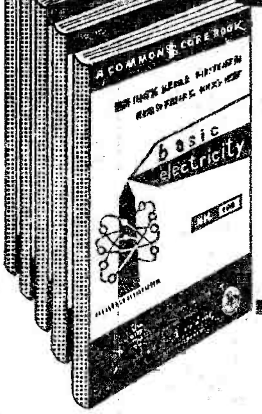


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| | | 6BA6 | 25 | 6J6 | 20 | 7C5 | £1·13 | 12SR7 | 35 | 37 | 40 | DAF91 | 25 | EBL31 | £1·38 | EL41 | 55 | N78 | £1·00 | PL504 | 80 | U404 | 40 |
| | | 6BE6 | 30 | 6J7M | 45 | 7C6 | 75 | 14H7 | 50 | 42 | 50 | DAF96 | 42 | EC90 | 33 | EL42 | 58 | N108 | £1·50 | PL508 | 90 | U801 | £1·18 |
| | | 6BH8 | 45 | 6J7G | 30 | 7D5 | 55 | 19AQ5 | 40 | 50B5 | 45 | DCC90 | £1·00 | ECC81 | 33 | EL84 | 25 | OA2 | 38 | PL509 | £1·45 | UABC80 | 35 |
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| 1CP31 | £6·00 | 6BQ7A | 40 | 6K6GT | 55 | 7R7 | 70 | 20F2 | 70 | 50CD6G | £1·65 | DF70 | 45 | ECC83 | 30 | ELL80 | £1·00 | OZ4 | 40 | PX4 | £2·00 | UBC41 | 50 |
| 1D5 | 40 | 6BR7 | 85 | 6K7M | 85 | 7S7 | £2·25 | 20L1 | £1·10 | 50L6GT | 50 | DF91 | 25 | ECC84 | 30 | EM34 | 90 | PC86 | 60 | PX25 | £2·00 | UBC81 | 45 |
| 1H5 | 42 | 6BR8 | 65 | 6K7G | 20 | 7Y4 | 60 | 20P4 | £1·10 | 75 | 50 | DF92 | 20 | ECC85 | 25 | EM80 | 40 | PC88 | 60 | PY33 | 63 | UBF80 | 40 |
| IN5GT | 48 | 6BS7 | £1·30 | 6K7GT | 25 | 9BW6 | 50 | 20P5 | £1·20 | 78 | 45 | DF96 | 42 | ECC88 | 40 | EM81 | 63 | PC97 | 50 | PY81 | 30 | UBF89 | 38 |
| IR5 | 35 | 6BW6 | 85 | 6K8M | 60 | 10C2 | 63 | 25A6 | 35 | 80 | 50 | DH3-91 | £6·00 | ECH21 | 63 | EM84 | 38 | PCC84 | 40 | PY82 | 30 | UCC84 | 48 |
| IS4 | 27 | 6BW7 | 70 | 6K8G | 35 | 10F1 | 90 | 25L6GT | 45 | 85A2 | 40 | DH77 | 30 | ECH35 | 60 | EY51 | 40 | PCC89 | 53 | PY83 | 38 | UCC85 | 40 |
| IS5 | 25 | 6C4 | 33 | 6K8GT | 50 | 10F3 | 90 | 25Y5 | 60 | 150B2 | 60 | DK32 | 40 | ECH42 | 70 | EY86 | 40 | PCC189 | 55 | PY500 | £1·00 | UCF80 | 55 |
| IT4 | 25 | 6C5G | 30 | 6K25 | 75 | 10F9 | 50 | 25Z4 | 45 | 150C4 | 60 | DK91 | 35 | ECH81 | 30 | EZ35 | 35 | PCF80 | 33 | PY800 | 50 | UCH42 | 70 |
| 3A4 | 35 | 6C6 | 25 | 6L6G | 45 | 10F13 | 45 | 25Z5GT | 55 | 801 | 50 | DK92 | 50 | ECH83 | 43 | EZ40 | 45 | PCF82 | 35 | PY801 | 50 | UCH81 | 35 |
| 3Q4 | 40 | 6CD6G | £1·20 | 6L18 | 45 | 10LD11 | 60 | 25Z6 | 65 | 807 | 50 | DK96 | 42 | ECL80 | 40 | EZ41 | 48 | PCF84 | 50 | R2 | 60 | UCL82 | 38 |
| 3Q5 | 45 | 6CH6 | 55 | 6Q7G | 30 | 10P13 | 68 | 30C1 | 33 | 813USA | £3·75 | DL66 | £1·25 | ECL82 | 35 | EZ80 | 28 | PCF86 | 60 | R19 | 40 | UCL83 | 60 |
| 3S4 | 35 | 6CW4 | 63 | 6Q7GT | 43 | 11E3 | £4·00 | 30C15 | 80 | 866A | 75 | DL92 | 35 | ECL83 | 65 | EZ81 | 28 | PCF801 | 50 | S130 | £1·75 | UF41 | 60 |
| 3V4 | 45 | 6D6 | 25 | 6SA7M | 40 | 12AT6 | 30 | 30C17 | 85 | 954 | 60 | DL93 | 35 | ECL86 | 45 | GY501 | 80 | PCF802 | 50 | SP4 | 50 | UF89 | 38 |
| 5R4GY | 60 | 6E5 | 38 | 6SC7M | 70 | 12AT7 | 33 | 30C18 | 75 | 1625 | 40 | DL94 | 45 | ECLL800 | | GZ30 | 50 | PCF805 | 75 | SP41 | 45 | UL41 | 65 |
| 5U4G | 33 | 6F1 | 70 | 6SG7M | 35 | 12AU6 | 30 | 30F5 | 85 | 4022AR | £5·00 | DL95 | 40 | | £1·50 | GZ32 | 50 | PCF806 | 70 | SP61 | 55 | UL84 | 35 |
| 5V4G | 42 | 6F5G | 50 | 6SH7M | 35 | 12AU7 | 30 | 30FL1 | 75 | 5763 | 70 | DL96 | 42 | EF9 | £1·00 | GZ34 | 60 | PCF808 | 78 | STV280/80 | | UM80 | 28 |
| 5Y3GT | 32 | 6F6G | 30 | 6SJ7GT | 30 | 12AX7 | 30 | 30FL12 | 95 | 7193 | 20 | DM70 | 40 | EF37A | 60 | HN309 | £1·50 | PCL82 | 38 | | £10·00 | UU6 | £1·05 |
| 5Z4G | 40 | 6F8G | 35 | 6SK7GT | 30 | 12BA6 | 35 | 30FL14 | 75 | 7475 | 40 | DY86 | 33 | EF39 | 40 | KT36 | £1·00 | PCL83 | 58 | SU25 | £1·00 | UU7 | £1·05 |
| 6/30L2 | 75 | 6F11 | 38 | 6SL7GT | 35 | 12BE6 | 35 | 30L15 | 85 | A61 | 48 | DY87 | 35 | EF41 | 65 | KT61 | £1·25 | PCL84 | 43 | SU2150 | 75 | UU8 | £1·05 |
| 6A7 | 75 | 6F13 | 38 | 6SN7GT | 35 | 12C8GT | 35 | 30L17 | 85 | ATP4 | 85 | E88CC | 85 | EF50 | 25 | KT66 | £1·70 | PCL85 | 40 | T41 | £1·00 | UU9 | 45 |
| 6A8G | 63 | 6F14 | 65 | 6SQ7GT | 40 | 12E1 | £1·35 | 30P4 | £1·12 | ATP5 | 60 | EA50 | 20 | EF80 | 25 | KT81 | £1·75 | PCL86 | 45 | TDD4 | 50 | UY21 | 50 |
| 6AK5 | 30 | 6F23 | 80 | 6U4GT | 60 | 12J5GT | 25 | 30P12 | 80 | ATP7 | 50 | EABC80 | 35 | EF85 | 35 | KT81(7C5) | | PD500 | £1·50 | TH41 | £1·75 | UY41 | 45 |
| 6AM5 | 32 | 6F24 | 75 | 6U5G | 40 | 12J7GT | 35 | 30P19 | 80 | AU2 | £4·00 | EAF42 | 55 | EF86 | 33 | | £1·13 | PENA4 | £1·00 | U10 | 60 | UY85 | 33 |
| | | 6F25 | 75 | 6V6M | 60 | 12K7GT | 35 | 30PL1 | 80 | AU5 | 60 | EB91 | 20 | EF89 | 28 | KT88 | £1.75 | PENB4 | £1·00 | U14 | 60 | VMP4G | 35 |
| 6AM6 | 33 | 6F28 | 70 | 6V6G | 30 | 12K8GT | 50 | 30PL13 | 93 | AZ1 | 48 | EBC33 | 50 | EF91 | 38 | KTW61 | £1·00 | PEN45 | 40 | U19 | £2·50 | VP4B | £1·25 |
| 6AQ5 | 35 | 6F32 | 25 | 6V6GT | 38 | 12Q7GT | 85 | 30PL14 | 90 | AZ31 | 55 | EBC41 | 55 | EF92 | 40 | KTZ41 | 45 | PEN46 | 40 | U25 | 78 | VR105/30 | 38 |
| 6AS7G | 80 | 6G6 | 25 | 6X4 | 30 | 12SA7GT | 40 | 35A5 | 75 | CBL31 | 90 | EBC90 | 30 | EF98 | 75 | ML4 | 38 | PL36 | 55 | U26 | 78 | VR150/30 | 35 |
| 6AT6 | 30 | 6H6 | 28 | 6X5G | 35 | 12SC7 | 35 | 35L6 | 50 | CCH35 | 75 | EBF80 | 40 | EF183 | 33 | ML6 | 40 | PL81 | 50 | U78 | 30 | VU111 | 60 |
| 6AU6 | 25 | 6J5M | 50 | 6X5GT | 35 | 12SH7 | 30 | 35W4 | 30 | CL33 | £1·00 | EBF83 | 45 | EF184 | 35 | | | PL82 | 45 | U191 | 75 | VU120 | 80 |
| 6B4G | £1·00 | 6J5G | 20 | 7B6 | 70 | 12SJ7 | 30 | 35Z3 | 60 | CY30 | 63 | EBF89 | 33 | EL32 | 30 | M8P4 | 50 | PL83 | 45 | U251 | 80 | VU508 | £2·50 |
| 6B8G | 20 | 6J5GT | 80 | 7B7 | 45 | 12SK7 | 45 | 35Z4GT | 50 | CY31 | 43 | EBL1 | 70 | EL33 | 63 | MU14 | 60 | PL84 | 40 | U301 | 63 | W81M | 63 |
| | | | | | | | | 35Z5 | 40 | DAC32 | 42 | EBL21 | 60 | EL34 | 53 | MX40 | 63 | PL500 | 80 | U403 | 50 | Y63 | 50 |

## Transistors

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2N2218 | 30 | 2N4289 | 18 | AD149 | 50 | BC169C | 13 | GET882 | 25 | NKT223 | 38 | OAZ200 | 55 | OC35 | 50 | OC81D | 20 | ZS170 | 10 |
| | | | | 2N2219 | 33 | AAZ12 | 30 | AD161 | 88 | BF898 | 28 | GJ7M | 38 | NKT251 | 24 | OAZ201 | 50 | OC44 | 18 | OC82 | 25 | ZS271 | 18 |
| | | | | 2N2369A | 20 | AC126 | 25 | AF115 | 30 | BFY50 | 23 | KS100A | 20 | NKT713 | 25 | OAZ207 | 48 | OC45 | 15 | OC82D | 15 | ZTX107 | 15 |
| 1N914 | 08 | 2N697 | 18 | 2N2646 | 58 | AC127 | 25 | AF117 | 25 | BFY51 | 20 | MJE520 | 88 | OA70 | 10 | OAZ210 | 33 | OC57 | 60 | OC84 | 25 | ZTX108 | 15 |
| 1S113 | 25 | 2N706 | 10 | 2N2904 | 30 | AC128 | 25 | ASY26 | 25 | BY100 | 18 | MJE2955 | | OA71 | 10 | OAZ222 | 40 | OC58 | 60 | OC170 | 25 | ZTX300 | 13 |
| 1S202 | 23 | 2N1132 | 30 | 2N2926 | 13 | ACY20 | 23 | BC107 | 13 | BZY88 | 18 | | £1·75 | OA81 | 10 | OAZ224 | 38 | OC59 | 65 | OC171 | 30 | ZTX304 | 28 |
| 2G302 | 23 | 2N1305 | 25 | 2N3055 | 75 | ACY39 | 55 | BC108 | 13 | CR81-40 | 48 | MJE3055 | 93 | OA85 | 13 | OAZ241 | 28 | OC71 | 15 | OC200 | 38 | ZTX500 | 15 |
| 2G371 | 23 | 2N2147 | 75 | 2N3702 | 13 | AD140 | 50 | BC109 | 13 | DD003 | 15 | NKT212 | 27 | OA91 | 08 | OAZ242 | 23 | OC72 | 25 | OCP71 | 98 | ZTX503 | 20 |
| 2N404 | 23 | 2N2160 | 63 | 2N3819 | 35 | | | | | GET102 | 30 | NKT214 | 15 | OA211 | 33 | OAZ246 | 23 | OC81 | 25 | ORP12 | 50 | ZTX531 | 30 |

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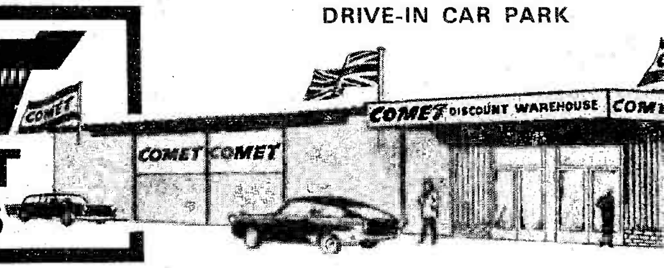


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| TELETON 201X FM | 36·00 | 30·00 |

All above Tuners are complete with MPX Stereo Decoder except where starred.

| | Rec. Retail Price | Comet Price |
|---|---|---|
| **TUNER/AMPLIFIERS** | | |
| AKAI AA 8500 | 229·00 | 181·00 |
| AKAI 6600 | 142·53 | 112·00 |
| ARENA R500 | 82·00 | 67·00 |
| ARENA 2400 | 90·30 | 72·00 |
| 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 Module 80, 35w. R.M.S. | 95·00 | 75·00 |
| GOODMANS 3000 | 77·73 | 53·00 |
| MIDLAND 19/542 | 49·56 | 37·50 |
| PHILIPS RH 790 | 139·00 | 112·00 |
| PIONEER SX770 AM/FM | 160·43 | 126·00 |
| PIONEER SX990 AM/FM | 194·74 | 150·00 |
| PIONEER 440 | 111·10 | 89·00 |
| *TELETON F2000 | 51·50 | 32·00 |
| TELETON 7 AT 20 | 105·00 | 80·00 |
| TELETON 10AT1 150w. RMS | 160·00 | 109·00 |
| TELETON TFS50 | 82·50 | 56·00 |
| TELETON TFS 50LA MW/LW/VHF | 87·50 | 64·90 |
| *TELETON R.8000 with Speakers | 63·25 | 50·00 |
| TELETON CR55 | 120·00 | 95·00 |
| WHARFEDALE 100.1 | 149·00 | 119·00 |

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.

| | Rec. Retail Price | Comet Price |
|---|---|---|
| **PICKUP ARMS** | | |
| GOLDRING Lenco L75 | 12·33 | 10·50 |
| GOLDRING Lenco L69 | 9·29 | 7·00 |
| SME 3009 with S2 Shell | 34·47 | 28·00 |
| SME 3012 with S2 Shell | 36·71 | 31·50 |
| **CARTRIDGES** | | |
| GOLDRING 800 | 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 |
| EMPIRE 100ZE/X | 63·00 | 52·50 |
| EMPIRE 999VE/X | 44·50 | 36·00 |
| EMPIRE 999TE/X | 27·60 | 22·50 |
| EMPIRE 999SE/X | 21·00 | 17·50 |
| EMPIRE 999E/X | 16·50 | 13·00 |
| EMPIRE 999/X | 11·50 | 9·25 |
| EMPIRE 909E/X | 12·85 | 10·25 |
| EMPIRE 909/X | 9·00 | 7·50 |
| EMPIRE 90EE/X | 9·75 | 8·00 |
| ORBIT Magnetic NM 22 | Special Price | 2·90 |
| 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 M44-5 | 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 M75-6 | 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 | 40·76 | 30·00 |
| SHURE V15-11-7 | 38·90 | 29·00 |

Starred cartridges above are ceramic. All others are magnetic.

**TURNTABLES**

**GARRARD AP76 turntable, complete with Goldring G.800 Cartridge base and cover. Special Price 30·95**

**GARRARD SP25, Mk III fully wired with Goldring G800 Magnetic Cartridge. Complete with base, plinth and cover— Special Price 21·98**

GARRARD 2025 fully wired with Sonotone 9TA HC Cartridge complete with base and cover Special Price 15·50

GOLDRING 705/P turntable, complete with Goldring G850 cartridge, base and cover ........ 25·00 15·95

| | Rec. Retail Price | Comet Price |
|---|---|---|
| DUAL 1219 transcription | 60·40 | 50·00 |
| DUAL 1209 transcription | 42·62 | 35·00 |
| GARRARD SP25 Mk III | 16·45 | 11·90 |
| GARRARD SL65 B | 21·25 | 15·90 |
| GARRARD SL75 B | 39·20 | 29·50 |
| GARRARD SL95 B | 50·01 | 38·50 |
| GARRARD 401 | 38·07 | 29·50 |
| GARRARD SL72 B | 33·11 | 27·90 |
| GARRARD 3500, with GKS Cartridge | 17·23 | 12·90 |
| Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500 | Special Price | 4·00 |
| GARRARD 40B | 13·84 | 10·97 |
| GARRARD AP 76 | 28·88 | 21·50 |
| GOLDRING GL69 Mk. II | 26·63 | 22·50 |
| GOLDRING GL69 P Mk. II | 35·14 | 29·50 |
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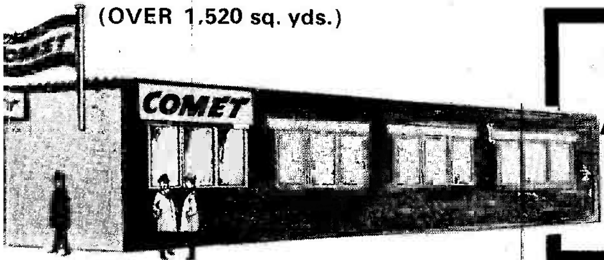
| GOLDRING GL75 P | 46·94 | 41·90 |
| GOLDRING Covers for 69P and 75P | 4·21 | 3·50 |
| GOLDRING C99—plinth and cover for G99 | 11·45 | 9·90 |
| GOLDRING G99 | 26·00 | 23·90 |
| GOODMANS 3025 | 37·74 | 26·90 |
| McDONALD MP 60 | 15·75 | 12·95 |
| McDONALD 610 | 20·00 | 16·50 |
| Base and Cover for McDONALD MP 60 and 610 | Special Price | 4·50 |
| PHILIPS 228 | 20·00 | 17·00 |
| PHILIPS GA 146 | 31·50 | 25·00 |
| PHILIPS 202 Electronic | 69·00 | 57·50 |
| PIONEER PL 12A with base & cover | 49.93 | 37·95 |
| THORENS TX 25 cover | 8·85 | 7·00 |
| THORENS TD125 | 79·04 | 64·95 |
| THORENS TD150A Mk. II | 46·16 | 35·95 |
| THORENS TD125AB | 120·20 | 100·00 |
| THORENS TD150AB Mk. II | 49·96 | 42·95 |
| THORENS TX11 Cover | 4·43 | 3·95 |

| | Rec. Retail Price | Comet Price |
|---|---|---|
| **SPEAKERS** | | |
| ARENA HT 16 | 13·00 | 10·95 |
| B & W Model 70 | 159·50 | 121·95 |
| B & W DM3 | 63·00 | 49·95 |
| B & W DM1 | 32·00 | 25·50 |
| CELESTION Ditton 120 | 24·00 | 18·00 |
| CELESTION Ditton 15 | 32·00 | 25·50 |
| CELESTION Ditton 25 | 65·00 | 51·50 |
| GOODMANS Minister | 25·00 | 21·20 |
| GOODMANS Magister | 62·50 | 47·95 |
| GOODMANS Maxim | 20·39 | 16·75 |
| GOODMANS Mezzo 3 | 34·00 | 26·50 |
| GOODMANS Magnum K2 | 44·00 | 33·00 |
| KEF Cresta | 22·17 | 18·00 |
| KELETRON KN 500 4 speaker system (pair) | 23·00 | 17·95 |
| KELETRON KN 700 4 speaker system (pair) | 27·50 | 21·95 |
| KELETRON KN 1000 4 speaker system | 19·25 | 14·95 |
| KELETRON KN 1500 4 speaker system | 24·75 | 19·95 |
| KELETRON KN 2000 4 speaker system | 28·75 | 21·95 |
| LEAK 200 | 24·95 | 18·90 |
| LEAK 300 | 32·50 | 23·95 |
| 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 (pair) | 39·00 | 25·95 |
| METROSOUND HFS 10 (pair) | 27·44 | 22·95 |
| 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 | 15·95 |
| WHARFEDALE Speakers | | |
| Airedale | 69·50 | 54·95 |
| Denton | 19·95 | 15·90 |
| Super Linton | 24·95 | 20·50 |
| Melton | 32·50 | 25·50 |
| Dovedale 3 | 42·50 | 32·50 |
| Rosedale | 65·00 | 52·50 |
| Triton (pair) | 59·90 | 46·90 |
| Unit 3 Speaker Kit | 13·00 | 10·50 |
| Unit 4 Speaker Kit | 18·00 | 14·25 |
| Unit 5 Speaker Kit | 26·00 | 20·50 |
| **CHASSIS SPEAKERS** | | |
| GOODMANS Axiette 8 | 8·10 | 6·50 |
| GOODMANS Twinaxiette 8 | 9·17 | 7·50 |
| GOODMANS Axiom 10 | 9·16 | 7·75 |
| GOODMANS Axiom 80 | 28·31 | 23·75 |
| GOODMANS Axiom 201 | 14·45 | 10·95 |

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| GOODMANS Audiom 8P | 5·55 | 4·25 |
| GOODMANS Audiom 10P | 6·05 | 3·58 |
| GOODMANS Audiom 51 | 13·05 | 9·75 |
| GOODMANS Audiom 61 | 18·95 | 14·00 |
| GOODMANS 12P | 12·37 | 10·00 |
| GOODMANS 15P | 20·00 | 16·97 |
| GOODMANS Audiom 18P | 34·00 | 26·97 |
| GOODMANS Twin Axiom 10 | 10·23 | 8·25 |
| GOODMANS ARU 172 | 4·50 | 3·50 |
| GOODMANS Trebax 100 | 8·60 | 6·00 |
| GOODMANS Trebax 5K/20XL | 9·70 | 7·50 |
| GOODMANS Midax | 12·95 | 9·00 |
| GOODMANS Attenuator | 3·55 | 2·50 |
| GOODMANS Crossover Networks XO/950/5000 | 9·75 | 7·25 |
| GOODMANS Crossover Networks XO/950 | 7·40 | 5·75 |
| GOODMANS Crossover Networks XO/5000 | 2·65 | 2·00 |
| WHARFEDALE 8 in. Bronze/RS/DD | 5·00 | 4·00 |
| 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 |

**HI-FI STEREO SYSTEMS** (complete)

| | | |
|---|---|---|
| ARENA MR15 | 145·00 | 115·95 |
| ALBA UA552 | 47·50 | 35·95 |
| ALBA UA662 | 62·97 | 47·95 |
| BUSH System 749/746/764 | 102·65 | 82·65 |
| DECCA Sound 603 | 72·50 | 58·95 |
| DECCA Sound 604 | 72·50 | 60·95 |
| DECCA Sound 1203 | 97·50 | 78·95 |
| DECCALIAN 5, complete with stand. | 65·50 | 52·95 |
| EKCO SRG 609 | 88·50 | 69·95 |
| EKCO ZU5 | 165·00 | 135·00 |
| FERGUSON 3422 | 87·85 | 69·95 |
| FERGUSON 3423 | 118·25 | 94·95 |
| FERGUSON 3424 | 123·15 | 99·95 |
| FERGUSON 3425 | 145·10 | 111·95 |
| FIDELITY Music Master UA2 | 46·00 | 34·95 |
| FIDELITY Music Master UA1 | 98·00 | 82·95 |
| GOODMANS 3000 Suite | 140·45 | 92·95 |
| H.M.V. 2416 | 129·70 | 103·00 |
| H.M.V. 204/5/6 | 202·85 | 165·00 |
| K.B. KA1250, complete with two 653 speakers | 72·00 | 59·95 |
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| LEAK 30/GOLDRING/WHARFEDALE | 182·65 | 142·95 |
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| MARCONI Unit 4 | 77·45 | 66·95 |
| MARCONI Unit 3 | 86·00 | 69·95 |
| METROSOUND Stereo 1010 | 77·32 | 65·95 |
| PHILIPS GF823 | 51·50 | 41·95 |
| PHILIPS GF824 | 69·50 | 56·95 |
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| PHILIPS GF834 | 88·00 | 73·95 |
| PHILIPS 882 (less L/S) | 99·00 | 78·50 |
| PHILIPS GF417 | 99·50 | 82·95 |
| TELETON 2S60F, with Stereo Radio | 75·00 | 55·95 |
| TELETON CRIOT 2025/1003, with Stereo Radio | 62·10 | 45·95 |
| TOSHIBA SP8507 | 248·00 | 175·00 |
| ULTRA 6405 | 79·95 | 66·95 |

**TAPE RECORDERS AND TAPE DECKS**

| | Rec. Retail Price | Comet Price |
|---|---|---|
| AKAI M10L | 245·05 | 189·00 |
| AKAI X200D | 190·00 | 159·95 |
| AKAI X5000 W/L | 177·98 | 140·00 |
| AKAI X330 | 342·57 | 269·00 |
| AKAI X-330D | 312·56 | 245·00 |
| AKAI X-360 | 380·03 | 284·00 |
| AKAI X-360 D-deck | 318·92 | 243·00 |
| AKAI 1800SD | 199·42 | 167·00 |
| AKAI 1710L | 89·85 | 65·95 |
| AKAI CR80 8-track stereo recorder | 115·03 | 99·95 |
| AKAI CR80D 8-track stereo tape deck | 95·00 | 79·95 |
| AKAI 4000 4-track Stereo | 124·90 | 99·95 |
| AKAI 4000 D 4-track Stereo deck | 89·95 | 69·95 |
| BUSH TP 60 Cassette Tape Recorder | 29·40 | 24·95 |
| BUSH TP 70 Cassette Battery/Mains Tape Recorder | 29·95 | 23·95 |
| BUSH Discassette DC70 | 21·95 | 16·95 |
| FERGUSON 3252 4-track | 104·30 | 83·95 |
| FERGUSON 3245 Twin track | 38·00 | 29·95 |
| FERGUSON 3246 4-track | 44·10 | 34·95 |
| FERGUSON 3247 4-track | 49·65 | 39·95 |
| FERGUSON 3248 4-track | 55·65 | 43·95 |
| FERROGRAPH 722 | 266·41 | 219·00 |
| FERROGRAPH 724 | 266·41 | 219·00 |
| FERROGRAPH 702 2 track tape deck | 228·71 | 193·00 |
| FERROGRAPH 704/W 4 track tape deck | 228·71 | 193·00 |
| GRUNDIG C200L Cassette | 39·90 | 29·95 |
| GRUNDIG TK 141 (4-track) | 61·85 | 49·95 |
| GRUNDIG TK 121 (Twin-track) | 56·85 | 43·95 |
| GRUNDIG TK 146 (4-track Auto) | 68·14 | 53·95 |
| GRUNDIG TK 149 4-track | 57·63 | 47·95 |
| MIDLAND TC 144 cassette | 18·00 | 13·95 |
| PHILIPS 2202 Cassette Tape Rec. | 29·90 | 23·95 |
| PHILIPS 2205 Cassette Tape Rec. | 43·15 | 34·95 |
| PHILIPS 4307 | 49·50 | 38·95 |
| PHILIPS 4404 4-track stereo recorder | 95·00 | 73·95 |
| PHILIPS 4407 4-track stereo recorder | 110·00 | 89·95 |
| PHILIPS 4302 Twin Track Auto | 39·00 | 32·00 |
| PHILIPS 4500 4-Track Stereo Tape Deck | 126·00 | 98·95 |
| PHILIPS 4408 4-Track Stereo | 139·00 | 109·00 |
| PHILIPS 4308 | 60·50 | 46·50 |
| PYE Cassette Recorder/Radio (Batt./Mains) | 45·50 | 36·95 |
| TELETON 511 Batt./mains cassette | 29·50 | 17·50 |
| TELETON FXB 510 D 4-track Stereo | 67·50 | 52·00 |
| TELETON TRC 130 cassette, with VHF/AM radio. Battery/mains twin motors | 41·75 | 31·90 |
| TELETON TC110 cassette, battery/mains | 27·75 | 20·00 |
| TOSHIBA GT 840 S | 110·00 | 67·95 |
| TOSHIBA GT 601v Twin Track | 45·15 | 29·95 |
| TOSHIBA 850 SA | 94·00 | 59·95 |

**BASES AND COVERS**

| | | |
|---|---|---|
| GARRARD WB1 Base | 3·86 | 3·25 |
| GARRARD WB4 Base | 5·69 | 4·75 |
| GARRARD SPC 1 Cover | 3·74 | 3·00 |
| GARRARD SPC 4 Cover | 4·44 | 3·75 |
| Special offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500 | Special Price | 4·00 |
| GOLDRING Plinth 75 | 8·52 | 7·00 |
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| GOLDRING Covers for 69P and 75P | 4·21 | 3·50 |
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| THORENS TX11 Cover | 4·11 | 3·75 |
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| SME Plinth System 2000 | 39·20 | 31·25 |
| MOTORBOARDS only | 4·95 | 3·00 |

**TEAK CASES**

| | | |
|---|---|---|
| Leak 70/30 Amp. case | 7·50 | 6·50 |
| Leak Tuner case | 7·50 | 6·50 |
| Leak Double case for amp. & tuner | 10·50 | 8·95 |

## COMPLETE HI-FI SYSTEMS

Completely wired, mounted and ready for use

| | Rec. Retail Price | Comet Price |
|---|---|---|
| GOODMANS AUDIO SUITE, Goodmans Maxamp stereo amplixer, Goodmans stereomax AM/FM Tuner with decoder. Pair of Goodmans Magnum K2 speakers, Garrard AP76 turntable in base, complete with cover and Goldring G800 Cartridge. Beautifully finished in walnut | 257·13 | 169·96 |
| METROSOUND 448 8-track stereo play-back unit complete with 2 HFS 10 Speakers | 83·56 | 70·95 |
| TELETON Stereo 8 track tape Audio system complete with speakers | 54·75 | 48·00 |
| GARRARD SP 25, Mk. III mounted in base, plinth and cover with GOLDRING G800 Cartridge. Teleton 203 or 206 Stereo Amplifier 12 watts RMS, and 2 KELETRON KN500 Speakers, each speaker is a 4 speaker system | 88·33 | 58·95 |
| PIONEER PL 12 turntable, Goodmans Maxamp, Shure M55E Cartridge, 2 Keletron KN 700 speakers (each speaker cabinet contains 4 speakers) | 144.38 | 105·00 |
| GARRARD AP76 turntable complete with Goldring G800 Cartridge, base and cover, Rogers Ravensbrook Amplifier in teak case and 2 Goodmans Minister Speakers | 142·41 | 108·50 |
| 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 | 200·50 | 154·20 |
| THORENS TD 150AB Mk. II with TX11 dust cover, SHURE M55E Cartridge, LEAK Stereo 70 Amplifier in Teak case. 2 Wharfedale Dovedale 3 Speakers | 226·87 | 175·00 |
| THORENS TD 125AB Electronic Turntable complete with cover. SHURE V15-11 Cartridge, GOODMANS Maxamp, GOODMANS Stereomax AM/FM Tuner. 2 GOODMANS Magister Speakers | 422·48 | 309·00 |


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| 2G302 | 20p | 2N3404 | 32½p | 40310 | 45p | BC212L | 12½p | BSX28 | 32½p | NKT281 | 27½p |
| 2G303 | 20p | 2N3405 | 45p | 40311 | 35p | BCY30 | 27½p | BSX60 | 82½p | NKT401 | 87½p |
| 2G306 | 42½p | 2N3414 | 22½p | 40312 | 47½p | BCY31 | 30p | BSX61 | 62½p | NKT402 | 90p |
| 2G308 | 30p | 2N3415 | 22½p | 40314 | 37½p | BCY32 | 50p | BSX76 | 22½p | NKT403 | 75p |
| 2G309 | 30p | 2N3416 | 37½p | 40320 | 47½p | BCY33 | 25p | BSX77 | 27½p | NKT404 | 62½p |
| 2G371 | 15p | 2N3417 | 37½p | 40323 | 32½p | BCY34 | 30p | BSX78 | 27½p | NKT405 | 75p |
| 2G374 | 20p | 2N3570 | £1·25 | 40324 | 47½p | BCY38 | 40p | BSY10 | 27½p | NKT406 | 62½p |
| 2G381 | 22½p | 2N3572 | 97½p | 40326 | 37½p | BCY39 | 60p | BSY11 | 27½p | NKT451 | 62½p |
| 2N404 | 22½p | 2N3605 | 27½p | 40329 | 30p | BCY40 | 50p | BSY24 | 15p | NKT452 | 62½p |
| 2N696 | 20p | 2N3606 | 27½p | 40344 | 27½p | BCY42 | 15p | BSY25 | 15p | NKT453 | 47½p |
| 2N697 | 20p | 2N3607 | 22½p | 40347 | 57½p | BCY43 | 15p | BSY26 | 17½p | NKT603F | 32½p |
| 2N698 | 25p | 2N3702 | 12½p | 40348 | 52½p | BCY54 | 32½p | BSY27 | 17½p | NKT613F | 32½p |
| 2N706 | 12½p | 2N3703 | 12½p | 40360 | 42½p | BCY58 | 22½p | BSY28 | 17½p | NKT674F | 30p |
| 2N705A | 12½p | 2N3704 | 17½p | 40361 | 47½p | BCY59 | 22½p | BSY29 | 17½p | NKT677F | 30p |
| 2N708 | 15p | 2N3705 | 15p | 40362 | 57½p | BCY60 | 97½p | BSY32 | 25p | NKT713 | 25p |
| 2N709 | 62½p | 2N3706 | 12½p | 40370 | 32½p | BCY70 | 20p | BSY36 | 25p | NKT781 | 30p |
| 2N718 | 25p | 2N3707 | 15p | 40406 | 57½p | BCY71 | 42½p | BSY37 | 25p | NKT10419 | 30p |
| 2N726 | 30p | 2N3708 | 09p | 40407 | 40p | BCY72 | 17½p | BSY38 | 22½p | NKT10439 | |
| 2N727 | 30p | 2N3709 | 10p | 40408 | 52½p | BCZ10 | 27½p | BSY39 | 22½p | | 37½p |
| 2N914 | 17½p | 2N3710 | 11p | 40410 | 62½p | BCZ11 | 42½p | BSY40 | 32½p | NKT10519 | |
| 2N916 | 17½p | 2N3711 | 12p | 40467A | 57½p | BD116 | £1·12½ | BSY51 | 32½p | | 32½p |
| 2N918 | 30p | 2N3715 | £2·22½ | 40468A | 35p | BD121 | 65p | BSY52 | 32½p | NKT20329 | |
| 2N929 | 22½p | 2N3716 | £2.90 | 40600 | 57½p | BD123 | 82½p | BSY53 | 37½p | | 47½p |
| 2N930 | 27½p | 2N3791 | £2.75 | AC107 | 30p | BD124 | 82½p | BSY54 | 40p | NKT20339 | |
| 2N1090 | 22½p | 2N3819 | 35p | AC126 | 20p | BD131 | 75p | BSY56 | 90p | | 37½p |
| 2N1091 | 22½p | 2N3823 | 97½p | AC127 | 25p | BD132 | 85p | BSY78 | 47½p | NKT80111 | |
| 2N1131 | 25p | 2N3854 | 27½p | AC128 | 20p | BDY10 | £1·37½ | BSY79 | 45p | | 77½p |
| 2N1132 | 25p | 2N3854A | 27½p | AC154 | 22½p | BDY11 | £1·62½ | BSY82 | 52½p | NKT80112 | |
| 2N1302 | 17½p | 2N3855 | 27½p | AC176 | 25p | BDY17 | £1·50 | BSY90 | 57½p | | 97½p |
| 2N1303 | 17½p | 2N3855A | 30p | AC187 | 62½p | BDY18 | £1·75 | BSY95A | 12½p | NKT80113 | |
| 2N1304 | 22½p | 2N3856 | 30p | AC188 | 37½p | BDY19 | £1·97½ | BSW41 | 42½p | | £1.12 |
| 2N1305 | 22½p | 2N3856A | 35p | ACY17 | 27½p | BDY20 | £1·12½ | BSW70 | 27½p | NKT80211 | |
| 2N1306 | 25p | 2N3858 | 25p | ACY18 | 25p | BDY38 | 97½p | C111 | 75p | | 92½p |
| 2N1307 | 25p | 2N3858A | 30p | ACY19 | 25p | BDY60 | £1·25 | C424 | 27½p | NKT80212 | |
| 2N1308 | 30p | 2N3859 | 27½p | ACY20 | 25p | BDY61 | £1·25 | C425 | 55p | | 92½p |
| 2N1309 | 30p | 2N3859A | 32½p | ACY21 | 25p | BDY62 | £1·00 | C426 | 40p | NKT80213 | |
| 2N1507 | 17½p | 2N3860 | 30p | ACY22 | 20p | BF115 | 25p | C428 | 37½p | | 92½p |
| 2N1613 | 25p | 2N3866 | £1.50 | ACY28 | 20p | BF117 | 47½p | C744 | 30p | NKT80214 | |
| 2N1631 | 35p | 2N3877 | 40p | ACY40 | 20p | BF163 | 37½p | D16P1 | 37½p | | 92½p |
| 2N1632 | 30p | 2N3877A | 40p | ACY41 | 25p | BF167 | 25p | D16P2 | 40p | NKT80215 | |
| 2N1638 | 27½p | 2N3900 | 37½p | ACY44 | 40p | BF173 | 32½p | D16P3 | 37½p | | 92½p |
| 2N1639 | 27½p | 2N3900A | 40p | AD140 | 52½p | BF177 | 30p | D16P4 | 40p | NKT80216 | |
| 2N1671B | £1·00 | 2N3901 | 97½p | AD149 | 57½p | BF178 | 30p | GET102 | 30p | | 92½p |
| 2N1711 | 25p | 2N3903 | 35p | AD150 | 62½p | BF179 | 30p | GET113 | 20p | OC20 | 75p |
| 2N1889 | 32½p | 2N3904 | 35p | AD161 | 37½p | BF180 | 35p | GET114 | 20p | OC22 | 50p |
| 2N18[illegible]3 | 37½p | 2N3905 | 37½p | AD162 | 37½p | BF181 | 32½p | GET118 | 20p | OC23 | 60p |
| 2N2147 | 82½p | 2N3906 | 37½p | AF106 | 42½p | BF184 | 25p | GET119 | 20p | OC24 | 60p |
| 2N2148 | 57½p | 2N4058 | 17½p | AF114 | 25p | BF185 | 42½p | GET120 | 52½p | OC25 | 50p |
| 2N2160 | 57½p | 2N4059 | 10p | AF115 | 25p | BF194 | 17½p | GET873 | 12½p | OC26 | 27½p |
| 2N2193 | 40p | 2N4060 | 12½p | AF116 | 25p | BF195 | 20p | GET880 | 30p | OC28 | 62½p |
| 2N2193A | 42½p | 2N4061 | 12½p | AF117 | 25p | BF196 | 42½p | GET887 | 20p | OC29 | 62½p |
| 2N2194A | 30p | 2N4062 | 12½p | AF118 | 62½p | BF197 | 42½p | GET889 | 22½p | OC35 | 50p |
| 2N2217 | 27½p | 2N4244 | 47½p | AF119 | 20p | BF198 | 42½p | GET890 | 22½p | OC36 | 62½p |
| 2N2218 | 32½p | 2N4285 | 17½p | AF124 | 22½p | BF200 | 52½p | GET896 | 22½p | OC41 | 22½p |
| 2N2219 | 32½p | 2N4286 | 17½p | AF125 | 20p | BF224 | 20p | GET897 | 22½p | OC42 | 25p |
| 2N2220 | 25p | 2N4287 | 17½p | AF126 | 20p | BF225 | 20p | GET898 | 22½p | OC44 | 20p |
| 2N2221 | 25p | 2N4288 | 17½p | AF127 | 17½p | BF237 | 22½p | MJ400 | £1·07½ | OC45 | 12½p |
| 2N2222 | 30p | 2N4289 | 17½p | AF139 | 37½p | BF238 | 22½p | MJ420 | £1·12½ | OC46 | 15p |
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| | £1·07½p | 2N4291 | 17½p | AF179 | 72½p | BFW61 | 47½p | MJ430 | £1·02½ | OC71 | 12½p |
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| 2N2368 | 17½p | 2N4303 | 47½p | AF181 | 42½p | BFX13 | 22½p | MJ480 | 97½p | OC74 | 32½p |
| 2N2369 | 17½p | 2N5027 | 52½p | AF239 | 42½p | BFX29 | 30p | MJ481 | £1·25 | OC75 | 22½p |
| 2N2369A | 17½p | 2N5028 | 57½p | AF279 | 47½p | BFX30 | 30p | MJ490 | £1·00 | OC76 | 22½p |
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| IS121 | 17½p | BA142 | 32½p | BY127 | 17½p | OA81 | 07½p |
| IS130 | 12½p | BA144 | 12½p | BY164 | 57½p | OA85 | 07½p |
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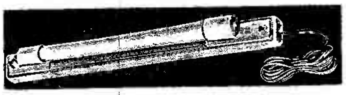

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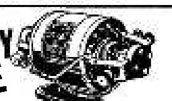

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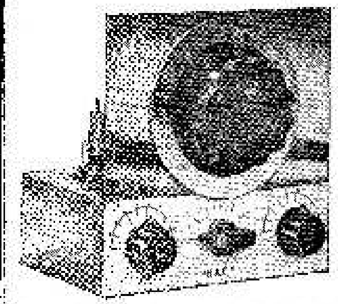

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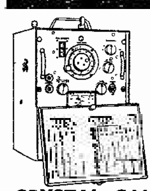

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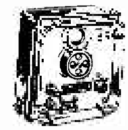

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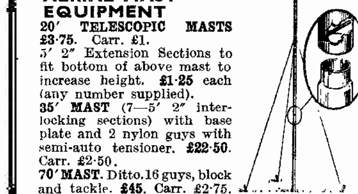

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**35' MAST** (7—5' 2" interlocking sections) with base plate and 2 nylon guys with semi-auto tensioner. **£22·50.** Carr. £2·50.
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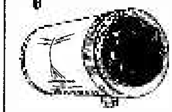

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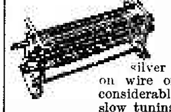
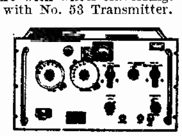


Improved version to above but with 'Roller Coaster' design silver or silver plated wheel traversing on wire on ceramic former. Will handle considerable RF. Logging dial with fast and slow tuning.
ONLY **£2·75.** P. & p. 37½p.
**A.T.U. OPEN TYPE.** Mounted on ceramic former and feet. 16G silver or silver plated wire with wheel traversing. In original packing. As used with No. 53 Transmitter. ONLY **£2·50.** P. & p. 50p.

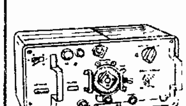
**VHF COMMUNICATION RECEIVER 1392**



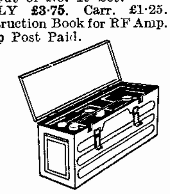
Frequency range 95—150 MHz. Normally crystal controlled model. Supplied for tuneable operation. Power requirements 240v AC 80mA 6·3v-4A. ONLY **£8·50.** Carr. £1. Complete station with PSU and Control Unit. ONLY **£12·50.** Carr. £2·50. **No. 19 TM/RC.** Rebuilt. Complete station with PSU, Cables, Mic, Aerial etc. **£22·50.** Carr. £3.

**No. 19 SET 500uA METERS**
Scaled 0–600 and 0–15V. Brand new, boxed **£1·25** Post Paid. (Quantity prices on request.)

**ALL No. 19 SPARES IN STOCK**
Complete instruction book with circuits for No. 19 Equipment. **37½p** Post Paid.



**R.F. AMPLIFIER.** To increase output of No. 19 Set. ONLY **£3·75.** Carr. £1·25. Instruction Book for RF Amp. **37½p** Post Paid.



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| 6v. | 40 AH | 10½" x 9½" x 5" | **£2·25.** | Carr. £1 |
| 6v. | 85 AH | 13" x 9½" x 7" | **£3·25.** | Carr. £1·25 |
| 6v. | 100/125AH | 15" x 11" x 7" | **£3·62½.** | Carr. £1·25 |
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Suitable for Farms, Building Sites etc. Communication up to 5 miles or more. Rugged construction, will last a lifetime. ONLY **£5·75** PAIR. Carr. £1. (Twin telephone wire for above available—ask for price.)
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| OA2 | 0.38 | 6AQ6 | 0.55 | 6F1 | 0.70 | 9BW6 | 0.50 |
| OA3 | 0.45 | 6AR5 | 0.35 | 6F5 | 0.50 | 10C2 | 0.50 |
| OB2 | 0.35 | 6AR6 | 0.40 | 6F6G | 0.30 | 10D1 | 0.50 |
| OB3 | 0.60 | 6AR11 | 1.25 | 6F11 | 0.38 | 10D2 | 0.40 |
| OC3 | 0.38 | 6AS5 | 0.35 | 6F13 | 0.38 | 10F1 | 0.90 |
| OD3 | 0.35 | 6AS7G | 0.80 | 6F14 | 0.65 | 10F9 | 0.50 |
| 1B3GT | 0.38 | 6AT6 | 0.30 | 6F15 | 0.65 | 10F18 | 0.45 |
| 1CP31 | 6.00 | 6AU6 | 0.25 | 6F18 | 0.45 | 10L1 | 0.45 |
| 1L4 | 0.20 | 6AV6 | 0.30 | 6F23 | 0.80 | 10LD11 | 0.60 |
| 1R4 | 0.35 | 6AW8A | 0.55 | 6F24 | 0.75 | 10P13 | 0.55 |
| 1R5 | 0.35 | 6BA6 | 0.25 | 6F25 | 0.75 | 10P14 | 1.10 |
| 1S4 | 0.27 | 6BE6 | 0.30 | 6F26 | 0.35 | 12AB5 | 0.60 |
| 1S5 | 0.25 | 6BF5 | 0.80 | 6F28 | 0.60 | 12AC6 | 0.40 |
| 1T4 | 0.25 | 6BF6 | 0.50 | 6J4 | 0.50 | 12AL5 | 0.45 |
| 1U4 | 0.27 | 6BH6 | 0.45 | 6J5GT | 0.30 | 12AQ5 | 0.43 |
| 1U5 | 0.50 | 6BJ6 | 0.45 | 6J7 | 0.45 | 12AT6 | 0.30 |
| 1V2 | 0.45 | 6BK7A | 0.55 | 6K6GT | 0.55 | 12AT7 | 0.33 |
| 1X2B | 0.40 | 6BN5 | 0.43 | 6K7 | 0.35 | 12AU6 | 0.30 |
| 2D21 | 0.35 | 6BN6 | 0.40 | 6K8G | 0.35 | 12AU7 | 0.30 |
| 3A4 | 0.35 | 6BQ5 | 0.25 | 6K25 | 0.75 | 12AV6 | 0.33 |
| 3B28 | 2.15 | 6BR8 | 0.65 | 6L6GT | 0.45 | 12AV7 | 0.50 |
| 3BP1 | 2.75 | 6BS7 | 1.30 | 6L7 | 0.40 | 12AX7 | 0.30 |
| 3Q4 | 0.40 | 6BW6 | 0.85 | 6L18 | 0.45 | 12AY7 | 0.70 |
| 3S4 | 0.35 | 6BW7 | 0.70 | 6LD20 | 0.40 | 12B44 A | 0.55 |
| 3V4 | 0.45 | 6BX6 | 0.25 | 6N7GT | 0.40 | 12BA6 | 0.35 |
| 5R4GY | 0.60 | 6BZ6 | 0.35 | 6P1 | 0.60 | 12BA7 | 0.35 |
| 5U4G | 0.38 | 6C4 | 0.33 | 6P25 | 1.25 | 12BE6 | 0.35 |
| 5U4GB | 0.42 | 6C5GT | 0.40 | 6P28 | 0.65 | 12BH7 | 0.40 |
| 5V4G | 0.42 | 6CB6 | 0.30 | 6Q7 | 0.40 | 12BY7 | 0.55 |
| 5Y3GT | 0.32 | 6CD6GA | 1.15 | 6SA7 | 0.40 | 12K5 | 0.55 |
| 5Z3 | 0.50 | 6CG7 | 0.50 | 6SG7 | 0.35 | 12K7GT | 0.35 |
| 5Z4G | 0.40 | 6CH6 | 0.55 | 6SK7 | 0.35 | 12Q7G | 0.30 |
| 6/30L2 | 0.75 | 6CL6 | 0.50 | 6SL7GT | 0.35 | 12SR7 | 0.35 |
| 6AB4 | 0.35 | 6CW4 | 0.63 | 6SN7GT | 0.35 | 1437 | 0.80 |
| 6AF4A | 0.50 | 6CY5 | 0.43 | 6SQ7 | 0.40 | 20D1 | 0.45 |
| 6AG7 | 0.40 | 6CY7 | 0.65 | 6SR7 | 0.40 | 20L1 | 1.10 |
| 6AH6 | 0.50 | 6D3 | 0.45 | 6T8 | 0.35 | 20P1 | 0.50 |
| 6AJ8 | 0.30 | 6DC6 | 0.75 | 6U4GT | 0.60 | 20P4 | 1.10 |
| 6AK5 | 0.30 | 6DK6 | 0.48 | 6U8A | 0.40 | 20P5 | 1.20 |
| 6AK6 | 0.57 | 6DQ6B | 0.63 | 6V6GT | 0.38 | 25C5 | 0.50 |
| 6AL3 | 0.43 | 6DS4 | 0.75 | 6X4 | 0.30 | 25L6GT | 0.45 |
| 6AL5 | 0.20 | 6EA8 | 0.58 | 6X5GT | 0.35 | 25Z4G | 0.30 |
| 6AM5 | 0.32 | 6EH7 | 0.30 | 6X8 | 0.55 | 25Z6GT | 0.65 |
| 6AM6 | 0.33 | 6EJ7 | 0.35 | 6Y6G | 0.65 | 30A5 | 0.45 |
| 6AQ5 | 0.35 | 6EW6 | 0.65 | 7Y4 | 0.60 | 30AE3 | 0.40 |

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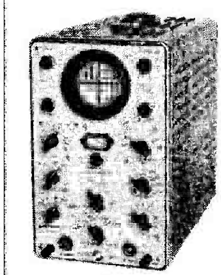
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30C1 | 0.30 | 50L6GT | 0.50 | DK96 | 0.42 | ECC85 | 0.40 |
| 30C15 | 0.80 | 85A2 | 0.40 | DL96 | 0.42 | ECC88 | 0.40 |
| 30C17 | 0.85 | 90AG | 2.40 | DM160 | 0.65 | ECC89 | 0.50 |
| 30C18 | 0.75 | 90AV | 2.50 | DY86 | 0.33 | ECC91 | 0.20 |
| 30F5 | 0.85 | 90C1 | 0.60 | DY87 | 0.35 | ECC189 | 0.60 |
| 30FL1 | 0.70 | 90CV | 1.25 | DY802 | 0.50 | ECF80 | 0.35 |
| 30FL12 | 0.93 | 807 | 0.50 | E88CC | 0.65 | ECF82 | 0.35 |
| 30FL14 | 0.75 | 813 | 3.75 | E180F | 0.95 | ECF86 | 0.65 |
| 30L1 | 0.40 | 866A | 0.75 | E810F | 2.90 | ECF804 | 1.50 |
| 30L15 | 0.85 | 5642 | 0.65 | EABC80 | 0.35 | ECH42 | 0.70 |
| 30L17 | 0.80 | 6080 | 1.50 | EAF42 | 0.55 | ECH81 | 0.30 |
| 30P12 | 0.80 | 6146 | 1.50 | EBC33 | 0.50 | ECH83 | 0.40 |
| 30P19 | 0.80 | 6360 | 1.25 | EBC41 | 0.55 | ECH84 | 0.45 |
| 30PL1 | 0.70 | 6870 | 2.50 | EBC81 | 0.30 | ECL80 | 0.40 |
| 30PL13 | 0.93 | 6939 | 2.15 | EBF80 | 0.40 | ECL81 | 0.45 |
| 30PL14 | 0.90 | 7199 | 0.75 | EBF83 | 0.40 | ECL82 | 0.35 |
| 35A3 | 0.55 | 7360 | 1.80 | EBF89 | 0.30 | ECL83 | 0.65 |
| 35A5 | 0.75 | 7586 | 1.25 | EC53 | 0.50 | ECL84 | 0.55 |
| 35B5 | 0.65 | 7895 | 1.25 | EC86 | 0.60 | ECL85 | 0.55 |
| 35C5 | 0.40 | 9002 | 0.35 | EC88 | 0.60 | ECL86 | 0.40 |
| 35D5 | 0.70 | 9003 | 0.50 | EC90 | 0.33 | ECLL800 | 1.50 |
| 35L6GT | 0.50 | AZ1 | 0.48 | EC91 | 0.50 | | |
| 35W4 | 0.30 | AZ31 | 0.55 | EC92 | 0.35 | EF37A | 0.60 |
| 35Z3 | 0.60 | CBL1 | 0.80 | EC93 | 0.50 | EF39 | 0.40 |
| 35Z4G | 0.30 | CBL31 | 0.90 | EC8010 | 2.25 | EF40 | 0.50 |
| 35Z5GT | 0.40 | CY31 | 0.35 | ECC40 | 0.60 | EF41 | 0.65 |
| 50A5 | 0.70 | DAF96 | 0.42 | ECC81 | 0.33 | EF42 | 0.70 |
| 50B5 | 0.45 | DF96 | 0.42 | ECC82 | 0.30 | EF80 | 0.25 |
| 50C5 | 0.40 | DK40 | 0.55 | ECC83 | 0.30 | EF83 | 0.55 |
| 50CD6G | 1.65 | DK92 | 0.50 | ECC84 | 0.30 | EF85 | 0.35 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EF86 | 0.30 | EZ41 | 0.45 | PCL801 | 0.70 | U191 | 0.75 |
| EF89 | 0.28 | EZ80 | 0.25 | PD500 | 1.50 | U201 | 0.35 |
| EF91 | 0.33 | EZ81 | 0.28 | PF86 | 0.60 | U281 | 0.40 |
| EF92 | 0.40 | GY501 | 0.80 | PF818 | 0.85 | U282 | 0.40 |
| EF95 | 0.30 | GZ30 | 0.40 | PFL200 | 0.70 | U301 | 0.40 |
| EF97 | 0.65 | GZ31 | 0.33 | PL33 | 0.35 | U403 | 0.50 |
| EP98 | 0.65 | GZ32 | 0.48 | PL36 | 0.55 | U404 | 0.40 |
| EF183 | 0.30 | GZ33 | 0.70 | PL81 | 0.50 | U801 | 1.00 |
| EF184 | 0.35 | GZ34 | 0.60 | PL82 | 0.45 | UABC80 | 0.35 |
| EF800 | 1.00 | HABC80 | 0.40 | PL83 | 0.45 | | |
| EF804 | 1.25 | HK90 | 0.35 | PL84 | 0.40 | UAF41 | 0.50 |
| EK90 | 0.30 | KT66 | 2.05 | PL302 | 0.80 | UAF42 | 0.55 |
| EL33 | 1.25 | KT88 | 2.60 | PL504 | 0.80 | UBC41 | 0.50 |
| EL34 | 0.50 | N78 | 1.45 | PL508 | 0.90 | UBC81 | 0.40 |
| EL36 | 0.50 | PABC80 | 0.40 | PL509 | 1.30 | UBF80 | 0.40 |
| EL37 | 1.25 | PC86 | 0.60 | PL801 | 0.80 | UBF89 | 0.35 |
| EL41 | 0.55 | PC88 | 0.60 | PM84 | 0.50 | UBL1 | 0.50 |
| EL42 | 0.58 | PC97 | 0.50 | PY31 | 0.30 | UBL21 | 0.60 |
| EL81 | 0.55 | PC900 | 0.48 | PY33 | 0.63 | UC92 | 0.35 |
| EL83 | 0.42 | PCC84 | 0.40 | PY80 | 0.35 | UCC85 | 0.40 |
| EL84 | 0.25 | PCC85 | 0.40 | PY81 | 0.30 | UCF80 | 0.55 |
| EL85 | 0.43 | PCC88 | 0.55 | PY82 | 0.30 | UCH21 | 0.60 |
| EL86 | 0.40 | PCC89 | 0.50 | PY83 | 0.38 | UCH42 | 0.70 |
| EL90 | 0.35 | PCC189 | 0.55 | PY88 | 0.40 | UCH43 | 0.75 |
| EL95 | 0.35 | PCC805 | 0.85 | PY500 | 1.00 | UCH81 | 0.35 |
| EL803 | 1.00 | PCC806 | 0.80 | PY800 | 0.50 | UCL81 | 0.60 |
| EL821 | 0.55 | PCF80 | 0.30 | PY801 | 0.50 | UCL82 | 0.35 |
| EL822 | 0.90 | PCF82 | 0.35 | PZ30 | 0.35 | UCL83 | 0.60 |
| ELL80 | 0.75 | PCF84 | 0.50 | QQV2-6 | 2.15 | UF41 | 0.60 |
| EM34 | 0.90 | PCF86 | 0.60 | QQVO3-10 | 1.25 | UF42 | 0.60 |
| EM71 | 0.75 | PCF87 | 0.85 | | | UF43 | 0.60 |
| EM80 | 0.40 | PCF801 | 0.50 | QQV03-20A | 5.25 | UF80 | 0.35 |
| EM81 | 0.60 | PCF802 | 0.50 | | | UF85 | 0.40 |
| EM84 | 0.35 | PCF805 | 0.75 | QQV06-4A | 5.50 | UF89 | 0.35 |
| EM85 | 1.00 | PCF806 | 0.70 | | | UL41 | 0.65 |
| EM87 | 0.55 | PCF808 | 0.75 | TT21 | 2.65 | UL84 | 0.30 |
| EN91 | 0.35 | PCH200 | 0.70 | TT22 | 2.80 | UM84 | 0.20 |
| EY51 | 0.40 | PCL81 | 0.50 | U18/20 | 0.75 | UY1N | 0.50 |
| EY80 | 0.45 | PCL82 | 0.35 | U25 | 0.75 | UY11 | 0.65 |
| EY81 | 0.40 | PCL83 | 0.65 | U26 | 0.75 | UY41 | 0.45 |
| EY83 | 0.55 | PCL84 | 0.45 | U31 | 0.45 | UY82 | 0.50 |
| EY86 | 0.40 | PCL85 | 0.40 | U37 | 1.50 | UY85 | 0.30 |
| EY87 | 0.43 | PCL86 | 0.45 | U52 | 0.38 | W729 | 0.60 |
| EY88 | 0.43 | PCL88 | 0.90 | U76 | 0.30 | Z759 | 1.85 |
| EZ40 | 0.45 | PCL800 | 0.93 | U78 | 0.30 | Z803U | 0.90 |

## TRANSISTORS

| | | | | | |
|---|---|---|---|---|---|
| 2N404 | 0.17 | 2S102 | 0.40 | BC175 | 0.25 |
| 2N444A | 0.25 | 2S104 | 0.50 | BCY30 | 0.35 |
| 2N696 | 0.20 | 2S701 | 0.50 | BCY33 | 0.25 |
| 2N697 | 0.23 | 2S702 | 0.50 | BCY34 | 0.30 |
| 2N698 | 0.40 | 2S746 | 0.30 | BCY72 | 0.20 |
| 2N705 | 0.70 | AC113 | 0.15 | BCZ11 | 0.40 |
| 2N706 | 0.15 | AC125 | 0.30 | BD121 | 0.80 |
| 2N708 | 0.20 | AC126 | 0.25 | BD123 | 0.95 |
| 2N753 | 0.25 | AC127 | 0.20 | BF115 | 0.20 |
| 2N929 | 0.30 | AC128 | 0.20 | BF167 | 0.25 |
| 2N930 | 0.35 | AC132 | 0.35 | BF173 | 0.30 |
| 2N987 | 0.35 | AC153 | 0.25 | BF181 | 0.25 |
| 2N1131 | 0.40 | AC154 | 0.15 | BF184 | 0.25 |
| 2N1132 | 0.45 | AC156 | 0.23 | BF185 | 0.20 |
| 2N1184 | 1.25 | AC157 | 0.20 | BF194 | 0.20 |
| 2N1301 | 0.40 | AC169 | 0.10 | BF195 | 0.15 |
| 2N1302 | 0.25 | AC176 | 0.25 | BF196 | 0.20 |
| 2N1304 | 0.25 | AC187 | 0.30 | BF197 | 0.20 |
| 2N1305 | 0.25 | AC188 | 0.30 | BFW87 | 0.30 |
| 2N1306 | 0.25 | ACY17 | 0.30 | BFW88 | 0.25 |
| 2N1307 | 0.30 | ACY18 | 0.20 | BFW89 | 0.28 |
| 2N1308 | 0.40 | ACY19 | 0.25 | BFW91 | 0.20 |
| 2N1309 | 0.35 | ACY20 | 0.20 | BFX88 | 0.25 |
| 2N1613 | 0.25 | ACY21 | 0.20 | BFY17 | 0.40 |
| 2N1711 | 0.30 | ACY22 | 0.15 | BFY19 | 0.60 |
| 2N1756 | 0.75 | AD140 | 0.80 | BFY50 | 0.25 |
| 2N2147 | 0.75 | AD149 | 0.50 | BFY51 | 0.20 |
| 2N2160 | 1.25 | AD161 | 0.35 | BFY52 | 0.25 |
| 2N2217 | 0.30 | AD162 | 0.35 | BSY26 | 0.25 |
| 2N2218 | 0.40 | AF114 | 0.25 | BSY27 | 0.30 |
| 2N2219 | 0.45 | AF115 | 0.30 | BSY28 | 0.30 |
| 2N2369A | 0.25 | AF116 | 0.25 | BSY65 | 0.20 |
| 2N2477 | 0.65 | AF117 | 0.20 | BSY95A | 0.20 |
| 2N2646 | 0.60 | AF118 | 0.45 | OC16 | 0.75 |
| 2N2905 | 0.50 | AF125 | 0.25 | OC22 | 0.65 |
| 2N2923 | 0.15 | AF127 | 0.25 | OC23 | 0.60 |
| 2N2924 | 0.15 | AF178 | 0.40 | OC24 | 0.60 |
| 2N2926 | 0.15 | AF180 | 0.35 | OC25 | 0.40 |
| 2N3053 | 0.30 | AF181 | 0.35 | OC26 | 0.30 |
| 2N3055 | 0.75 | AF186 | 0.50 | OC28 | 0.60 |
| 2N3133 | 0.35 | AF239 | 0.40 | OC29 | 0.65 |
| 2N3134 | 0.50 | AFZ11 | 0.45 | OC30 | 0.75 |
| 2N3391 | 0.20 | ASY26 | 0.25 | OC35 | 0.50 |
| 2N3392 | 0.15 | ASY27 | 0.30 | OC36 | 0.60 |
| 2N3393 | 0.15 | ASY28 | 0.30 | OC42 | 0.30 |
| 2N3394 | 0.15 | ASY29 | 0.30 | OC44 | 0.20 |
| 2N3395 | 0.20 | ASY54 | 0.25 | OC45 | 0.20 |
| 2N3402 | 0.15 | ASY74 | 0.50 | OC70 | 0.20 |
| 2N3403 | 0.15 | ASY77 | 0.35 | OC71 | 0.15 |
| 2N3404 | 0.35 | ASY82 | 0.20 | OC72 | 0.25 |
| 2N3414 | 0.20 | ASY86 | 0.20 | OC73 | 0.40 |
| 2N3415 | 0.15 | ASZ16 | 0.70 | OC75 | 0.25 |
| 2N3416 | 0.25 | ASZ17 | 0.75 | OC76 | 0.25 |
| 2N3417 | 0.25 | ASZ18 | 0.75 | OC78 | 0.25 |
| 2N3702 | 0.15 | ASZ21 | 0.50 | OC78D | 0.20 |
| 2N3703 | 0.15 | BC107 | 0.15 | OC81 | 0.25 |
| 2N3704 | 0.20 | BC108 | 0.15 | OC81D | 0.15 |
| 2N3707 | 0.20 | BC109 | 0.20 | OC83 | 0.20 |
| 2N3709 | 0.15 | BC113 | 0.40 | OC139 | 0.35 |
| 2N3710 | 0.15 | BC118 | 0.30 | OC140 | 0.40 |
| 2N3819 | 0.35 | BC134 | 0.30 | OC141 | 0.60 |
| 2N3906 | 0.30 | BC147 | 0.20 | OC170 | 0.25 |
| 2S002 | 1.00 | BC148 | 0.15 | OC171 | 0.25 |
| 2S004 | 1.00 | BC149 | 0.15 | OC200 | 0.30 |
| 2S034 | 1.00 | BC152 | 0.15 | OC202 | 0.65 |

## SYNCHROSCOPE TYPE C1-5



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight.
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke. Free-running time base 20 c/s to 2000kc/s with built-in crystal calibrator providing timing marks at .05-.2-1-5-20-100 μ sec + 5%.
Amptitude calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.

PRICE £39.00. Packing and carriage 1.50

### 100-AMP THYRISTORS

| | | |
|---|---|---|
| CR100-151A | 150 p.i.v. | £1.75 |
| CR100-301A | 300 p.i.v. | £2.50 |
| CR100-351A | 350 p.i.v. | £3.00 |
| CR100-401A | 400 p.i.v. | £3.50 |

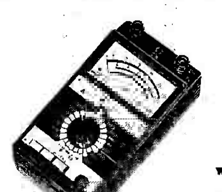
Minimum Gate Firing Voltage is 3V at 15oms.

### SOLID STATE LIGHT EMITTING DIODES MV10B

T018 outline. Brightness 500 FT-L at 50mA. Forward voltage 1·65 to 2V. Diode gives bright red pinpoint of light when supplied from a 2V source. Lens diameter 0·170in. PRICE £1.05

OUR NEW 1970/1971 CATALOGUE IS NOW READY AND AVAILABLE FREE OF CHARGE. PLEASE SEND QUARTO STAMPED AND ADDRESSED ENVELOPE FOR THIS VALUABLE SOURCE OF REFERENCE LISTING MANY THOUSAND TYPES OF VALVES, SEMICONDUCTORS, TUBES ETC.

## TWO NEW MULTIMETERS FROM RUSSIA



**Type U4312**
**U4313**
**with AC current ranges**

**Type U4312**—Low sensitivity instrument (667 o.p.v.) 1% accuracy on DC and 1·5% on AC. 9 current ranges on DC (300μA to 6A) and 8 current ranges on AC (1·5mA to 6A). 9 voltage ranges 0·3 to 900V AC/DC. Resistance 0·2 to 30k Ω. Mirror scale.
PRICE, complete with leads and steel carrying case £9.75

**Type U4313**—20,000 o.p.v. DC and 2,000 o.p.v. on AC. 8 DC current ranges 60μA to 1·5A. 6 AC current ranges 0·6 to 1·5A. 9 DC and AC voltage ranges 1·5–500V. Resistance ranges 0·5–500k Ω. Accuracy 1·5% DC and 2·5% AC. Mirror scale.
PRICE, complete with test leads and steel carrying case £10.50

### MINIATURE CERAMIC CAPACITORS 25V WORKING

5% tolerance 22–27–33–39–47–56–68–82–100–120–150–180–220–270–330–390–470–560–680–820–1000pF
All at 20np per twenty.
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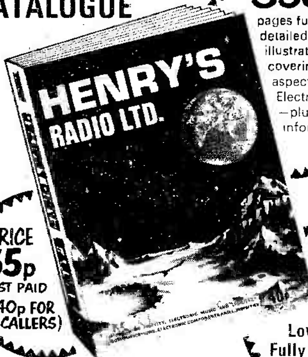


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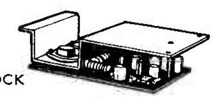

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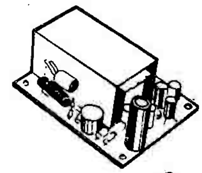

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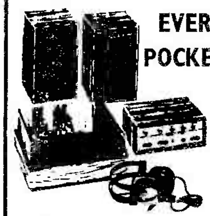

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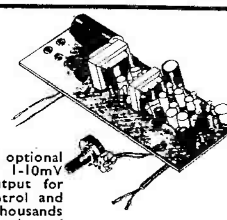

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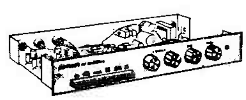

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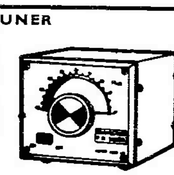

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