

PRACTICAL WIRELESS

JANUARY
1972

20p

EXTRA

**EXPERIMENTERS
CIRCUITS
SUPPLEMENT**

stereo
decoder



Also:
AF/RF Mini-probe
Sound operated flash

THE SOUND OF QUALITY



HI-FI CENTRES LTD.

A COMPLETELY NEW DESIGN FURTHER IMPROVED IN BOTH APPEARANCE and PERFORMANCE.

REPRESENTING VALUE FAR HIGHER THAN THE PRICES SUGGEST.

SUPER 30 MkIII HI-FI STEREO AMPLIFIER

Only high grade components by leading manufacturers.

COMPLETE KIT OF PARTS **£25** Carr. 65p

Or FACTORY BUILT with 12 months guarantee **£33.75**

Dep. **£5.75** and 9 monthly payments **£3.50** (Total **£37.25**)

Or FACTORY BUILT in Teak finished case as illus. Dep. **£6** and 9 monthly payments **£3.88** (Total **£40.74**) **£37.75**



- ★ SATIN SILVER METAL FACIA with black lettering. Black edged knobs with bright silver centres.
- ★ PUSH-BUTTON SELECTOR SWITCHING
- ★ NEON INDICATOR
- ★ JACK SOCKET FOR HEADPHONES
- ★ CABINETED MODEL VENEERED IN SATIN TEAK. SUITABLE FOR ANY MODERN PICK-UP CARTRIDGE CERAMIC or MAGNETIC, REGARDLESS OF PRICE.
- ★ WE RECOMMEND USE WITH THE BEST ANCILLARY EQUIPMENT THAT CAN BE AFFORDED.

PRINTED CIRCUITRY, TWENTY SILICON TRANSISTORS, FOUR DIODES, FOUR RECTIFIERS. TECHNICAL DETAILS (Applying to each channel where appropriate) CONTROLS: PUSH-BUTTON SELECTOR (1) Disc (2) Radio (3) Tape (4) Mono L (5) Mono R (6) SPEAKER DIS. (7) Mains on/off. Bass, Treble, and Balance. Plus Ceramic/Mag P.U. Switch. 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. FREQUENCY RESPONSE: -3dB 7Hz to 70KHz TREBLE CONTROL: +16dB to -12dB at 14KHz BASS CONTROL: +17dB to -16dB at 40Hz HARMONIC DISTORTION 0.1% at 1000 Hz 10 Watts CROSS TALK - 58dB COMPLETE KIT OF PARTS WITH FULL WIRING DIAGRAMS & INSTRUCTIONS. £15.50 Carr. Factory built with 12 mths guarantee £19.50 or Dep. £3 and 9 monthly payments £2.15 (Total £22.65). Or in Teak veneer housing £23 Dep. £3 and 9 monthly payments £2.55 (Total £25.95). Send S.A.E. for leaflet

RSC G66 MkII 6+6 Watt HIGH QUALITY STEREO AMPLIFIER



Individual Ganged Controls, Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12dB. Treble Control ± 13dB. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200-250V A.C. mains operation. Attractive Black and Silver finished metal facia plate and matching control knobs.

COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT **£10.50** 40p Carr.

Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated or dep. **£3** and 9 monthly payments **£1.50** **£13.99** (Total **£18.50**)



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.

COMPLETE KIT OF PARTS WITH FULL WIRING DIAGRAMS & INSTRUCTIONS. **£15.50** Carr. Factory built with 12 mths guarantee **£19.50** or Dep. **£3** and 9 monthly payments **£2.15** (Total **£22.65**). Or in Teak veneer housing **£23** Dep. **£3** and 9 monthly payments **£2.55** (Total **£25.95**). Send S.A.E. for leaflet

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. Gauss 10,000. Impedance 3 or 8-15 Ω PLEASE STATE WHEN ORDERING **£3-50**



AUDIOTRINE HI-FI SPEAKER SYSTEMS

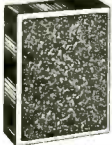
Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5.75** Carr. 30p OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER **£6.75** Carr. 35p



HI-FI SPEAKER ENCLOSURES

Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 30p. 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. **£6.47** Ported

SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24 x 15 x 10in. P'd. **£6.74** SE12 For excellent performance with 12in. Hi-Fi speaker and Tweeter. Size 25x16x10 **£7.87**



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. Excellent performance at low cost.



HF808T	8" 10W	£2.88	HF120D 12" 15W	£4.75
HF102D	10" 10W	£4.40	HF126 12" 15W	£5.50
HF120	12" 15W	£4.25	HF126D 12" 15W	£5.90

R.S.C. All HI-FI 12-14 WATT AMPLIFIER

PUSH-PULL OUTPUT. Two input sockets, with sep. vol. controls for mixing



Carr. 60p SAE for leaflet. Twin handled metal cover **£1.75** Factory built **£14.75** or Dep. **£3** and 9 monthly payments of **£1.60** (Total **£17.40**)

High sensitivity. 5 valves. Bass and treble controls. Response ± 3dB 30-20,000 c.s. Hum level - 60dB Sensitivity 40 millivolts. For Crystal or Ceramic P.U.s. High Impedance "mikes". For Musical Instruments etc. **£10.50**

Std. AC mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. **£1.75** Excellent value **£2.50**

FANE PRESSURE TWEETER

Model 303 Gauss 10,000. Impedance 3 ohms or 8-15 ohms. Carr. Free

SPECIAL HI-FI OFFER

WHARFEDALE SUPER LINTON SPEAKERS

Teak Finish Matching Pairs **£36.75** PAIR carr. **£1**

ALL RSC UNITS MANUFACTURED TO EXACTING SPECIFICATIONS

★ DEMONSTRATION FACILITIES AT ALL BRANCHES



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, 9 1/2 x 2 1/2 x 6 1/2 in. Attractive brushed silver finish facia plate 10 1/2 x 3 1/2 in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7.50** Carr. 40p

OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£9.75**

R.S.C. PLINTHS

Superior Solid Natural Wood Construction



WITH TRANSPARENT PLASTIC COVER

for Record Playing units, cut for Garrard 1025, 2025, 3000, AT60, SP26 etc **£3-15** **£6-30**

RSC

HIGH-FIDELITY STEREO

PACKAGE OFFERS

- Four fully wired units ready to 'plug in'.
- ★ SUPER 30 AMPLIFIER (15 + 15 watt) in veneered housing
- ★ GARRARD SP25 MK III 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**

Terms: Deposit £12 and 9 monthly payments £8-55 (Total £88-95).

- ★ Super 30 Amplifier (15 + 15 watt) in veneered housing
- ★ Goldring GL69 II Transcription Turntable on Plinth as illustrated
- ★ Goldring Magnetic P.U. Cartridge.
- ★ Pair of Stanway II speaker units.

Special Total Price **£96-75**

Terms: Deposit £14 and 9 monthly payments £10-53 (Total £113-55).



ATTRACTIVE TEAK OR AFROMOSIA VENEERED CABINETS AND PLINTHS
Send S.A.E. for coloured brochure showing other money saving offers.

- ★ TA12 AMPLIFIER 6.5 + 6.5 watt in veneered housing
- ★ GARRARD SP25 MK III Player unit on Plinth
- ★ GOLDRING CS90 Ceramic P.U. Cartridge with diamond stylus
- ★ PAIR OF DORCHESTER Loudspeaker Units

Special Total Price **£58**

Or Deposit £7-15 and 9 monthly payments £6-35 (Total £64-30). Carr. £1-25 Trans. Plastic cover £3-15 extra.

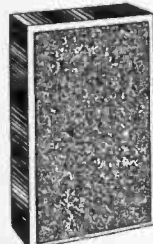
- PACKAGE AS ABOVE but with Garrard 3000 Autochanger and Sonotone 9TA Ceramic Cartridge in lieu of SP25 and CS90 Carr. £1-25

Special Total Price **£51-75**

Or Deposit £6 and 9 monthly payments £5-70 (Total £57-30) Trans. Plastic cover £3-15 extra.

HIGH FIDELITY SPEAKER UNITS

Cabinets latest style Satin Teak veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.



DORCHESTER (Illustrated) Size 16x11x9in. apprx. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High flux 13x8in. Dual Cone speaker. Imp. 3 or 15 ohms. **£9-45** Carr. 40p.

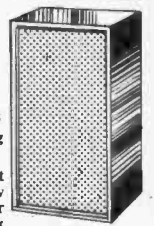
STANWAY II Size 20x10 1/2 x 9 1/2 in. approx. Rating 10 watts. Inc. 13x8in. speaker with highly flexible cone surround, long throw voice coil and 10,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 35-20,000 c.p.s. Imp. 8 ohms. Gives smooth realistic sound output. **£17-85** Carr. 63p.

See 'package offers' for illustration.

'YORK' HIGH FIDELITY 3 SPEAKER SYSTEM

- ★ Moderate size only 25x14x10in.
- ★ Response 30-20,000 c.p.s. Impedance 15 ohms
- ★ 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) 8x5in. 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. £4-60 and 9 monthly payments £2-47 (Total £26-83).



COMPLETE KIT **£23** Carr. 63p

DEMONSTRATIONS AT ALL BRANCHES

AUDIOTRINE A55 HIGH QUALITY STEREO SYSTEM

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. Silver finished fascia plate and matching control knobs.



Transparent plastic (tinted) cover included for main unit.

PAIR OF LOUSPEAKERS incorporating high flux 8in. 5in. speaker. Size approx. 13 x 7 1/2 x 8 1/2 in. **£42**

PRICE COMPLETE ONLY Carr. £1-25

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

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

RSC TRANSFORMERS, L.F. CHOKES and RECTIFIERS

FULLY GUARANTEED. Impregnated and interleaved where necessary

Primaries 200-250v. 60c/a. Screened	
MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 x 2 1/2 in.	
250v., 60mA, 6.3v. 2a.	99p
250-0-250v., 60mA, 6.3v. 2a.	£1-05
FULLY SHROUDED UPRIGHT MOUNTING	
250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1-40
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a.	
For Mullard 610 Amplifier	£2-45
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-65
425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a.	£4-95
425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a.	£5-10
450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a.	£5-50
TOP SHROUDED DROP-THRU TYPE	
250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1-35
250-0-250v. 100mA, 6.3v. 3.5a.	£1-55
250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a.	£1-60

350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1-65
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
300-0-300v. 8.3v. 4a. c.t. 6.3v. 1a. c.t.	£2-60
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-20
350-0-350v. 160mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2-60
FILAMENT or TRANSISTOR POWER PACK	
Types 6.3v. 1.5a. 49p; 6.3v. 2a. 54p; 6.3v. 3a. 78p; 6.3v. 6a. £1-30; 12v. 1a. 55p; 12v. 3a. or 24v. 1.5a. £1-35; 0-9-18v. 1 1/2a. £1-10; 0-12-25-42v. 2a. £1-78	
CHARGER TRANSFORMERS 0-9-15v. 1 1/2a. 99p; 2 1/2a. £1-10; 3a. £1-25; 5a. £1-45; 6a. £1-65; 8a. £2-00	
AUTO (Step UP/step DOWN) TRANSFORMERS	
0-110/120v. 200-230-250v., 50-80 watts £1-10; 150 watts, £1-90 250 watts £2-75; 500 watts £5-75.	
OUTPUT TRANSFORMERS	
Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω 50p	
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω 83p	
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω £1-87	
Push-Pull EL84 to 3 or 15 Ω 10-12 watts £1-35	
Push-Pull Ultra Linear for Mullard 610, etc. £2-20	
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc. for 3 or 15 Ω £1-99	
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £3-30	

R.S.C. BATTERY/MAINS CONVERSION UNITS



TYPE BMI. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2in. approx. Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 50c/s is available.

Complete kit with diagram. **£3-25** Assembled ready for use **£3-75**

SMOOTHING CHOKES

150mA, 7-10H, 250 Ω 70p;
100mA, 10H, 200 Ω 60p;
80mA, 10H, 350 Ω 50p;
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.

You're never very far from an **RSC** HI-FI CENTRE

BRADFORD BLACKPOOL (AGENT) BIRMINGHAM DARLINGTON DERBY EDINBURGH GLASGOW HULL LEICESTER LEEDS LIVERPOOL LONDON MANCHESTER MIDDLESBROUGH NEWCASTLE-ON-TYNE NOTTINGHAM SHEFFIELD

SEE NEXT PAGE FOR LIST OF BUSINESS, ADDRESSES etc.

RSC BULK BUYING ENSURES YOU GET BETTER VALUE

THE SOUND

RSC

OF QUALITY

50 WATT SPEAKER

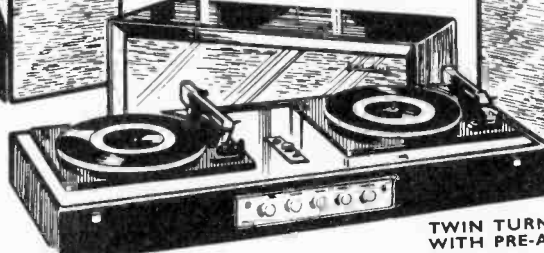


HEADPHONES MICROPHONE

SEND S.A.E. FOR LEAFLET



100 WATT AMPLIFIER



TWIN TURNTABLE WITH PRE-AMP

50 WATT SPEAKER



DISCOTHEQUE EQUIPMENT
—SAVINGS ON PACKAGE OFFER

- (1) FAL FG1/2 Console
- (2) 100W Power Amplifier
- (3) Pair High Quality Headphones
- (4) Matching Microphone fitted to H/phones
- (5) Pair 50W Speakers black rexine covered Size approx. 18" x 18" x 8"

TOTAL COST OF ALL ILLUSTRATED UNITS **£132**

Terms: Deposit £20 and 9 monthly payments of £14.34 (Total £149.06).

RSC 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.
★ Two extra heavy duty 12in. 50 watt 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**
& 9 mthly pymts of **£5.75** **£60**
(Total £67.75) Carr. £1.50

FAL DISCOTHEQUE CONSOLE FG1/2

SEND S.A.E. FOR LEAFLET



TWIN TURNTABLE WITH PRE-AMP

TWIN TURNTABLE UNIT WITH MONITORING FACILITIES **£65** Carr. £1.25

Separate Volume Controls plus Treble & Bass Controls Microphone Socket with associated Switch & Vol. Control Incorporating twin Garrard SP25 Mk. III turntables and Goldring CS90 Ceramic Cartridges with diamond stylii. Size approx. 36" x 6 1/2" x 15". Black Rexine covered Cabinet with lid. Fitted carrying handle.

Terms: Deposit £11 and 9 monthly payments of £6.70 (Total £71.80).

DISCO/GROUP EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 Mk. II AMPLIFIER PAIR FANE POP 25/2 25W L/SPEAKERS.

PACKAGE PRICE **£44** carr. £1

Terms: Deposit 25.50 and 9 monthly payments of **£4.72** (Total £47.98).

F.A.L. PHASE 50 Mk. II AMPLIFIER PAIR FANE POP 50 L/SPEAKERS OR PAIR L12/25 Cabined. Speakers.

£49.50 carr. £1

Terms: Deposit 210.50 and 9 monthly payments of **£5** (Total £255.50)

F.A.L. PHASE 100 AMPLIFIER PAIR L125 50W L/S in cabinets.

£118 carr. £1.50

Terms: Deposit 225 and 9 monthly payments **£11.62** of (Total £129.50).

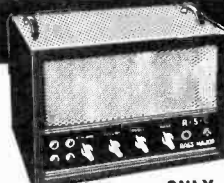
F.A.L. PHASE 100 AMPLIFIER 4 FANE POP 50 L/SPEAKERS.

£99 carr. £1.50

Terms: Deposit 215 and 9 monthly payments **£10.52** of (Total £109.50).

30 WATT HI-FI AMPLIFIER

FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP

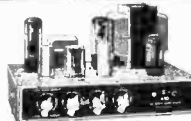


A 2 or 4 input, 2 vol. control Hi-Fi unit with Separate Bass and Treble controls.

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.

ONLY **£19.95** Carr. 65p

Terms: Deposit £3.70 and 9 monthly payments of £2.10 (Total £22.60). S.A.E. for leaflet.



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 perforate cover £1.90 Or factory built with EL34 output valves and 12 months' guarantee for £19.75 Carr. 65p

TERMS: Deposit £4 and 9 monthly payments of £2.10 (Total £22.60). Send S.A.E. for leaflet.

MINIMUM 12 MONTHS GUARANTEE, LABOUR & MATERIALS (Excl. Valves) ON ADVERTISED GOODS

RE-FUND OF INTEREST CHARGES ON CREDIT SALES SETTLED IN 3 MONTHS

PHASE 50 MKII 50W AMPLIFIER

OUTPUT 60 Watts (Music) 40 " R.M.S. (Cont.) 100 " (Peak)

£33.50 Carr. 65p

Terms: Deposit £6 and 9 monthly payments **£3.50** (Total £37.50)

SOLID STATE, ALL SILICON TRANSISTORS. ★ Protective circuitry in case of overload or short circuiting of output. ★ Frequency Range 30-20,000 c.p.s. ★ 4 Separately controlled inputs for mixing; plus master volume control. ★ Individual Bass and Treble Controls. ★ Suitable for any loudspeaker combination between 3 & 30 ohms. ★ Cabinet covered in black rexine. Brushed silver finish metal facia, with black lettering. Matching control knobs. For Clubs, Discotheques, Hotels, Restaurants, Schools, Theatres, etc. For Vocal & Instrumental Groups, Gram., Radio or Tape. Send S.A.E. for leaflets.



PHASE 100 100W AMPLIFIER

OUTPUT 100 Watts (Music) 70 " R.M.S. (Cont.)

£61.95 Carr. 75p

I.H.F.M. Output rating Terms: Deposit £12 and 9 monthly payments **£6.25** (Total £68.25).

RSC

CABINET LOUDSPEAKERS

L13 8-10 WATTS

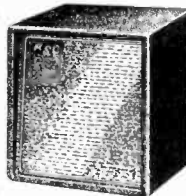
Incorporating high flux 13" x 8" 8-10 watt loudspeaker. Available with 3 or 15 ohm impedance. (State when ordering.) Cabinet finished in Teak or Afrormosia Veneer.
(Carr. 37p)

£5-25

L12/25 25 WATTS

12" 25 watt heavy duty loudspeaker. Impedance 15 ohms. 18" x 18" x 8" approx. Veneered or Rexine/Vynair finish. Suitable small Discotheques, Clubs, Schools etc., etc. (Carr. 45p)

Terms: Deposit £3 and 9 monthly payments £1 (Total £12)

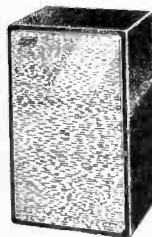
£10-50

Fitted four extra heavy duty 12" 14,000 Gauss 50 watt speakers for conservative rating of 100 watts. Impedance 15 ohms. Cabinet in 3/4" chipboard with centre reinforcement back to front. Rexine/Vynair covered. Acoustically filled and pressurised. 27" x 27" x 14" approx. Ideal for bass guitar or electronic organ.

Or Deposit £8 and 9 monthly payments £5-90 (Total £61-10).

£55

B4/100 100 WATTS



L125 50 WATTS

Incorporating two 12" 50 watt 14,000 Gauss extra heavy duty loudspeakers for conservative rating of 50 watts. Impedance 8-15 ohms. Sturdy pressurised cabinet in 3/4" chipboard. Rexine/Vynair Covered 31" x 20" x 16" approx. Suitable Vocal or Instrumental Groups. Bass Guitar or Electronic Organ, etc. For use in Discos, Clubs, etc.

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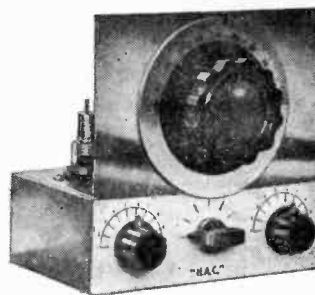
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100-0-100μA	1 amp. D.C.	\$2-80
500μA	5 amp. D.C.	\$2-80
1mA	30V. A.C.	\$2-80
5mA	50V. A.C.	\$2-80
10mA	VU Meter	\$2-80

Type MR.58P. 1 21/32 in. square fronts.

50μA	20V. D.C.	\$1-60
50-0-50μA	50V. D.C.	\$1-60
100μA	300V. D.C.	\$1-60
100-0-100μA	1 amp. D.C.	\$1-60
500μA	5 amp. D.C.	\$1-60
1mA	30V. A.C.	\$1-60
5mA	50V. A.C.	\$1-60
10mA	VU Meter	\$2-10

Type MR.52P. 2 1/2 in. square fronts.

50μA	20V. D.C.	\$2-00
50-0-50μA	50V. D.C.	\$2-00
100μA	300V. D.C.	\$2-00
100-0-100μA	1 amp. D.C.	\$2-00
500μA	5 amp. D.C.	\$2-00
1mA	30V. A.C.	\$2-00
5mA	50V. A.C.	\$2-00
10mA	VU Meter	\$2-00

Type MR.45P. 2 1/2 in. square fronts.

50μA	20V. D.C.	\$1-70
50-0-50μA	50V. D.C.	\$1-70
100μA	300V. D.C.	\$1-70
100-0-100μA	1 amp. D.C.	\$1-70
500μA	5 amp. D.C.	\$1-70
1mA	30V. A.C.	\$1-70
5mA	50V. A.C.	\$1-70
10mA	VU Meter	\$2-10

Type MR.65P. 3 1/2 in. x 3 1/2 in. fronts.

50μA	20V. D.C.	\$2-20
50-0-50μA	50V. D.C.	\$2-20
100μA	300V. D.C.	\$2-20
100-0-100μA	1 amp. D.C.	\$2-20
500μA	5 amp. D.C.	\$2-20
1mA	30V. A.C.	\$2-20
5mA	50V. A.C.	\$2-20
10mA	VU Meter	\$2-37

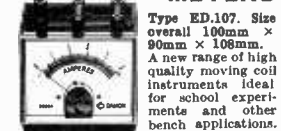
"SEW" BAKELITE PANEL METERS

Type MR.65. 3 1/2 in. square fronts.

50μA	20V. D.C.	\$1-90
50-0-50μA	50V. D.C.	\$1-90
100μA	300V. D.C.	\$1-90
100-0-100μA	1 amp. D.C.	\$1-90
500μA	5 amp. D.C.	\$1-90
1mA	30V. A.C.	\$1-90
5mA	50V. A.C.	\$1-90
10mA	VU Meter	\$2-10

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Type ED.107. Size overall 100mm x 90mm x 108mm. A new range of high quality moving coil meters. Ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	25-00	20V. d.c.	\$4-40
100μA	24-65	50V. d.c.	\$4-40
1mA	24-40	300V. d.c.	\$4-40
50-0-50μA	24-65		
100-0-100μA	24-40		
1-0-1mA	24-40		
1A d.c.	24-40		
5A d.c.	24-40		
10V. d.c.	24-40		

EDGWISE METERS

Type PE.70. 3 17/32 in. x 1 15/32 in. x 2 1/2 in. deep.

50μA	\$3-10	500μA	\$2-75
50-0-50μA	\$3-00	1mA	\$2-45
100μA	\$3-00	300V. A.C.	\$2-45
100-0-100μA	\$2-90	VU Meter	\$3-40
200μA	\$2-90		

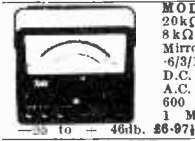
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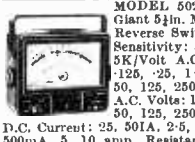


MODEL LT.101 1000 O.P.V. 0.10/50/250/1000 V. D.C. 0.10/50/250/1000 V. A.C. 0.1/100 M.A. 0.150 K ohms. \$1-97. P. & P. 15p.



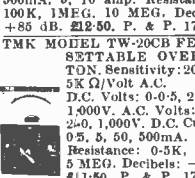
MODEL PL.436 20K Volt D.C. 8kΩ/Volt A.C. Mirror scale. -63/12/30/120/600V D.C. 3/50/120/600V A.C. 50/600uA/10/600 mA. 10/100K/1 MegΩ MegΩ. P & P 12p.

TMK MODEL MD.120 Mirror scale. 20k/Volt D.C. 10k/Volt A.C. 30/60/300/600/3,000 V. D.C. 6/120/1,200 V. A.C. Current 0-60uA/0-12/20 300mA. 0-600/5 MegΩ -20 to +63 db. \$4-62. P & P 15p



MODEL 5025 57 Rangefinder. Giant 5 1/2 in. 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, 50μA, 2.5, 5, 25, 50, 100, 500μA, 5, 10 amp. Resistance: 2K, 10K, 100K, 1MEG, 10 MEG. Decibels: -20 to +85 db. \$12-50. P. & P. 17p.

MODEL 500 30,000 O.P.V. with overload protection mirror scale 0.5/2.5/10/25 100/250/500/1,000V. D.C. 0.2/5/10/25/100/250/500/1,000V. A.C. 0.50uA/5/50/500mA. 12 amp. D.C. 0.60K/6 MegΩ. Post paid.



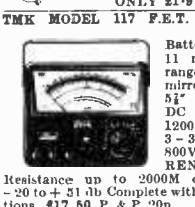
TMK MODEL TW-20CB FEATURES RE-SETTABLE OVERLOAD BUTTON. Sensitivity: 20K Ω/Volt D.C. 5K Ω/Volt A.C. D.C. Volts: 0-0.5, 2.5, 10, 50, 250, 1,000V. A.C. Volts: 2.5, 10, 50, 200, 1,000V. D.C. Currents: 0-0.05, 0.5, 5, 50, 500mA. 10 amp. Resistance: 0-5K, 50K, 0-500K, 5 MEG. Decibels: -20 to +52dB. \$41-50. P. & P. 17p.

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



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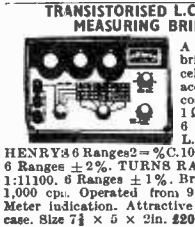
TE22 SINE SQUARE WAVE AUDIO GENERATORS Sine: 20cps to 200 kc/s on bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms, 200/250V. A.C. operation. Supplied brand new and guaranteed with instructions manual and leads. \$17-50. Carr. 37p.

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2G301	20p	2N3417	27p	BC116	25p	BFX12	22p	NKT224	25p	FJH12	25p	8N7441AN		0Z4	30p	25Z6	65p	EM81	60p
2G302	20p	2N3439	130p	BC118	15p	BFX13	22p	NKT225	25p	FJH13	25p	8N7442	75p	1L4	20p	30C15	80p	EM84	35p
2G303	20p	2N3440	87p	BC119	80p	BFX29	25p	NKT229	30p	FJH14	25p	8N7447	135p	1R6	40p	30C17	80p	EM85	41.00p
2G306	80p	2N3564	17p	BC121	20p	BFX30	25p	NKT237	35p	FJH15	25p	8N7446	100p	1R6	30p	30C18	80p	EM87	70p
2G308	80p	2N3566	15p	BC122	20p	BFX37	37p	NKT238	25p	FJH16	70p	8N7447	135p	1R6	30p	30C18	80p	EM87	70p
2G309	60p	2N3568	22p	BC123	65p	BFX44	37p	NKT240	27p	CA3012	85p	FJH17	25p	8N7448	125p	1T4	40p	EM89	40p
2G371	15p	2N3568	22p	BC124	20p	BFX68	25p	NKT241	27p	CA3013	125p	FJH18	25p	8N7449	25p	1U4	40p	EM90	40p
2G374	20p	2N3569	25p	BC134	12p	BFX84	25p	NKT242	20p	CA3014	124p	FJH21	25p	8N7451	20p	1U4	40p	EM91	40p
2G381	22p	2N3570	125p	BC135	12p	BFX85	30p	NKT243	62p	CA3018	84p	FJH23	25p	8N7453	20p	1U5	60p	EM92	40p
2N388A	40p	2N3572	97p	BC136	15p	BFX86	25p	NKT244	17p	CA3018A		FJH24	25p	8N7454	20p	2D21	35p	EM93	40p
2N404	20p	2N3605	27p	BC137	15p	BFX87	25p	NKT245	20p		110p	FJH25	25p	8N7460	20p	3Q4	50p	EM94	50p
2N606	15p	2N3606	27p	BC138	20p	BFX88	20p	NKT261	20p	CA3019	84p	FJF101	50p	8N7472	30p	3R4	35p	EM95	27p
2N697	15p	2N3607	22p	BC139	50p	BFX89	25p	NKT262	30p	CA3020	128p	FJF111	60p	8N7476	40p	3R4	45p	EM96	25p
2N698	25p	2N3638	18p	BC141	72p	BFX93A	70p	NKT264	20p	CA3020A		FJF121	60p	8N7474	40p	5U4	35p	EM97	40p
2N699	80p	2N3638A	20p	BC147	55p	BFY11	42p	NKT271	20p		160p	FJF131	60p	8N7475	45p	5V4	35p	EM98	40p
2N706	10p	2N3641	18p	BC148	10p	BFY12	40p	NKT282	20p	CA3021	160p	FJF141	125p	8N7476	45p	5V4	45p	EM99	40p
2N706A	12p	2N3642	18p	BC149	12p	BFY21	25p	NKT274	20p	CA3022	130p	FJF181	75p	8N7483	87p	5Y3	40p	EM100	40p
2N708	12p	2N3643	20p	BC152	17p	BFY21	40p	NKT275	20p	CA3023	128p	FJF191	60p	8N7486	33p	5Z4G	40p	EM101	40p
2N718	25p	2N3645	25p	BC153	20p	BFY24	45p	NKT278	25p	CA3026	100p	FJF211	125p	8N7490	87p	6Y3/50L2	80p	EM102	40p
2N718A	30p	2N3691	15p	BC154	20p	BFY29	40p	NKT281	27p	CA3028A	74p	FJF231	125p	8N7492	87p	6A7G	40p	EM103	40p
2N726	25p	2N3692	18p	BC155	15p	BFY30	40p	NKT401	87p	CA3028B		FJL101	125p	8N7493	77p	6AK6	35p	EM104	40p
2N727	25p	2N3693	16p	BC158	12p	BFY41	60p	NKT402	90p		105p	FJY101	25p	8N7495	87p	6AK6	60p	EM105	40p
2N914	17p	2N3694	18p	BC159	12p	BFY43	62p	MKT403	75p	CA3029	87p	IC10	250p	8N7496	87p	6AK6	60p	EM106	40p
2N916	17p	2N3702	18p	BC160	20p	BFY50	20p	NKT404	55p	CA3029A		IC12	250p	8N74107	52p	6AL5	20p	EM107	40p
2N918	50p	2N3704	10p	BC162	37p	BFY51	20p	NKT405	75p		165p	L90	40p	8N74183		6AM6	30p	EM108	40p
2N929	22p	2N3704	12p	BC168B	20p	BFY52	20p	NKT406	27p	CA3030	137p	FJF111	60p	8N7426	40p	6AQ5	38p	EM109	40p
2N929	22p	2N3704	12p	BC168C	15p	BFY53	15p	NKT451	65p	CA3035	122p	L923	40p	8N74154		6AT6	65p	EM110	40p
2N930	20p	2N3705	10p	BC169B	14p	BFY66	57p	NKT462	62p	CA3036	72p	MC724P	60p	220p		6AT6	65p	EM111	40p
2N937	52p	2N3706	10p	BC169C	15p	BFY76	42p	NKT453	47p	CA3039	82p	MC780P	247p	8N74160		6AU6	25p	EM112	40p
2N1090	22p	2N3707	12p	BC170	12p	BFY77	57p	NKT713	20p	CA3041	109p	MC788P	146p	180p		6AV6	30p	EM113	40p
2N1091	22p	2N3708	10p	BC171	15p	BFY90	65p	NKT717	42p	CA3042	109p	MC790P	124p	8N74161		6BA6	25p	EM114	40p
2N1131	25p	2N3710	10p	BC172	15p	BSX19	12p	NKT734	27p	CA3043	137p	MC792P	80p	260p		6BA6	25p	EM115	40p
2N1132	25p	2N3710	10p	BC175	22p	BSX20	15p	NKT736	25p	CA3044	120p	MC798P	66p	8N74164		6BE6	75p	EM116	40p
2N1302	17p	2N3711	10p	BC177	20p	BSX21	20p	NKT773	25p	CA3045	122p	MC1303L		220p		6BJ6	50p	EM117	40p
2N1303	17p	2N3713	187p	BC178	20p	BSX26	45p	NKT781	30p	CA3046	81p	100p	8N74165		6BQ7A	40p	EM118	40p	
2N1304	22p	2N3714	200p	BC179	20p	BSX27	47p	OC16	50p	CA3047	137p	MC1304P		225p		6BR7	90p	EM119	40p
2N1305	22p	2N3715	200p	BC182	52p	BSX28	32p	OC19	37p	CA3048	204p		8N74192		6BR7	70p	EM120	40p	
2N1305	22p	2N3716	200p	BC182L	45p	BSX29	60p	OC20	60p	CA3049	150p	MC1305P		175p		6BR7	85p	EM121	40p
2N1307	25p	2N3773	240p	BC183	9p	BSX61	62p	OC22	50p	CA3050	135p	8C838P		386p	8N74193	30p	6BW7	40p	
2N1308	25p	2N3791	275p	BC183L	9p	BSX76	15p	OC29	60p	CA3051	134p	8C838P		175p		6BZ6	40p	EM122	40p
2N1309	25p	2N3819	34p	BC184	11p	BSX77	20p	OC24	60p	CA3052	165p		54p	TAA241		6C4	33p	EM123	40p
2N1507	17p	2N3820	55p	BC184L	11p	BSX78	25p	OC25	40p	CA3053	46p	MC1435P		162p		6CD6	125p	EM124	40p
2N1613	20p	2N3823	50p	BC186	25p	BSY24	15p	OC26	25p	CA3054	109p		345p	TAA242		6CL6	60p	EM125	40p
2N1631	20p	2N3825	50p	BC187	25p	BSY25	15p	OC27	15p	CA3055	240p		481p	TAA243		6CW6	85p	EM126	40p
2N1632	30p	2N3854A	27p	BC192L	18p	BSY26	17p	OC29	60p	CA3059	185p			TAA263		6F6G	35p	EM127	40p
2N1637	30p	2N3855	27p	BC213L	12p	BSY27	15p	OC35	60p	CA3064	120p	MC1790CG		78p		6F6G	35p	EM128	40p
2N1638	27p	2N3855A	30p	BC214L	15p	BSY28	17p	OC36	60p	FCH101	85p	94p	TAA293	97p		6F13	45p	EM129	40p
2N1639	27p	2N3856	30p	BCY10	27p	BSY29	17p	OC41	22p	FCH111	105p	MFC4000P		175p		6F14	70p	EM130	40p
2N1710	187p	2N3856A	35p	BCY30	30p	BSY32	22p	OC42	40p	FCH121	105p		70p	TAA310	125p	6F15	65p	EM131	40p
2N1711	24p	2N3857	30p	BCY31	25p	BSY33	22p	OC43	25p	FCH131	60p	PA222	280p	TAA320	75p	6F16	50p	EM132	40p
2N1889	30p	2N3858A	30p	BCY32	30p	BSY37	25p	OC45	15p	FCH151	105p	PA230	140p	TAA350	175p	6F18	50p	EM133	40p
2N1893	37p	2N3859	27p	BCY33	30p	BSY38	20p	OC46	15p	FCH151	105p	PA234	92p	TAA435	147p	6H6	17p	EM134	40p
2N2147	72p	2N3859A	32p	BCY34	35p	BSY39	22p	OC70	15p	FCH161	60p	PA237	210p	TAA521	128p	6J5	50p	EM135	40p
2N2160	87p	2N3860	30p	BCY36	45p	BSY43	50p	OC71	12p	FCH171	105p	PA246	160p	TAA522	360p	6J5	25p	EM136	40p
2N2183	40p	2N3866	150p	BCY39	60p	BSY61	32p	OC72	12p	FCH181	105p	PA248	235p	TAA530	485p	6J5GT	30p	EM137	40p
2N2184	30p	2N3874	40p	BCY40	60p	BSY62	30p	OC73	30p	FCH191	105p	PA256	200p	TAA531	445p	6K6	20p	EM138	40p
2N2184	30p	2N3874A	40p	BCY41	15p	BSY63	37p	OC74	30p	FCH201	180p	PA265	200p	TAB101	97p	6K6G	40p	EM139	40p
2N2194A	80p	2N3900	37p	BCY42	22p	BSY64	40p	OC75	25p	FCH211	130p	8N7400	20p	TAD100	150p	6K8G	40p	EM140	40p
2N2194	80p	2N3900A	40p	BCY43	15p	BSY65	90p	OC76	25p	FCH221	130p	8N7401	20p	TAD110	150p	6L6GT	45p	EM141	40p
2N2218	20p	2N3901	97p	BCY44	22p	BSY79	45p	OC77	40p	FCH231	160p	8N7402	20p	8L403D	150p	6L2D0	50p	EM142	40p
2N2219	20p	2N3903	20p	BCY48	22p	BSY80	57p	OC78	20p	FCH101	160p	8N7403	20p	8L702C	147p	6Q7	40p	EM143	40p
2N2220	20p	2N3903	20p	BCY49	22p	BSY95A	12p	OC81	20p	FCH111	160p	8N7404	20p	UA702A	260p	6A7	40p	EM144	40p
2N2221	20p	2N3905	30p	BCY60	27p	C494	15p	OC81D	20p	FCH121	275p	8N7405	20p	UA702C	77p	6A7	40p	EM145	40p
2N2222	20p	2N3906	25p	BCY70	15p	C480	15p	OC82	25p	FCH131	275p	8N7406	20p	UA703C	177p	6B7	40p	EM146	40p
2N2222A	25p	2N4058	12p	BCY71	20p	GET102	25p	OC82D	15p	FCH141	525p	8N7408	20p	UA709C	125p	6K7	40p	EM147	40p
2N2297	30p	2N4059	10p</																

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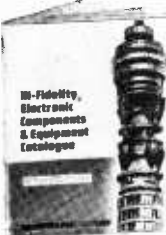
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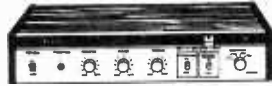
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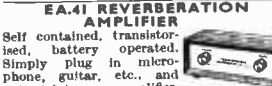
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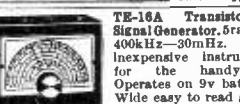
3in. tube. Y amp. Sensitivity 0.1v p-p/CM. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω 25pF. X amp. sensitivity 0.8v. p-p/CM. Bandwidth 1.5 cps-200KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps-300 KHz. Synchronization. Internal external. Illuminated scale 140 x 215 x 330 mm. Weight 16 1/2 lb. 220/240V. A.C. Supplied brand new with handbook. £37.50. Carr. 50p

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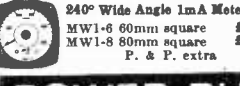
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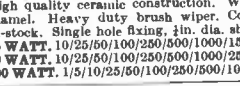
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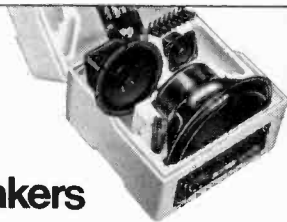
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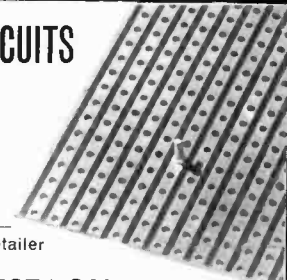


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CN.240/2 Miniature soldering iron 15 watt 240 volts, fitted with nickel plated 3/32" bit and packed in transparent display box. Also available for 220 volts. **Price £1.70**

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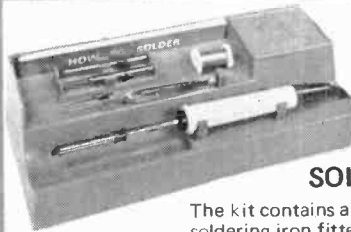
CCN.240 New model 15 watt 240 volts miniature soldering iron with ceramic shaft to ensure perfect insulation (4,000 v A.C.). Will solder live transistors in perfect safety: fitted with 3/32" iron coated bit. Spare bits 1/8" 3/16" and 1/4" available. Can also be supplied for 220 volts. **Price £1.80**

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SK.1 SOLDERING KIT

The kit contains a 15 watt 240 volts soldering iron fitted with a 3/16" bit, nickel plated spare bits of 5/32" and 3/32", a reel of solder, heat sink, cleaning pad, stand and booklet "How to Solder". Also available for 220 volts.

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SK.2 SOLDERING KIT

This kit contains a 15 watt 240 volts soldering iron fitted with a 3/16" bit, nickel plated spare bits of 5/32" and 3/32", a reel of solder, Heat Sink, 1 amp fuse and booklet "How to Solder".

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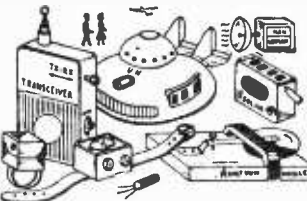
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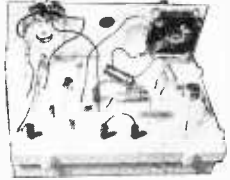
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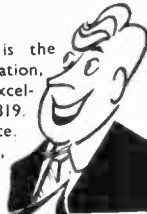
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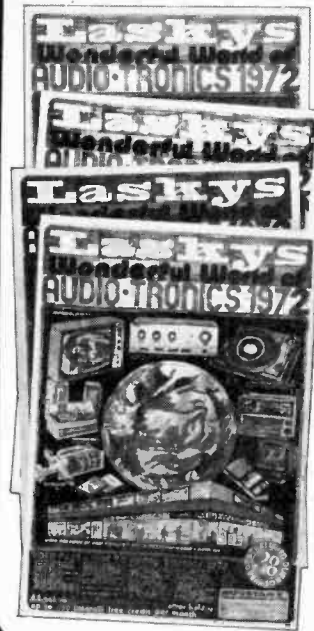


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SONY 7R-77



List Price **£31.65**

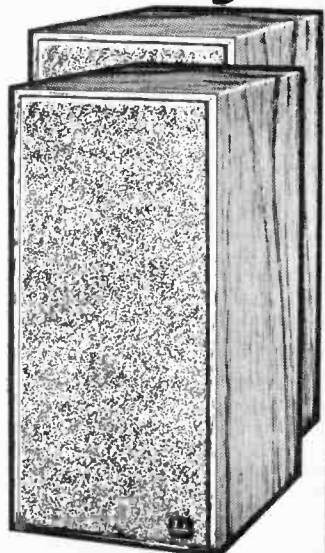
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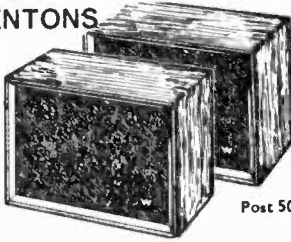
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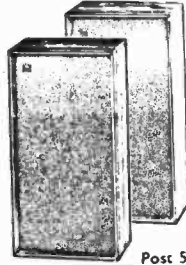


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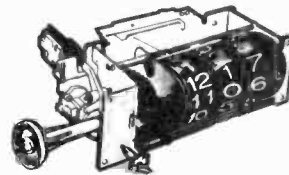
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DC/AC Volts 1-2KV, 600V, 300V, 60V, 12V,
3V & 0-6V
DC Current 12A, 300mA, 30mA, 3mA & 60
micro A
Switch—Divide by 2 on Volts and Amps. Ranges
DC 50 & 25K ohms/V 5 & 2.5 Kohms/V
C1085 (Illustrated) **£16-25**
Res. Range x1, x10, x1K, x10K
AC Volts 1-2KV, 600V, 300V, 60V, 12V, 3V
DC Volts 1-2KV, 600V, 120V, 60V, 12V, 3V,
1-2V, 0-6V
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Switch—Divide by 2 on Volts and Amps. Ranges
DC 100,000 ohms/V AC 10,000 ohms/V
Postage and Insurance 40p per Meter.
Each meter comes complete with test prods.
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Plug your Transistor Radio, Amplifier, Cassette, etc., into the a.c. mains through this compact eliminator, 2 1/2in x 2in x 3in approx. 4.1V £1-50, 6V £1-50, 9V £1-50, 7.1V complete with cable and plug for Philips Cassette. **£2** P. & P. each.



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D.P.D.T. SLIDE SWITCH



SIZE
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13p each
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2 1/2 inch 40 ohm **38p**
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Phono pre-amp E1311 input 100k: gain 28dB max out 3 volt: max input 50mV. Tape pre-amp as above E1313. Power amp E1314 input 1,000 ohms gain 20dB 300mW. Organ tone osc E1315 tone freq. 200-1k. Hz output 80mW. All above modules 9 volt. Dual flasher E1318 flash time 1-4 secs power 6 volt. Lamp 6V 150mA. All at **£1.25 P. & P. 10p**



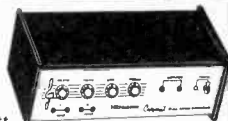
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Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge ready wired in teak plinth with cover **£14.00**

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GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 800 MAGNETIC STEREO CARTRIDGE as available. COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER. Total list price over £34.

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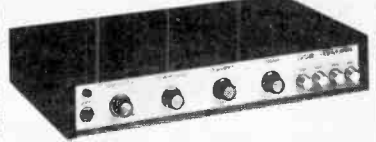


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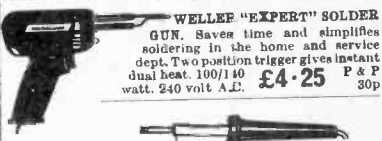
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6V8G	23	CY31	30	EF41	40	PC900	31	PY801	34	AP116	20
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6X4	23	DAF96	38	EF85	28	PC85	25	R20	56	AP118	18
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7B7	38	DF91	16	EF89	28	PC89	42	PY88	56	AP127	17
10P13	58	DF96	38	EF91	13	PCC189	48	U47	64	OC26	35
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25U4GT	57	DY86	24	EL95	33	PCF808	68	U801	80	OC170	28

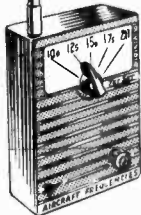
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Many thousands of v.h.f. Aircraft Band Converters now sell in U.S.A. Listen in to AIRLINES, PRIVATE PLANES, JETPLANES. Eavesdrop on exciting croak talk between pilots, ground approach control, airport tower. Hear for yourself the disciplined voices hiding tensions on talk downs. Be with them when they have to take nerve rippling decisions in emergencies—Tune into the international distress frequency. Covers the aircraft frequency band including HEATHROW, GATWICK, LUTON, RINGWAY, PRESTWICH ETC., ETC. CLEAR AS A BELL. This fantastic fully transistorised instrument can be built by anyone nine to ninety in under two hours. (Our design team built four—everyone worked first time). No knowledge of radio or electronics required. No soldering necessary. Fully illustrated simply worded instructions take you step-by-step. Uses standard PP3 battery. Size only 4 1/2" x 3" x 1 1/2". All you do is extend rod aerial, place close to any ordinary medium-wave radio (even tiny portables) NO CONNECTIONS WHATSOEVER NEEDED. Use indoors or outdoors. THERE WILL BE ENORMOUS DEMAND FOR THIS NEW DESIGN, SEND NOW, ONLY £2-37 + 23p p. & p. for all parts, including case nuts, screws, wire, etc., etc. (Parts available separately).

FIND BURIED TREASURE! TREASURE LOCATOR TRANSISTORISED

NOW IT'S HERE AT LAST, after experimenting for four and a half months with a multitude of different circuits and carrying out actual field tests with prototypes, our design team have come up with this real winner. This fully portable transistorised metal object detector and tracks down buried metal objects—it signals exact location with loud audible sound (no phones used)—uses any transistor radio which is inside—no connections needed. FINDS GOLD, SILVER, LOST COINS, JEWELLERY, KEYS, WAR SOUVENIRS, ARCHAEOLOGICAL PIECES, METALLIC ORE, NUGGETS ETC. ETC. Outdoors or indoors. Extremely sensitive. Will signal presence of certain objects buried several feet below ground! No knowledge of radio or electronics required. Can be built with ease in one short evening by anybody from nine years of age upwards, with the wonderfully clear, easy to follow, step-by-step, fully illustrated instructions—it really is easy as A.B.C. transistorised—no valves. Uses standard PP3 battery. No soldering necessary. Size of detector head 13 1/2" x 10" x 2 1/2". Great demand expected at this remarkably low price—ORDER WHILE PRESENT STOCKS LAST. All parts including detector head case, nuts, screws, wire, simple instructions etc. etc. ONLY £2-37 + 27p p. & p. (Sectional handle as illustrated 75p extra).

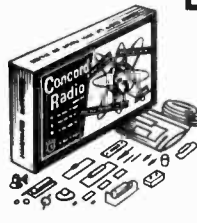


Makes Fantastic Christmas Gift

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Parts available separately. Made up looks worth £15!

BUILD 5 RADIO AND ELECTRONIC PROJECTS



TOTAL BUILDING PRICE £1-97

Amazing Radio Construction set! Become a radio expert for £1-97 (39/6). A complete Home Radio Course. No experience needed. Parts including simple instructions for each design. Illustrated Step-by-step plans, all Transistors, loudspeaker, personal

Makes exciting Christmas present

phone, knobs, screws, etc., all You need. Presentation Box 37p extra as illus. (if required) (extra parts available separately) no soldering necessary. Send only £1-97 + 23p p. & p.



Only £4-95 FIND BURIED TREASURE WITH THIS READY BUILT & TESTED

Treasure Locator Module

Makes an exceptional Christmas present

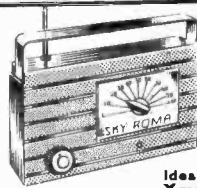
BRAND NEW FULLY TRANSISTORISED PRINTED CIRCUIT METAL DETECTOR MODULE. Ready built and tested—just plug in a PP3 battery and it's working. Put it in a case, screw a handle on and YOU HAVE A PORTABLE TREASURE LOCATOR EASILY WORTH ABOUT £20! Extremely sensitive—penetrates through earth, sand, rock, wood, dirt, water, etc.—EASILY DEMAND EXPECTED AT THIS REMARKABLY LOW PRICE. DEMONSTRATIONS DAILY. ORDERS DESPATCHED IN STRICT ROTATION. SEND NOW £4-95 + 30p carr. etc. (High quality Danish Stethoscope headphones £2-75 extra if required).

SHORTWAVE TRANSISTOR RADIO

ONLY £2-25

Can be built in one evening

At last! After trying countless circuits searching for easy build, work first-time short wave. Giving advanced world-wide performance, we chose this 'Sky Roma'. Anyone from 9 years up can follow the step-by-step, easy-as-ABC fully illustrated instructions. (We built ten prototypes and everyone worked first time) no soldering necessary. 76 stations logged on rod aerial in 30 mins.—Russia, Africa, USA, Switzerland, etc. Experience thrills of world wide news, sport, music, etc. Eavesdrop on unusual broadcasts. Uses PP3 battery. Transistorised (no valves). Size only 3" x 4 1/2" x 1 1/2". As tremendous demand anticipated price held to only £2-25 + 17p p. & p. for all parts incl. Cabinet, screws, instructions, etc. (Parts available separately).



Ideal Xmas Gift

SOOTHE YOUR NERVES, RELAX WITH THIS AMAZING RELAXATRON

Ideal Christmas Gift

only £2-25

CUTS OUT NOISE POLLUTION—SOOTHS YOUR NERVES! Don't underestimate the uses of this fantastic new design—the RELAXATRON! It's basically a pink noise generator based on avalanche operated transistors. Besides being able to mask out extraneous unwanted sounds, it has other very interesting properties. For instance, many people find a rainstorm mysteriously relaxing, a large part of this feeling of well-being can be directly traced to the sound of falling raindrops!—a well known type of pink noise. A group of Dentists have experimented on patients with this pink noise—NO ANAESTHETICS WERE USED! The noise ostensibly created a most definite reaction on these patients nervous systems with the results that their pain systems were blocked. IF YOU WORK IN NOISY OR DISTRACTING SUBROUNDS, IF YOU HAVE TROUBLE CONCENTRATING, IF YOU FEEL TENSED, UNABLE TO RELAX—then build this fantastic Relaxatron. Once used you will never want to be without it—use this amazing pink noise generator whenever you feel uneasy, can't relax or wish to concentrate. TAKE IT ANYWHERE, pocket sized. Use standard PP3 batteries (current used so small that battery life is almost shelf-life) CAN BE EASILY BUILT BY ANYONE OVER 12 YEARS OF AGE using our unique, step-by-step, fully illustrated plans. No soldering necessary. All parts including case, a pair of crystal phones, Components, Nuts, Screws, Wire, etc. etc. no soldering. Send only £2-25 + 25p p. & p. parts available separately.)

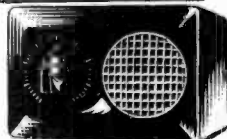


GET A GOOD NIGHT'S SLEEP—EVERY NIGHT!

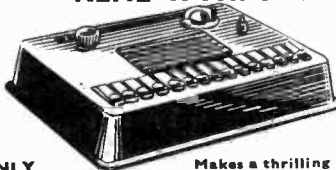
INGENIOUS ELECTRONIC SLEEP INDUCER

Ideal Xmas Gift only £2-75

CAN'T SLEEP AT NIGHTS? DO YOU WAKE UP IN THE NIGHT AND CAN'T GET OFF TO SLEEP AGAIN? WOULD YOU LIKE TO BE GENTLY SOOTHED OFF TO SATISFYING SLEEP EVERY NIGHT? Then build this ingenious electronic sleep inducer. It even stops by itself so you don't have to worry about it being on all night! The loudspeaker produces soothing audio-frequency sounds, continuously repeated—but as time goes on the sounds gradually become less and less—until they eventually cease altogether, the effect it has on people is amazingly very similar to hypnosis. A control is provided for adjusting the length of times etc., all transistor, can be built by anyone over 12 years of age in about two hours. No knowledge of electronics or radio needed. Extremely simple, easy-to-follow, step-by-step, fully illustrated instructions included. No soldering necessary. Works off standard batteries—extremely economical. Size only 3" x 4 1/2" x 1 1/2"—take it anywhere. All parts including case, loudspeaker, components, nuts, wire, screws, etc. etc. THERE WILL BE A GREAT DEMAND FOR THIS UNIQUE NEW DESIGN—SEND NOW £2-75 + 25p p. & p. (parts available separately)



REAL WORKING ELECTRONIC ORGAN



ONLY £2-75

Makes a thrilling Christmas present

Anyone from nine years upwards can build it easily in one short evening following the fully illustrated, step-by-step, simply worded instructions. BIG DEMAND ANTICIPATED FOR THIS UNIQUE INSTRUMENT at our low, low building price. ONLY £2-75 + 23p p. & p. for all parts, including case, loudspeaker, transistors, condensers, resistors, knobs, transformer, volume control, wire, nuts, screws, simple (but full) instructions, etc. etc. Use standard battery (parts available separately). Have all the pleasure of making it yourself, finish with an exciting gift for someone.

Don't confuse with ordinary electric organs that simply blow air over mouth-organ type reeds etc. Eight months were spent in creating and testing this superb, revolutionary electronic organ. Fully transistorised—no valves. Proper self-contained loudspeaker. Fifteen separate keys span two full octaves—play the "Yellow Rose of Texas", play "Silent Night", play "Auld Lang Syne", play lots and lots of similar tunes on this real working electronic organ. Although it's no theatre organ it's certainly no tiny thing, it measures 13 1/2" x 10" x 2 1/2". You have the thrill and excitement of building it together with the pleasure of playing a real, live, throbbing electronic organ. Take it anywhere—play it anywhere. NO PREVIOUS KNOWLEDGE OF ELECTRONICS NEEDED—NONE WHATSOEVER. No soldering necessary. It really is as simple as A.B.C. to make.

EXAMINE AT HOME FOR 7 DAYS. YOUR MONEY REFUNDED IN FULL IF NOT 100% DELIGHTED.

CONCORD ELECTRONICS LTD (Dept. PW27) 8 Westbourne Grove, London W.2.
(Mr Bayswater & Queensway Tubes. 1 minute ABC Cinema)
(QUICK DELIVERY) Callers Welcome 9 a.m.-6 p.m. inc. Saturday

28watts, r.m.s. 40Hz to 40kHz $\pm 3dB$



Viscount III Audio Suite complete **£49**



There are two stereo amplifiers—the R100 for ceramic cartridges, the R101 for magnetic and ceramic. Both incorporate FETs (FIELD EFFECT TRANSISTORS), just like top-priced units. FETs give you more of the signal you want, and almost none of the background hiss you don't. Both units have a jack socket to plug in headphones and there's a separate output for tape recorder. Filters (an unusual feature in this price range) and tone controls give a wide range of bass and treble adjustment which compensate for input deficiencies and domestic acoustic conditions.

PRICES SYSTEM 1

Viscount III R101 amplifier	£22.00+90p p&p
2 x Duo Type II speakers,	£14.00+£2 p&p
Garrard SP25 Mk. III with MAG.	
cart ridge plinth and cover	£23.00+£1.50
	p&p
Total	£59.00

Available complete for only **£52.00+£3.50 p&p**

SYSTEM 2

Viscount R101 amplifier	£22.00+90p p&p
2 x Duo Type III speakers	£32.00+£3 p&p
Garrard SP25 Mk. III with MAG.	
cartridge, plinth and cover	£23.00+£1.50
	p&p
Total	£77.00

Available complete for **£69+£4 p&p**

SYSTEM 3

Viscount III Amplifier R100	£17.00+90p p&p
2 x Duo Type II speakers, pair	£14.00+£2 p&p
Garrard SP25 Mk. III with CER. diamond	
cartridge, plinth and cover	£21.00+£1.50
	p&p
Total	£52.00

Available complete for only **£49.00+£3.50 p&p**

SPEAKERS Duo Type II

Size approx 17" x 10½" x 6½". Drive unit 13" x 8" with parasitic tweeter. Max. power 10 watts. 3 ohms. Simulated Teak cabinet. **£14 pair+£2 p&p.**

Duo Type III Size approx 23½" x 11½" x 9½". Drive unit 13½" x 8½" with H.F. speaker. Max. power 20 watts at 3 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. **£32 pair+£3 p&p.**

SPECIFICATION R101

14 watts per channel into 3 to 4 ohms. Total distortion @ 10W @ 1kHz 0.1%. P.U.1 (for ceramic cartridges) 150mV into 3 Meg. P.U.2 (for magnetic cartridges) 4mV @ 1kHz into 47k. equalised within $\pm 1dB$ R.I.A.A. Radio 150mV into 220k. (Sensitivities given at full power). Tape out facilities; headphone socket, power out 250mV per channel. Tone controls and filter characteristics. Bass: +12dB to -17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to -12dB @ 15kHz. Treble filter: 12dB per octave. Signal to noise ratio: (all controls at max) R101—P.U.1 and radio—65dB. P.U.2. —58dB. R100 same as R101 but P.U.2 (for crystal cartridges) 450mV into 3 Meg. Cross talk better than -35dB on all inputs. Overload characteristics better than 26dB on all inputs. Size approx 13½" x 9" x 3½".

R+TV

Radio and TV Components (Acton) Ltd. 21C High Street, Acton, London W3 6NG
323 Edgware Road, London, W.2. Mail orders to Acton. Terms C.W.O. All enquiries S.A.E.
Goods not despatched outside U.K.

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



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

Output Power: 45 watts R.M.S. (Sine wave drive). Frequency response: -3dB points 30Hz at 18KHz. Total distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB.

Speaker Impedance: 3, 8 or 15 ohms. Bass Control Range: ± 13dB at 60Hz. Treble Control Range: ± 12dB at 10 KHz. Inputs: 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K.

To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.

SPEAKERS! Size 20" x 20" x 10" incorporating 12" heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

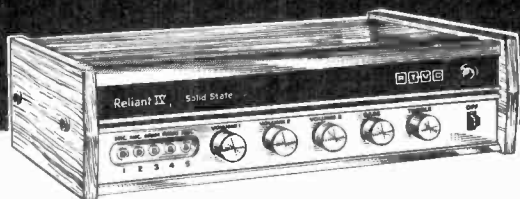
COMPLETE SYSTEM £50 Plus £6 P. & P.

Sound 50 amp and 2 speakers

or available separately.

Amplifier £28.50 plus £1.50 P. & P.
Speakers £12.50 each plus £2.25 P. & P.

RELIANT mk. IV



Provides a high standard of sound reproduction, with full mixing facilities. It's versatility makes it suitable for: Discotheque, P.A., Home Entertainment Applications, etc.

- ★ Five Electronically Mixed Inputs
- ★ Three Individual Mixing Controls
- ★ Separate base and treble controls common to all five inputs
- ★ Mixer employing F.E.T. (Field Effect Transistor)
- ★ Solid State Circuitry ★ Attractive Styling

£9.50 plus P. & P. 60p.

INPUTS:—1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram. Tuner, Monitor, Organ, etc.). All 250mV sensitivity.

CONTROLS:—3 Volume controls. Bass control range: 13db @ 60 Hz. Treble control range ±12db @ 15KHz. Separate ON/OFF Switch. Neon Indicator.

POWER OUTPUT:—12 Watts R.M.S. Into 3 to 4 ohms speaker

SIGNAL/NOISE:—Better than -60db on Inputs 3, 4 and 5 & -50db on 1 & 2

SUPPLY:—220 - 250 AC Mains. **SIZE:**—12½" x 6" x 3½"

THE ELEGANT SEVEN Mk. III

(350m W Output)



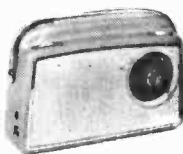
7 transistor fully-tunable M.W.—L.W. superhet portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction.

MAINS POWER PACK KIT: 75p extra.

Price **£5.25** plus 50p. P. & P.

Circuit 13p FREE WITH PARTS.

THE DORSET (600m W Output)

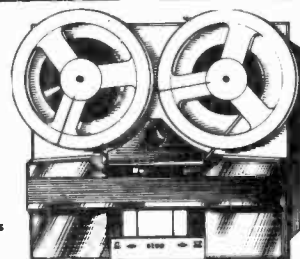


7-transistor fully tunable M.W.—L.W. superhet portable. Set of parts. The latest modulated and pre-alignment techniques make this simple to build. Sizes: 12 x 8 x 3in.

Price **£5.25** plus 50p P. & P.

Circuit 13p FREE WITH PARTS

CONTINENTAL 4 TRACK, 3 SPEED TAPE DECK



with high impedance heads

R.C. 74 tape deck. Three speeds—7½, 3½ and 1½ ips.

4-track record/playback head. Plus 4-track erase head. Positive pressure pad system. Takes any tape spool up to and including 7". The R.C. 74 is driven by a powerful 200/250V 50-cycle A.C. motor. A heavy, accurately balanced, flywheel brings wow and flutter levels down to approx. 0.3% total at 3½ and 7½ ips. Fast rewind in both directions.

Controls couldn't be simpler! Just five push buttons that interlock to cut out accidental tape damage. Efficient servo-action type braking. Easy drop-in tape loading.

The R.C. 74 comes with an attractive moulded deck cover, which has positions for tone and volume controls. The unit is built into a rigid die-cast frame, and overall size of the whole unit is 12½ x 11½ x 6 inches. Every single deck fully tested before dispatch. Spools not supplied.

Price complete **£15.00**. Plus 75p P. & P.

TOURIST CAR RADIO

MARK 3



ALL TRANSISTOR

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts. Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4½in deep.

SET OF PARTS

£6.30

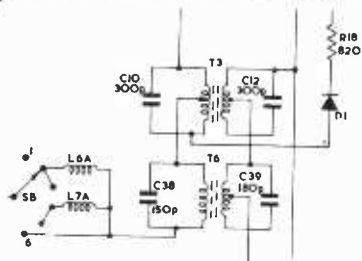
plus P. & P. 50p.

Circuit diagram 13p. Free with parts Speaker, baffle and fixing kit £1.25 extra plus 25p. p. & p. Postage free when ordered with parts.

See previous page for address

RADIO & TV COMPONENTS
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(ACTON) LIMITED

electronics mastered!*



by our highly practical
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Step by step we take you through the apparent intricacies of electronics and show you how easily you can master the subject. Write for the brochure which shows, in full detail, how you can do it.

1

We provide a full range of components and sub-assemblies, with details of what they do, so that you learn to recognise all the 'bits and pieces'. Using some of these you are instructed in how to build this oscilloscope, simply and quickly.

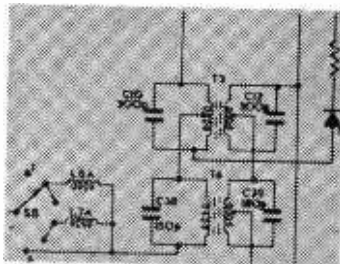
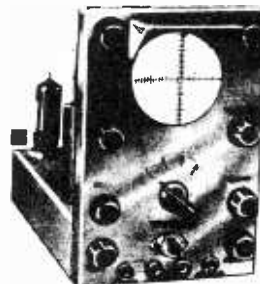
2

You are shown how to read and understand circuit diagrams so that you can later build more advanced equipment or draw your own diagrams.

3

You can construct over 40 kits, including:—

- Valve experiments
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- Computer circuit
- Basic radio receiver
- Electronic switch
- Simple transmitter
- a.c. experiments
- d.c. experiments
- Simple counter
- Time delay circuit
- Servicing procedures



This course has been designed to help even those who are complete newcomers to electronics. No Maths needed!

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To: **British National Radio School, Reading, Berks.**
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ADDRESS.....

1/72

FREE

SPECIAL ELECTRONIC GIFT
to all our Students **POST COUPON NOW!**

PRACTICAL WIRELESS

VOL 47 NO 9

Issue 779

JANUARY 1972

MOST constructional articles appearing in P.W. relate to specific projects, designed so that individual readers can make exact replicas. However, readers who have attained a reasonable proficiency and knowledge often want to incorporate a particular refinement or facility or otherwise change the design of the prototype. We know that some readers search through their back numbers and, by combining features from several designs, come up with a piece of equipment to meet their specific needs.

The reader who wants to experiment in this way is worthy of encouragement—providing he has sufficient theoretical know-how and is capable of assessing how such modifications or amalgamations should be carried out. He is, of course, progressing to the stage where he will begin to design his own individual pieces of equipment.

In order to encourage the experimentally-minded reader we are publishing in this issue a special 8-page *Experimenters Circuits Supplement*. This contains the bare bones for countless projects with more than 20 building bricks in the way of basic circuits which can be used on their own or amalgamated to make more complex units to be used as a springboard for more sophisticated designs.

Together with the wall chart given away with the October issue, and the associated series *Transistor Circuitry for Beginners* which is still running, this provides a stockpile for those interested in finding out what makes circuits tick and a stimulus for experimentation. We would like to hear from any readers who, as a result of these recently published guides, have successfully designed their own pieces of equipment. The best ones will be published.

W. N. STEVENS—*Editor*.

Merry Christmas and a Happy New Year

from

W. Norman Stevens (Editor)

Lionel E. Howes, G3AYA (Assistant Editor)

Halvor Moorshead John Reddihough

Eric Dowdeswell, G4AR Colin R. Riches

Peter Metalli (Art Editor)

Ruth Cyster and Miriam Casey (Secretarial)

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PUBLISHED ON JANUARY 7th**

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SPECIAL FEATURE

SUPPLEMENT:

Experimenters Circuits

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

Texas Data Books

Six extremely useful data books are available from Texas Instruments Ltd. Data Book 1 covers linear and ECL integrated circuits and MACH IV procurement specifications. Data Book 2—digital integrated circuits including TTL/MSI, DTL circuits summary, SNF/SNG circuits summary, high noise immunity logic (HNIL) circuits. Data Book 3 covers transistors and includes an instant transistor selector and data sheets for transistors located alphanumerically.

For data on devices from 2N2368 to 3N111 refer to Data Book 4. Data Books 3 and 4 total 772 pages. Data Book 5 (over 600 pages) contains comprehensive data on diodes, regulators, triacs, SCRs bridges, high voltage stacks and the optoelectronic and microwave ranges. Data Book 6 covers MOS/LSI circuits and hybrid integrated circuits. The data books are available separately at 60p each, post free. *Texas Instruments Ltd., Manton Lane, Bedford, England.*

Eagle Amplifier AA6



A new stereo amplifier with seven individual tone controls will be added to its extensive range of Hi-fi products by Eagle International next month.

In addition to the normal bass and treble controls, the Eagle AA6 has five "slide" controls to boost or cut specific sectors of the whole frequency range. The Hi-fi enthusiast is thus able to mix the sound to suit his own taste by controlling individually frequency bands around 40, 200, 1200, 6000 and 15000Hz.

An independent switch allows the amplifier to revert to simple bass/treble controls when required.

With an output of 12.5 watts r.m.s. per channel, it has a frequency range of 20-30,000Hz \pm 2dB.

While the retail price is not yet finalised, it is understood that it will be under £60.00. *Eagle International, Precision Centre, Heather Park Drive, Wembley, HAO 1SU.*

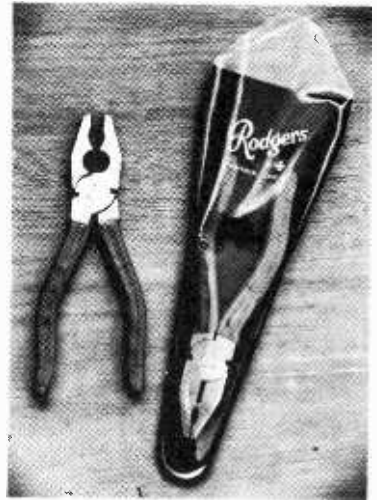
Hong Kong II

Princess Anne brought into service a new space communications link between the Far East and Europe when she officially opened the second Hong Kong earth station on Monday, November 1, at Stanley Point.

Hong Kong II, owned and operated by Cable and Wireless, was built at a cost of £1,650,000, the prime contractor being The Marconi Company. The station provides immediate links for all types of service with Britain, Germany, Indonesia and Singapore, Bahrain and Malaysia and subsequently Ceylon, India, Italy and Pakistan.

Forebears of the Cable and Wireless Group brought international communications to mainland China 100 years ago when an undersea cable was laid to Hong Kong. In the century following, Hong Kong has become a key communications centre not only in its own right but as a focal point for Far East communications.

New Pliers



Joseph Rodgers & Sons Limited who are the owners of Cooper & Sons (Sheffield) Ltd, tool makers, announce a new range of pliers. This new patented plier involves the cold pressing of pliers from tool steel followed by heat treatment.

The first plier the Company has developed is the 6in. combination plier. Currently under development are the radial plier and the wire cutting plier. These pliers are attractively packed in polythene wallets and the recommended retail price of the 6in. plier is 40p. *Joseph Rodgers & Sons Ltd, No. 6 Works, St. Mary's Gate, P.O. Box 96, Sheffield, S2 4QB.*

Trans-Atlantics

Top-Band amateurs will again be looking forward to the series of trans-Atlantic tests arranged as usual by "Stew" Perry W1BB. Dates are Sundays, Dec. 26th, Jan. 9th, 23rd, and Feb. 13th, from 0500-0730 GMT W/VE stations to call CQ for first five minutes of period and alternately thereafter, with European stations calling between these times. W/VE's will call on 1800-1810kHz and listen 1824-1830kHz so do NOT call W/VE stations on their own frequency. The tests are intended for those stations who have not yet managed a trans-Atlantic contact.

Ford-Mullard Car Safety Belt

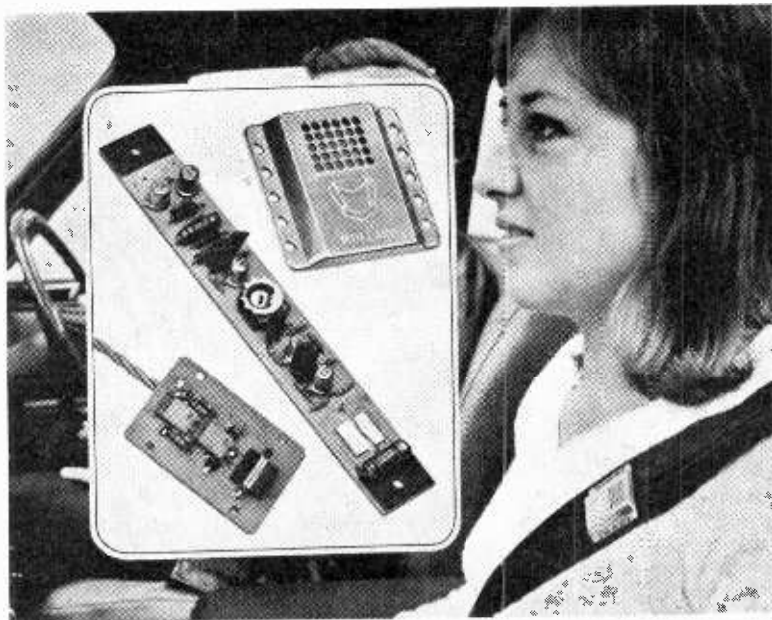
Most of the existing car safety belt systems which require the wearing of safety belts can be fooled. For instance, the type which depends on the belt being worn and fastened by the driver in the seat before the ignition can be switched on, can be by-passed simply by buckling the belt and sitting in the seat.

A new system, using ultrasonics, developed jointly by the Ford Motor Co. and Mullard Ltd. makes cheating and tampering impracticable by the introduction of an additional sequence in the ignition-linked-chain. Before the ignition can be switched on the driver must occupy his seat, so depressing a sensor fitted beneath it, buckle the belt across his lap and close the belt switch. Then, provided the belt is correctly worn, an ultrasonic signal, emitted by a transmitter mounted in the belt and received by a detector mounted in the wind-screen corner pillar, completes the ignition circuit.

If the sequence is not completed, the logic circuit will activate an audible alarm to warn the driver that the ignition switch cannot be closed until the belt-up sequence has been carried out.

The audible and visible alarm, mounted on the dashboard, indicates to the driver that the correct sequence has not been completed or has been broken. It is basically a piezoelectric ceramic multivibrator working within the audible frequency range (3kHz). The d.c. supply to the alarm is interrupted periodically by use of a slow-running multivibrator whereby an intermittent tone is produced.

The logic of the system can be so arranged that if the belt is unfastened while the car is moving the ignition is not immediately affected. Instead, an audible and visible warning is given. If, at the end of a specified time, say 30 seconds, the belt still remains unfastened, the ignition can be cut out. The system say the developers, could be put into production quickly and cheaply.



Edgware Road

Electro-tech Sales (E.T.S.) are the latest company to open new premises in the 'Mecca' of electronic components — Edgware Road, London, W.2. Their new 'browse around' shop (you won't be pestered) is now open at number 301, Edgware Road, W.2, and all and sundry are invited to view their extensive stocks of 'goodies'.

Their telephone number is 01-262 2251.

Language Lab

Now it seems that we are in the Common Market there should be a demand for Crown Radio Co. Ltd's personal portable language laboratory embodying modern learning systems based upon the international compact cassette.

To ensure the best use of the language course cassette a patented feature allows the continuous play-back of a segment of the tape via a repeater tape. This facility permits the tones and inflections of the "instructor's" voice to be compared with the student's recording for as long as is necessary to match the instructor. This repeat mechanism is one

of great benefit to the student who desires a proper knowledge of the subtle intonations of the language being learned.

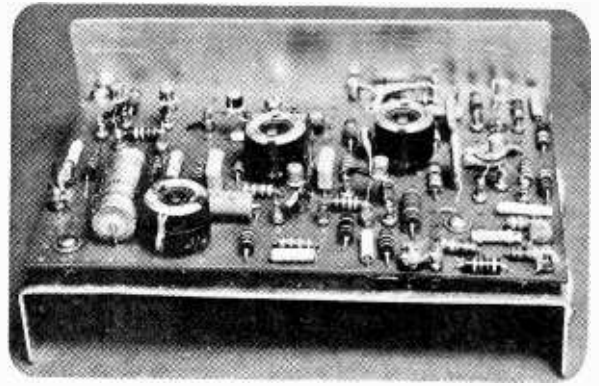
The circuit includes 17 transistors, 2 diodes and a thermistor, the frequency response is from 200 to 5,000Hz and the output from the oval 3 $\frac{1}{4}$ in. by 4 $\frac{3}{4}$ in. permanent magnet loudspeaker is controllable up to 1,000mW. Power source is 240V a.c.

A mains lead, microphone, stethoscope earpiece, C60 compact cassette, repeat tape, dust cover and instruction manual are included for a suggested retail price of £69.75. As an optional extra, there is a headset with boom microphone which costs £8. Crown Radio Co. Ltd., 128 Shore-ditch High Street, London, E.1 6JF.



stereo decoder

A. BARBER



SINCE the advent of stereophonic transmissions by the BBC, constructional articles dealing with stereo decoders have been few and far between. The unit to be described is intended for use with either valve or transistor type f.m. tuners.

Alignment procedure utilises the BBC stereo transmission as a signal source. An indicator is included to give warning of a stereo transmission.

The complete circuit of the stereo decoder is shown in Fig. 1.

The composite stereo signal from the f.m. tuner is fed to Tr1 and Tr2, which are signal amplifiers.

Tr1 is connected in the common-emitter mode and Tr2 operates as an emitter follower thus minimising the loading of T1 secondary winding.

Stabilising feedback from the emitter of Tr2 to the base of Tr1 is provided by resistor R5.

The M signal and the sidebands of the S signal are passed to the centre tap on the secondary winding of the matrix transformer T1 via the r.c. filter R7, C5.

The 19kHz pilot frequency is selected by the filter circuit C4/L1 in the base circuit of Tr3.

The 19kHz signal is then amplified via Tr3; this amplified signal appearing across Tr3 collector load circuit comprising L2, C7. This signal is then passed to Tr4 via C8.

Tr4, operating as a frequency doubler-amplifier stage where the 38kHz sub-carrier frequency appears across the tuned primary of T1 located in the collector circuit of Tr4.

The secondary winding of T1 applies the anti-phase switching signals to the emitters of Tr5 and Tr6 along with the multiplex sideband information. This results in the original A and B signals appearing at the collectors of Tr5 and Tr6.

The A and B signals from the matrix are then fed to separate left- and right-hand audio channels via a 50µS de-emphasis and filter and filter circuit to reduce the 38kHz signal to an acceptable level.

The 38kHz r.f. signal from the collector of Tr4 is rectified by D1 and "switches" Tr7 "on" which in

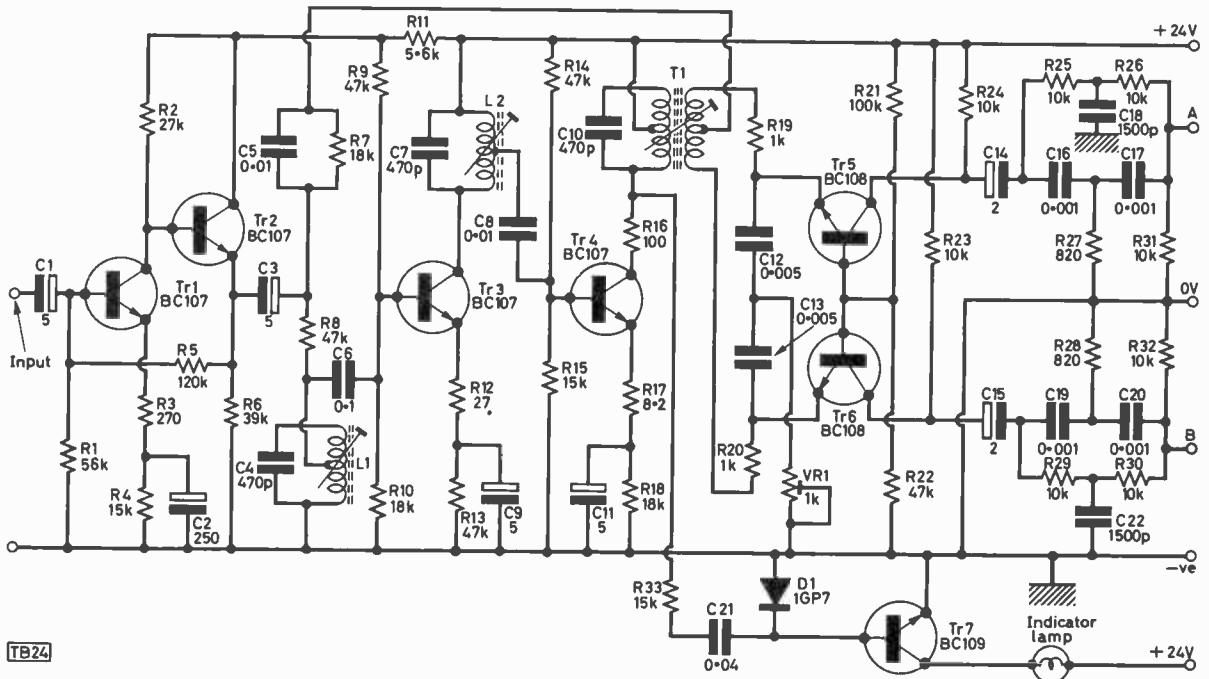


Fig. 1 : Complete theoretical circuit of the stereo decoder.

turn operates the stereo "beacon" indicator lamp. This means that the stereo beacon will only light when the 19kHz pilot tone is present at the input so giving automatic indication of a stereo transmission.

Construction

The decoder is constructed on a piece of s.r.b.p. perforated 150×95mm as shown in Fig. 2. The layout is not critical.

No details for a cabinet are given as this is a matter of personal preference and the unit is more likely to be housed with existing equipment.

The input and output leads should be screened and as short as possible. Care should be taken to keep them away from mains leads or transformers to reduce the chance of hum pick-up.

The completed panel is bolted to an aluminum chassis which is used for mounting the input and output sockets. A B9A valve base is used as a socket for the d.c. power supply, provision also being made on this socket for the stereo indicator output so that the stereo beacon can be mounted adjacent to or on the tuner unit.

The coils L1 and L2 are 19kHz (type MXC2) and the transformer, T1, 38kHz (MXT3) manufactured by Messrs. Denco Ltd. Alternatively Mullard decoder coils would probably suit though these have not been tried.

After the components have been mounted on the perforated sheet, connections are made for the d.c. supply and the input and output leads. These leads are passed through the holes marked in the aluminium chassis and the component assembly board is then bolted to the aluminium using 4BA nuts and bolts with spacing washers. The leads are then connected to the sockets mounted on the chassis.

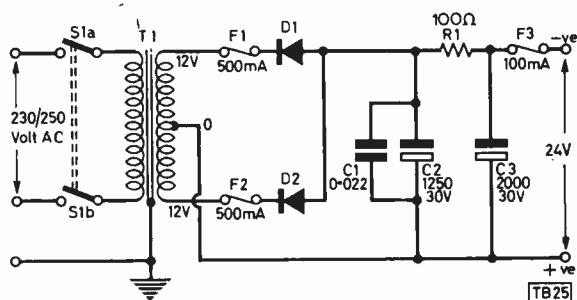


Fig. 3 : Circuit diagram of a suitable power supply for the decoder.

A suitable d.c. power supply is shown in Fig. 3. The mains transformer has a 12.0-12 volt secondary winding which feeds a pair of silicon diode rectifiers. The d.c. output is fully smoothed by C2 and C3. C1 acts as r.f. decoupling.

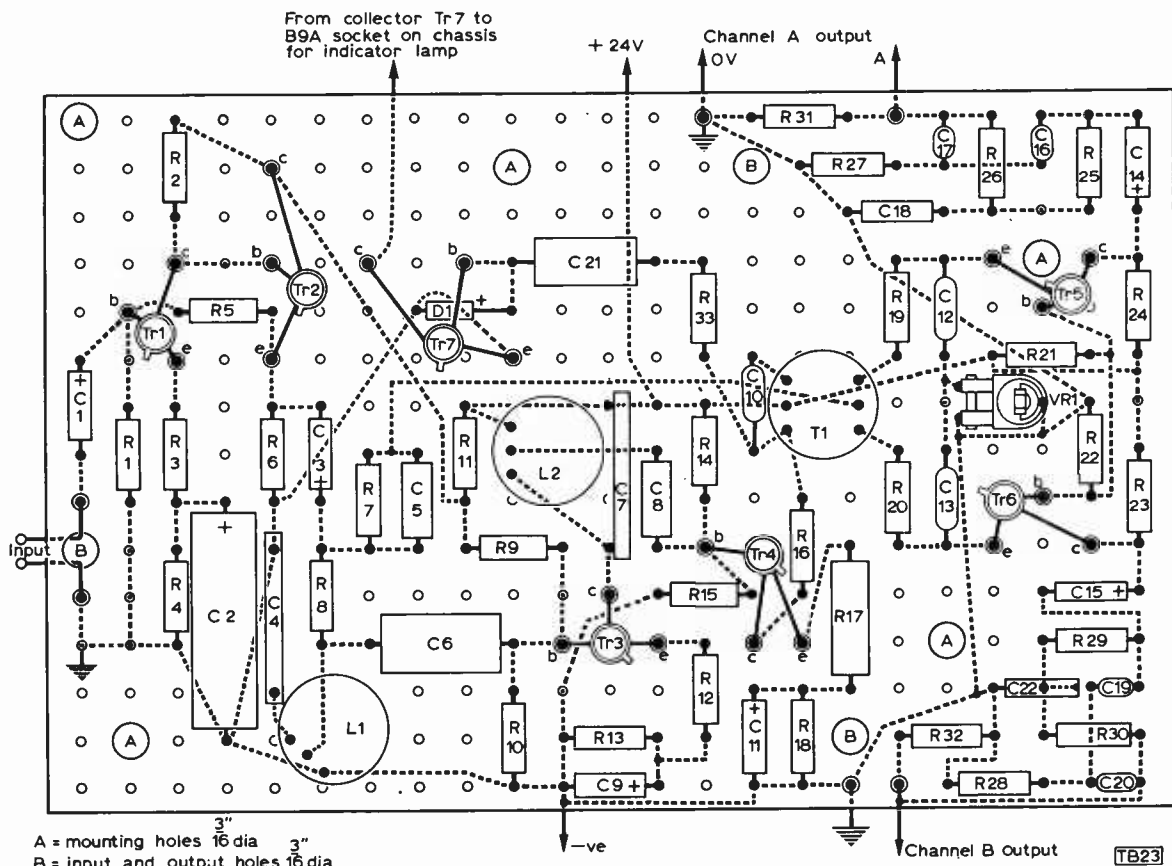


Fig. 2 : Component layout and wiring.

When the decoder is connected up, it should draw approximately 1.8mA under no signal conditions. When a stereo signal is present it will draw approximately 23mA.

Transistor voltages for both mono and stereo are given in the table.

Alignment

One of the advantages of the decoder is the simplicity of alignment. This can be done on any stereo transmission, and the procedure is as follows. Connect a potentiometer of about 100kΩ across the

★ components list

Resistors:

R1	56kΩ	R12	27Ω	R23	10kΩ
R2	27kΩ	R13	47kΩ	R24	10kΩ
R3	270Ω	R14	47kΩ	R25	10kΩ
R4	15kΩ	R15	15kΩ	R26	10kΩ
R5	120kΩ	R16	100Ω	R27	820Ω
R6	39kΩ	R17	8.2Ω	R28	820Ω
R7	18kΩ	R18	18kΩ	R29	10kΩ
R8	47kΩ	R19	1kΩ	R30	10kΩ
R9	47kΩ	R20	1kΩ	R31	10kΩ
R10	18kΩ	R21	100kΩ	R32	10kΩ
R11	5.6kΩ	R22	47kΩ	R33	15kΩ

all 10% miniature 1/4W carbon.

Semiconductors:

Tr1	} BC 107	Tr5	} BC108	D1 1GP7	
Tr2		Tr6			
Tr3		Tr7			BC 109
Tr4					

Inductors:

L1, L2 19kHz—Denco MXC2
T1 38kHz—Denco MXT3.

Power Supply:

T1 mains transformer 12-0-12V 50mA secondary;
F1, F2 500mA fuse; F3 100mA fuse; D1, D2 OA200 silicon rectifier; R1 100Ω; C1 0.22μF 100V, C2 1250μF 30V, C3 2000μF 30V; S1 d.p. on/off switch.

Capacitors:

C1	5μF	15V electrolytic
C2	250μF	25V electrolytic
C3	5μF	15V electrolytic
C4	470pF	10% silver mica
C5	0.01μF	
C6	0.1μF	
C7	470pF	10% silver mica
C8	0.01μF	
C9	5μF	15V electrolytic
C10	470pF	10% silver mica
C11	5μF	15V electrolytic
C12	0.005μF	
C13	0.005μF	
C14	2μF	6V electrolytic
C15	2μF	6V electrolytic
C16	0.001μF	
C17	0.001μF	
C18	1500pF	
C19	0.001μF	
C20	0.001μF	
C21	0.04μF	
C22	1500pF	

Miscellaneous:

Indicator lamp 24V 20mA; 3 Co-axial sockets; Perforated s.r.b.p. assembly board; B9A valve base; Aluminium sheet 18 s.w.g. 8 in. x 5 in. VR1 1kΩ miniature skeleton pre-set potentiometer.

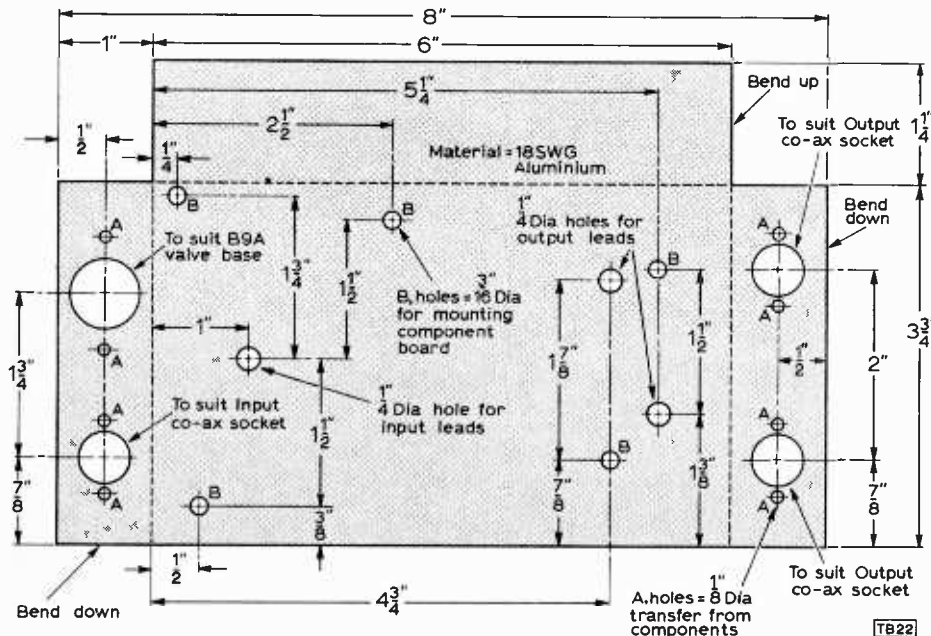


Fig. 4 : Metalwork and drilling details for the decoder chassis.

tuner output with the slider connected to the decoder input. It should be noted at this point that take-off from the tuner unit *must be before the de-emphasis circuit*. On some f.m. tuner designs this point is given as MPX or multiplex output. Turn the potentiometer to its maximum value and tune the receiver to a stereo broadcast. Adjust the cores of L1, L2 and T1 until maximum brightness of the indicator lamp is obtained. Re-adjust the potentiometer and re-set the cores of L1, L2 and T1 until maximum brightness is obtained. Repeat this operation until any adjustment of the cores no longer produces an increase of brightness of the indicator lamp. Disconnect the potentiometer and reconnect the decoder to the discriminator output.

With the pre-set potentiometer, VR1, set at its mid-position the decoder will give a reasonable degree of separation. Final alignment should be done with the aid of the BBC test tone transmissions. When the left-hand channel only is being transmitted, disconnect the left-hand amplifier channel and adjust the core of T1 in an anticlockwise direction until the output from the right-hand loudspeaker is at a minimum.

Re-connect the left-hand amplifier channel and disconnect the right-hand amplifier channel. When only the right-hand channel is being transmitted, adjust VR1 for minimum output from the left-hand loudspeaker.

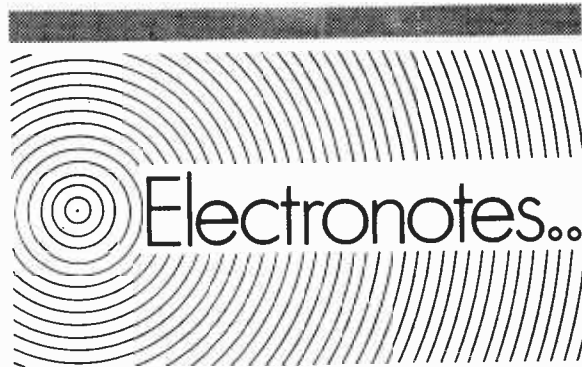
TABLE

Transistor	Mono			Stereo		
	e	b	c	e	b	c
Tr1	3.3	3.6	13.0	3.3	3.6	13.0
Tr2	12.8	13.0	19.0	12.8	13.0	19.0
Tr3	4.6	4.8	24.0	4.5	4.8	23.8
Tr4	5.2	5.5	24.0	5.9	5.5	23.8
Tr5	6.5	6.1	23.0	6.5	6.0	23.0
Tr6	6.5	6.1	23.0	6.5	6.0	23.0
Tr7	—	—	—	—	0.15	—

The decoder gives good performance with both transistor and valve tuners. The tuner unit used by the author for testing and aligning the decoder was a Pye V.H.F.2D table receiver, the output being taken from the tape socket. It should be noted that the signal-to-noise ratio of a stereo transmission is slightly lower than for mono, and it is therefore essential that an adequate signal is received from the BBC transmitter. A good f.m. outdoor receiving aerial, placed in as high a position as possible is one way of ensuring a satisfactory and noise free stereo performance.

Alternative transistors

Alternative devices to those specified in this design are available in the Texas range of Silect transistors. For BC107 use BC182L, for BC108 use BC183L and for BC109 use BC184L. The lead connections however differ, and reference to manufacturers data is recommended. ■



S. GINSBERG

SO much seems to be happening in electronics, that it is very difficult to decide just what to comment on. Perhaps the humble cathode ray tube is a worthy contestant for examination. Recently, top experts, in the field of displays, met at Loughborough University. Two types of c.r.t. were on show which readers may not be aware of.

One was shaped rather like a flowerpot, the thin tube neck and gun assembly protruding from the smaller diameter end while the viewing screen was at the larger end. By using a projector to shine an image (from a suitable negative or positive), through a small window in the smaller diameter end, it is possible to superimpose this information onto the electronic information supplied on the tube face via the electron gun. In this way, the outline rules and headings of tables (say) can be projected, leaving the electronics to fill in the words or figures.

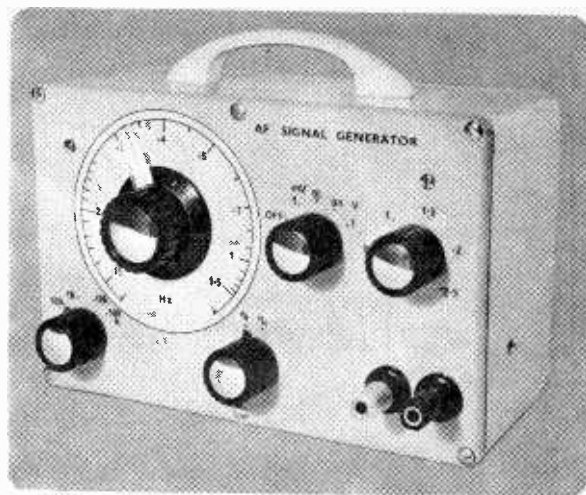
The second type of c.r.t. shown was a bi-colour display tube. This tube has a phosphor coating on the tube face, then an inert layer, then another phosphor coating. This sandwich uses different colour phosphors, say red and green, for the two active layers. Electrons from the gun strike the phosphor causing it to fluoresce. A greater electron energy is needed to penetrate the inert layer and strike the second phosphor. So by varying the electron velocity we can have a red or a green trace. By careful adjustment it is possible to make both phosphors glow thus giving a third colour, yellow (red + green). Because there is no mosaic dot pattern, these bi-colour tubes give far superior resolution to the colour-mask tubes used in colour television receivers.

Bi-colour tubes are, at present, undergoing various tests in all sorts of equipment. One example might be a ship in a convoy. At present, all ships show as a "blob" on the screen, all blobs being the same colour. If all ships in the convoy were picked up as (say) blue blobs, then any "foreign" ships coming onto the screen would show as (say) red blobs making them immediately conspicuous.

"Everything is relative," says the local know-all pretending to explain Einsteins theories. Of course everything is relative—but to what? Well, our "knowledgeable friend" is right in his statement. Look at one millimetre, not very big is it. Imagine that divided into one thousand divisions, small, aren't they. They're still enormous to the laser interferometer built by Hughes in the U.S. This gadget measures down to a little 'ol 0.0003 angstroms which, if you work it out, is about one ten thousandth of an atom—some 50 million times shorter than the wavelength of light itself. How does that grab you, mechanical engineers?

AUDIO SIGNAL GENERATOR

JOHN THORNTON-LAWRENCE



THE A.F. Signal Generator to be described is an addition to the range of test instruments recently published in *Practical Wireless*. The generator has a frequency coverage from 15Hz to 150kHz in four ranges.

- 15Hz-150Hz
- 150Hz-1.5kHz
- 1.5kHz-15kHz
- 15kHz-150kHz

The output can be either sine wave or square wave and a switched and variable attenuator enables the output to be adjusted up to a maximum of 2.5 volt r.m.s. (7V p-p) sine wave or 2.5V p-p square wave. The square wave has a rise time of typically 0.1μS. The A.F. Signal Generator is powered by two PP7 batteries contained within the case. The appearance matches the other instruments in the range.

Circuit

The circuit may be divided into five sections, the sine wave oscillator, driver stage, bi-stable squaring circuit, output stage and attenuator. A block diagram is shown in Fig. 1 and the full circuit is shown in Fig. 2.

Sine Wave Oscillator. This oscillator is the familiar Wien Bridge circuit in which Tr1, Tr2 and Tr3 form a wide band amplifier and the variable resistors VR1, VR2 and the capacitors associated with S1 provide the tunable bridge circuit.

To stabilise the amplitude of oscillation, negative feedback is provided via C9, R8 and a thermistor, R7.

The thermistor has a negative temperature coefficient and is self-heated by the alternating signal current passing through it. An increase in the oscillator signal amplitude causes further self-heating

of R7 and a resultant reduction in its resistance increases the negative feedback. This reduces the overall gain and thus stabilises the amplitude of the signal.

Driver Stage. When switched to sine wave output, this stage, Tr4, provides an interface between the oscillator and the output stage and sets the biasing conditions for correct operation.

The operating current for Tr4 is determined by the potential divider R11 and R12 and by the emitter resistor R13. The collector of Tr4 is connected through S2C directly to the base of Tr8 and so sets the voltage at this point to be a little below half the total supply voltage. VR5 enables the amplitude of the sine wave output voltage to be set to 2.5 volt r.m.s.

Bi-Stable Squaring Circuit. In the square wave position of S2, the oscillator output is connected to the input of the bi-stable circuit and the square wave output is connected to the output stage.

The bi-stable consists of Tr5 and Tr6 connected as a Schmitt trigger. The sine wave input at Tr5 base produces a square wave output at the collector of Tr6. Bias to Tr5 is set by VR6 so that the circuit operates at the correct point on the sine wave and provides an output with a mark-space ratio of 1:1.

The collector of Tr6 is directly connected through zener diode D8 to the output stage. The output amplitude is restricted by D7 and VR7, and this enables the square wave output to be set to 2.5 volts p-p. The current supply to the squaring stages is provided through R14 and the voltage is regulated by the 4.3 volt zener diode D6.

Output Stage. The output stage consists of Tr7 and Tr8 connected in complementary symmetry. Biasing is provided by D4 and D5 and the quiescent current

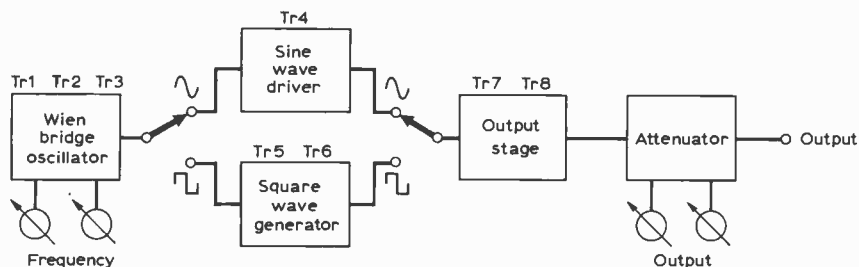


Fig. 1: Block diagram of the five stages comprising the audio signal generator.

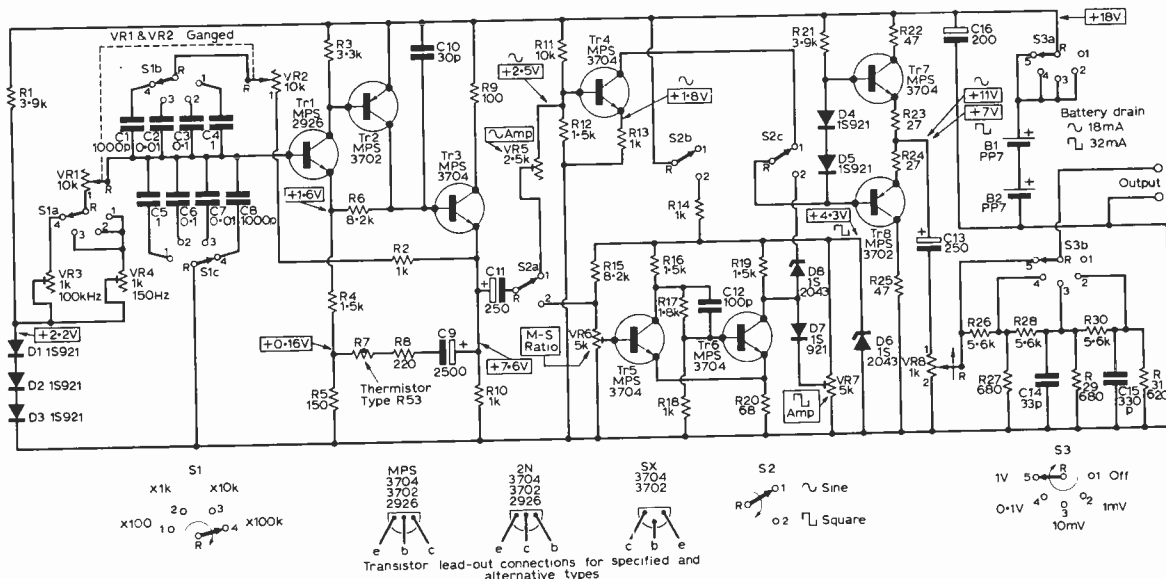


Fig. 2: Full circuit diagram of the signal generator.

is determined by R23 and R24. R22 and R25 are parasitic stoppers. The output is taken from the junction of R23 and R24 and is coupled through C13 to the output attenuator.

Output Attenuator. The output attenuator consists of a variable control VR8 and a switched ladder attenuator having steps of 10:1 and an impedance of approximately 600 ohms. Frequency compensation on the 10mV and 1mV ranges is provided by C14 and C15 respectively.

Construction

The A.F. Signal Generator is built in the large type of Eddystone die-cast box, the lid of the box being the front panel. The Veroboard panel, containing the circuit, and all the controls are mounted on the

front panel and the two PP7 batteries are mounted in the box. The drilling details for the front panel are shown in Fig. 3.

The Veroboard panel is of 0.15×0.15in. matrix and is 6⁵/₁₆in. long by 2⁷/₁₆in. wide. The component layout is shown in Fig. 4. Because of the complexity of the layout it is strongly recommended that a strip of masking tape be attached to the top and left hand side edges of the Veroboard and the hole numbering and lettering marked on this, on both sides. This will reduce the possibility of incorrect placement and connection of the components.

The Veroboard panel is fastened with 6BA nylon screws and nuts to two small brackets and these are fastened to the front panel with 6BA metal screws and nuts.

The wiring and position of components on the front panel is shown in Fig 5. The Wien Bridge capacitors C1-C8 are mounted directly on the tags of S1 and the free ends are fastened to a 1¹/₁₆in. diameter ring of 18 s.w.g. tinned copper wire, as shown in the photograph.

The connecting points on the Veroboard panel, for the various wires from the front panel controls are shown in the drawing (e.g. C/35 is strip C, hole 35).

The earth connection to the front panel is made by soldering to the metal case of VR8, but if this is inconvenient a solder tag may be fitted under one of the screws holding the Veroboard bracket to the front panel.

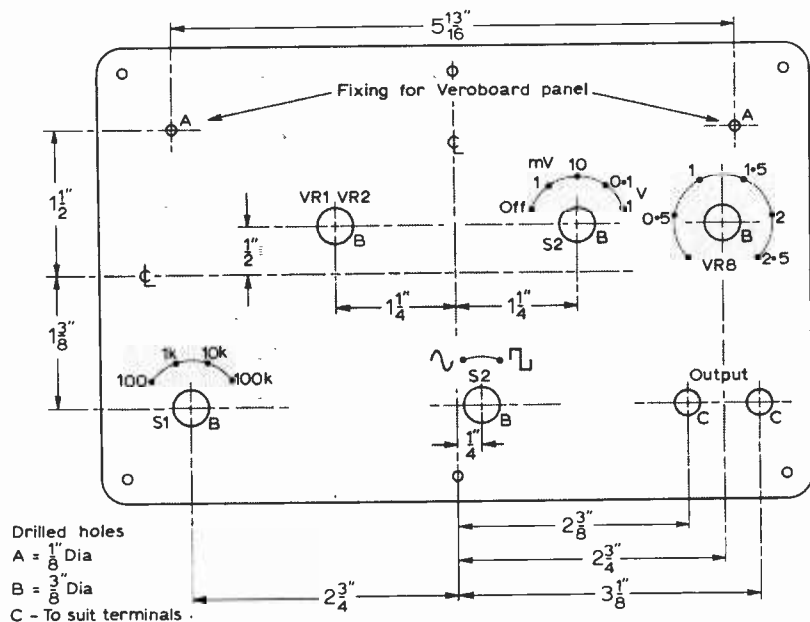
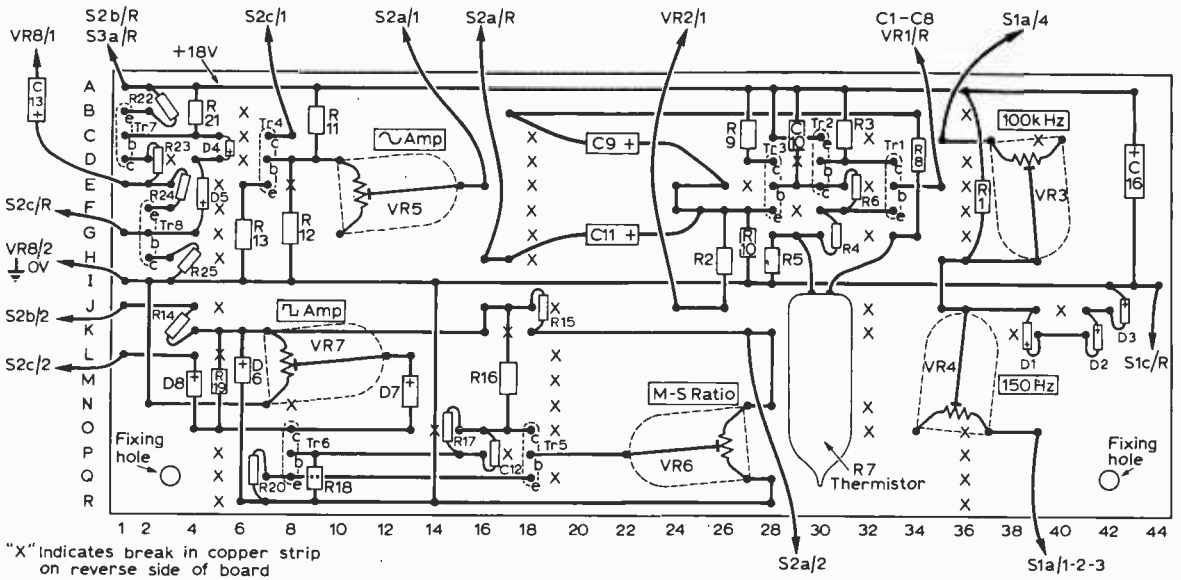


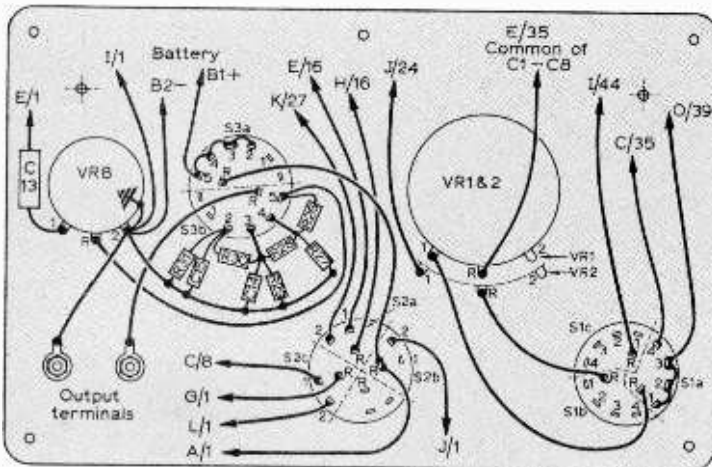
Fig. 3: Drilling details for the front panel on which the circuit board and all components are mounted.

AF Signal generator Veroboard panel 0·15" x 0·15" matrix



▲ Fig. 4: Layout of components on the plain side of the veroboard. All horizontal connections shown are automatically made by the copper rails.

▲ Fig. 5: Mounting of controls and components on inside of panel. Lead-out numbering refers to connection points on circuit board.



Capacitors C1 to C8 mounted on S1

A full scale drawing of the dial is given in Fig. 6 and this is attached to the front panel with "Cow Gum" or other photographic mounting adhesive.

The dial pointer is made of 1/16 in. perspex and is cemented into a gap cut in the skirt of the control knob.

The two PP7 batteries are held in the case by two small hooks (bent solder tags) bolted to the side and back of the box and linked by a rubber band.

The case is sprayed with car aerosol touch-up enamel and lettered with Letraset (sheet 209). A plastic carrying handle and adhesive feet are attached to the case to complete the external appearance.

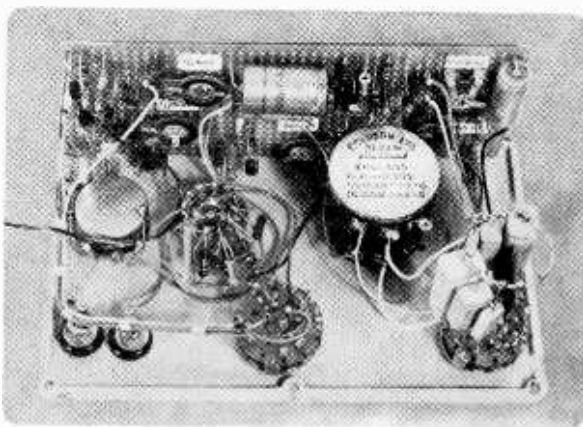
Testing and Calibration

It is essential to double check all the Veroboard wiring, components and drillings before switching on.

After switching on, the oscillator will not start immediately due to the charging current of C9 temporarily heating the thermistor and excessively reducing the amplifier gain. However, the oscillator should start after about 5 seconds.

Frequency Calibration

1. Check that the dial pointer is correctly positioned to coincide with the datum marks at each end of the scale.
2. Set the frequency range switch S1 to x100.
3. Set the frequency control to 1·5 (150 Hz).
4. Set S2 to sine wave.



View of the circuit board, Fig. 4, attached to the front panel, Fig. 5.

★ components list

Resistors:

R1 3.9kΩ	R12 1.5kΩ	R22 47Ω
R2 1kΩ	R13 1kΩ	R23 27Ω
R3 3.3kΩ	R14 1kΩ	R24 27Ω
R4 1.5kΩ	R15 8.2kΩ	R25 47Ω
R5 150Ω	R16 1.5kΩ	R26 5.6kΩ
R6 8.2kΩ	R17 1.8kΩ	R27 680Ω
R7 *	R18 1kΩ	R28 5.6kΩ
R8 220Ω	R19 1.5kΩ	R29 680Ω
R9 100Ω	R20 68Ω	R30 5.6kΩ
R10 1kΩ	R21 3.9kΩ	R31 620Ω
R11 10kΩ		

*R7 Thermistor type R53 (STC or Radiospares TH-B18)

All resistors are ½ watt 5% carbon

VR1-2 10kΩ — 10kΩ W.W. pot. (Colvern CLR 4049/15 10kΩ — 10kΩ 2½%—Home Radio)

VR3 1kΩ skeleton pot.

VR4 1kΩ " "

VR5 2.5kΩ " "

VR6 5kΩ " "

VR7 5kΩ " "

VR8 1kΩ W.W. pot.

Capacitors:

C1 0.001μF	100V	1%	Silver Mica
C2 0.01μF	100V	1%	Polystyrene
C3 0.1μF	100V	1%	Polystyrene
C4 1.0μF	63V	1%	Polycarbonate
C5 1.0μF	63V	1%	Polycarbonate
C6 0.1μF	63V	1%	Polystyrene
C7 0.01μF	100V	1%	Polystyrene
C8 0.001μF	100V	1%	Silver Mica

(The above capacitors are available from Home Radio)

C9 2500μF 15V	C13 250μF 15V
C10 30pF 10% ceramic	C14 33pF 10% ceramic
C11 250μF 15V	C15 330pF 10% ceramic
C12 100pF 10% ceramic	C16 200μF 30V

Semiconductors:

Tr1 MPS2926	Tr5 MPS3704
Tr2 MPS3702	Tr6 MPS3704
Tr3 MPS3704	Tr7 MPS3704
Tr4 MPS3704	Tr8 MPS3702

(Or 2N equivalents but check connections)

D1 1S921 Silicon	D5 1S921 Silicon
D2 1S921 Silicon	D6 1S2043 Zener 4.3V
D3 1S921 Silicon	D7 1S921 Silicon
D4 1S921 Silicon	D8 1S2043 Zener 4.3V

Switches:

S1 3 pole 4 way midget wavechange (Radiospares)
S2 4 pole 2 way " " (")
S3 2 pole 6 way " " (")

(S3 is modified to 5 way by moving stop)

Miscellaneous:

Batteries PP7 (2). Die cast box type 6357P (Eddy-stone). Knobs, type PK ¼in. (4) type SK 1¼in. (1) (Radiospares). Terminals 4mm (2). Two pairs battery connectors. Handle, plastic feet, etc. Veroboard 6½ x 2½in. 0.15 x 0.15in. matrix.

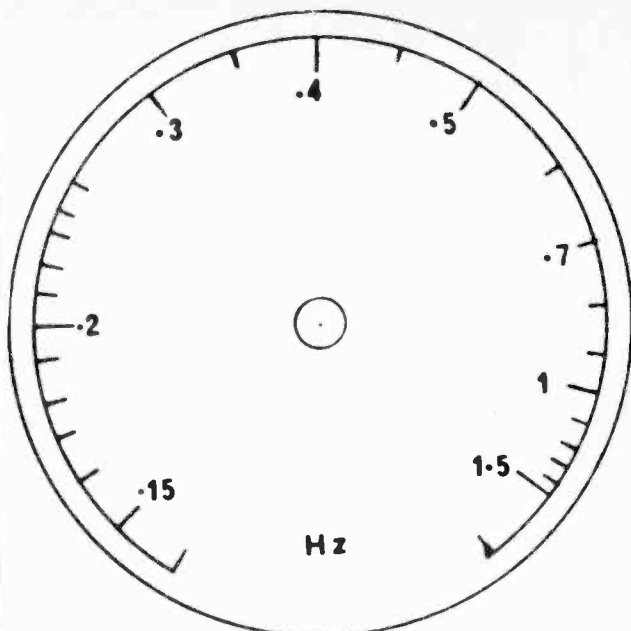


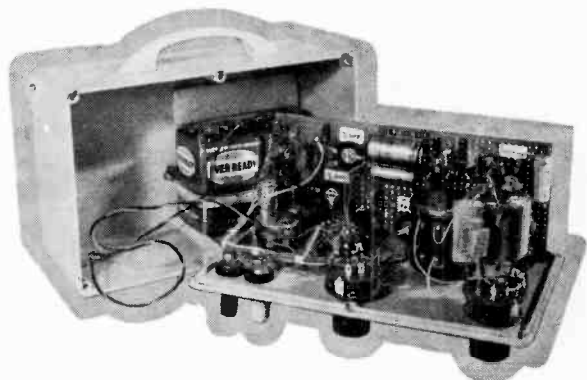
Fig. 6: Full scale drawing of the calibrated dial.

the output of the generator, as shown in Fig. 7.

8. Adjust VR4 to zero beat frequency.
9. Set the frequency range switch S1 to x100k.
10. Set the frequency control to 1.0 (100 kHz).
11. Compare the output frequency with that of a known 100 kHz signal using an oscilloscope. Alternatively by using a portable radio receiver tuned to Droitwich on 200 kHz (BBC Radio 2). The output of the generator may be loosely coupled to the aerial in the receiver to produce a noticeable beat frequency. About 2 feet of wire connected to the live output terminal should suffice.
12. Adjust VR3 to give zero beat.

Mark-Space Ratio

13. Set the frequency range switch S1 to x1k.
14. Set the frequency control to 1.0 (1 kHz).
15. Set switch S2 to square wave output.
16. Connect an oscilloscope to the output terminals.
17. Adjust VR6 to produce a square wave with a mark-space ratio of 1:1.



The two PP7 batteries are held in the case by a rubber band stretched between two bent-up soldering tags.

5. Set the output switch S3 to 1V.
6. Set the output control VR8 as required.
7. Compare the output frequency with that of the 50Hz mains supply either by the Lissajous figure method, using an oscilloscope or simply by mixing a 50Hz signal of a few volts with

Amplitude Calibration

18. Set switch S2 to sine wave output.
19. Set the output control VR8 to maximum.
20. Connect Avo 8 or other sensitive a.c. voltmeter (range 0-10V a.c.) to the output terminals.
21. Adjust VR5 to give an indication on the meter of 2.5 volts.

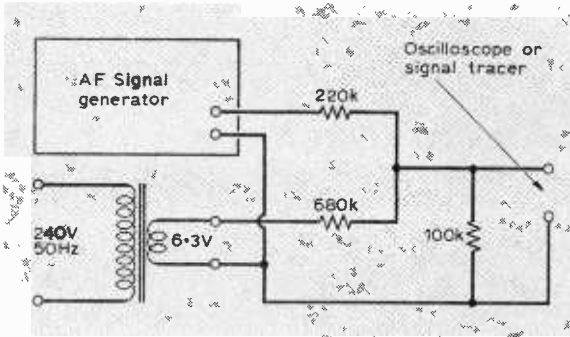


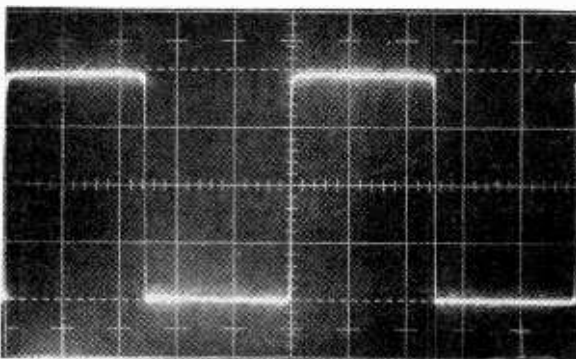
Fig. 7: Test set-up for calibrating audio signal generator.

22. Set switch S2 to square wave output.
23. Adjust VR7 to give an indication on the meter of approximately 1.3 volts, this is equivalent to 2.5 volts p-p. This completes the calibration.

Note: If a calibrated oscilloscope is available, the sine wave amplitude control VR5 may be adjusted for 7 volts p-p sine wave and the square wave amplitude control VR7 may be adjusted for 2.5 volts p-p.

Uses

The A.F. Signal Generator may be used for most a.f. amplifier tests and in combination with other instruments, measurements may be made of gain, frequency response, distortion etc.



Oscilloscope photograph of the square-wave output from the generator at 100kHz, 2.5 volts peak-to-peak.

Using an a.f. power amplifier, loudspeakers may be tested for rattles and spurious vibrations throughout the a.f. range. Square wave and transient testing may be carried out using the square wave output and monitoring the results on an oscilloscope. ■

THE Medium Wave Column

DAVID DOBSON of Leyland, Lancashire has been active on the medium waves. Using a modified 5 valve domestic receiver, a 100ft. longwire and a medium wave loop antenna he logged CKCM 620Hz in Grand Bank; CBN 640 in St John's; CJOX 710 Grand Bank; CBNM 740 Marystown; CJON 930 St John's; all in Newfoundland. Other Canadians heard include CFCY 630 Charlottetown, Prince Edward Island; CBM 940 Montreal; CHER 950 Sydney, Nova Scotia; CHNS 960 Halifax, N.S.; CFRB 1010 Toronto; CBA 1070 Moncton, N.B.; CKEC 1320 New Glasgow, N.S.; CKBC Bathurst, N.S. From the United States, five stations in New York City were heard; WOR 710kHz, WABC 770, WCBS 880 WINS 1010 and WHN 1050 together with WTIC 1080 in Hartford, Connecticut; WBAL 1090 Baltimore, Maryland; WHAM 1180 Rochester, NY; WOWO 1190 Fort Wayne, Indiana; WCAU 1210 Philadelphia; WKLX 1350 Portsmouth, Virginia; WMEX 1510 in Boston; WKBW 1520 Buffalo, NY; WCKY 1530 Cincinnati, Ohio. Conditions on the North American path have improved considerably this year, several stations appearing regularly before midnight. Newcomers to the band should listen for CJOX 710kHz after 2305hrs, when Rennes and Cairo 2 on the same frequency, have signed-off for the night. CJOX carries the CJON Radio Service programme and it usually identifies with this announcement.

Do North American MW stations verify, asks David. Yes, North Americans are good verifiers and nearly all will answer a correct reception report with a QSL card or a letter confirming reception. Reports should include the date, the time of reception (preferably in the local time of the station), along with details of the programmes heard. Commercials, station slogans, weather reports, names of announcers, programmes titles (but not titles of records) are items that are easily checked against the station log. Always send return postage when reporting to a medium wave station; International Reply Coupons (Commonwealth Reply Coupons for Canada) are available from all main Post Offices. Send reports to the Chief Engineer and include the station call letters (e.g., WINS Radio) in the address as well as the name of the town or city and the state or province if in Canada).

A new MW outlet in Iran (Persia) on 840kHz is reported by Noel Green of Blackpool. It can be found between Nancy, France, on 836kHz and Rome 2 on 845kHz any time between sunset and 2130hrs. Although the signal fades deeply at times it is quite conspicuous on peaks. No details of power or location are available but at 2030 hrs there is a 3-pip time signal, the identification 'Radio Irana' and a news bulletin in Farsi. Programmes are generally of European pop or Arab style music and singing. Two other Asian stations are being heard regularly in the late evening.

Please send reports and information to the author at 132 Segars Lane, Southport, PR8 3JG.

THIS MONTH'S SPECIAL BARGAINS

SINCLAIR Z: 30 £3.95, 250 £4.20, PZ5 £4.40 Micromatic Kit £2.25, Micromatic Built £2.75 PZ6 £6.95, PZ7 £5.95, PZ8 £6.95, AFU £5.25 Stereo 60 £7.98, Project 60 FM Tuner £20.90

AUTOCHANGERS BSR UA25 dual mono cart. £5.95. De Luxe Portable R/P cabinet, Blue. £2.50, £7.95 **THE PAIR GARRARD** AP75 £15.90, 3000 £9.95, 3500 £8.95, 1025 W/GKS26 SC. Cart. £8.50.

MAGNETIC CARTS AT55 Latest Audio Technica £4.75, AT35 Super Hi Fi £11.90, PIEZO De Luxe £4.50.

RECORD PLAYERS "HOB PARTY" German Transistor Portable 33/45 RPM. Small But Superior. £7.90. SEAFIRLE Teak De Luxe Garrard Deck Base Treble Controls (Worth £32) £19.00.

STEREO TUNER AMPS General R4200 (List £51.15) £29.50. Teleton 7 AT1 FANTASTIC PERFORMANCE £69.00. Teleton 10AT1 (List Approx. £150) 100W R.M.S. Total FET (DEM Models) Guaranteed £85.

STP800 8-TRACK TAPE PLAYER Stereo background music. Teleton complete in "Rosewood" plinth with matching speakers (List Approx. £50) **£39**

CMS4000 TUNER-AMP-PLAYER Teleton complete with stereo decoder perspex top (requiring only speakers to make complete system). Amazing value **£69**

COMPLETE STEREO SYSTEMS Sharp STA11 MW/FM/Multiplex stereo tuner AMP F.E.T. Front end 27 transistors 10W+10W Max O.P. Requiring only record deck to complete (List Approx. £85) £69. Full complete system STS-BLT similar to above but complete with built in record deck, snip at **£59**

TAPE DECKS Teleton FXB510D Stereo (List £65) less only at £45. BSR TD2 Standard 2 track deck with 2 tone top plate **£7.50**

AMSTRAD 8000 Stereo amplifier 7w+7w R.M.S. Mag/Cer/Tape **£19.50** (List £26)

EMI LOUDSPEAKERS CHASSIS 13" x 8" 10,000 line, 10 watts R.M.S. In 3Ω, 8Ω or 15Ω £11-65, two for £2-95.

EMI "150" 13" x 8" units, 3Ω, 8Ω or 15Ω with tweeter cone £1-95 or 2 for £3-50.

EMI "450" UNITS 13" x 8" 8Ω with 2 tweeters and crossover.

EMI "350" UNITS 8Ω 20 watt very heavy duty with ceramic magnet concentric tweeter (Rec. List £12.90)



FANTASTICALLY POPULAR ★ TAPE ★

We offer you fully lensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacture. They are truly worth a few more coppers than acetate, ub-standard, jointed or cheap imports.

TRY ONE AND PROVE IT YOURSELF.

Standard Play		Long Play	
3in. 150ft.	19p	3in. 225ft.	19p
4in. 300ft.	22p	4in. 450ft.	27p
5in. 600ft.	45p	5in. 900ft.	52p
5 1/2in. 900ft.	52p	5 1/2in. 1,200ft.	65p
7in. 1,200ft.	82p	7in. 1,800ft.	92p
Double Play		Triple Play	
3in. 300ft.	20p	4in. 900ft.	65p
4in. 600ft.	40p	5in. 1,800ft.	£1.12
5in. 1,200ft.	75p	5 1/2in. 2,400ft.	£1.70
5 1/2in. 1,800ft.	95p	7in. 3,600ft.	£2.40
7in. 2,400ft.	£1.35		
Quadruple Play			
3in. 600ft.	42p		

Postage 5p reel.
Post Free less 5% on three reels.
Quantity and Trade enquiries invited.
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PLINTHS & COVERS for Garrard (takes all current models except heavy transcription types) Beautiful heavy solid perspex top with "stereo" badge high quality base with solid wood sides machined ready for R/P deck to drop in without any further work. **£3.75** complete. Carr. & Insurance 40p. Terrific value at only

Introducing The New "ALPHA" Loudspeaker Enclosure.



Incorporating the famous EMI "450" set consisting of a 13x8in. bass unit with a high flux ceramic magnet, 2 tweeters and crossover. 16 watt peak handling power (8 watts RMS).

Heavy duty 16mm infinite baffle case in superb quality genuine golden teak veneers with solid mahogany contrasting leading edges. High quality foam loaded cloth fret. Acoustically loaded. "Jason" rotatin' badge in genuine gold leaf for horizontal or vertical operation. Size 19in. x 10in. x 10 1/2in. Weight 18lbs. A price break through at only Carriage etc. 50p singly. **£12-50** each Carriage free in pairs.

JASON SENIOR 80W ENCLOSURE. As above but with super heavy duty bass unit with 3-6lb magnet in Magnaducer II material with 1-5in speech coil and super tweeter giving frequency range of 20-20,000Hz. Standard 8Ω impedance in beautifully finished heavy teak veneers. Size 12 1/2 x 12 x 23 1/2in. 15 Watts RMS, 30 watts peak. At a super keen price **£18** or **£35** a pair carriage and ins. 62p for 1 or 2.

KG-620 4 1/2 VTM KIT ★ NEW!



SPECIFICATIONS
 Ranges: 0-1.5-5-15-50-150-500-1,500V full scale; with optional High-Voltage Probe, to 25,000V. Accuracy: ±3% Of full scale reading.
 Input Resistance: 11 megohms (1 meg in probe) up to 1,500V.
 Ranges (rms): 0-1.5-5-15-50-150-500-1,500V full scale (p-p); 0-4-8-14-42-140-420-1,400-4,200V full scale.
 Decibels: -10 to +65 in 1 ranges.
 Response: ±1dB, 30Hz to 3MHz; ±3dB, 30Hz to 5MHz; with optional H.F. Probe, to 250MHz.
 Accuracy: ±5% of full scale reading.
 Ranges: 0-1,000-10,000-100,000 ohms; 0-1-10-100-1,000 megohms.
 Centre Scales: 10, 100, 1,000, 10,000, 100,000 ohms; 1 and 10 megohms.
 Battery: 1 1/2V size U2.

Recommended List Price £18.27; **£9-95** Assembled Price **£12-90** (RR Price £20)

KG-865 50 Watt Stereo Amplifier Chassis



DE-LUXE FEATURES

All Silicon Transistors for Stability. Cleaner Sound. Extremely Wide Power Bandwidth and Frequency Response. 50W IHF Power Output. Specially Selected Low-Noise Pream Transistors. Two Printed Circuit Boards for Fast Easy Assembly. Convenient Front-Panel Stereo Headphone Track. Teak-finished Extruded Aluminium Front Panel. Two a.c. Convenience Outlets.

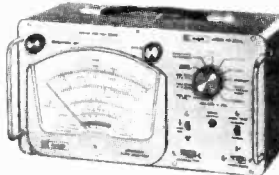
Output: 50W IHF, 25W per channel; 34W continuous sine wave. Response: ±1dB, 18 to 30,000Hz. Output Impedances: 4 through 16 ohms, plus stereo headphones. THD Distortion: under 1% at 60Hz and 7,000Hz mixed 4:1 at rated power. Input Sensitivity: Magnetic Phono, 5mV; Tuner and Auxiliary, 500mV. Power Requirement: 230-250V, 50Hz a.c. Rec. List Price **£51-00** Our Price **£29**

KG-375 Deluxe Solid-State Auto Analyser

Tune-up and trouble-shoot any car, perform actual road tests

It's several testers in one... do all this

Set Engine Idle and Automatic Transmission Shift Points. Detect Condition of Point Surfaces. Detect Distributor Wear. Check Voltage and Current Regulators. Check Generators for both Current and Voltage Output. Find Poor or Open Earth Circuits. Detect Variation in Dwell Angle.



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CASSETTE RECORDERS Crown CTR320W Mains/BATT. (List £33.40) £29, CTR9001 (List £28) £24.80, CTR9700 (List £24.28) **£21-90**

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BELOW RETAIL VALUES

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*** JULIETTE *** MPR 3065

is a high quality
COMMUNICATIONS
RECEIVER

(replaces NA 5018A)
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IT NOT ONLY RECEIVES Aircraft,
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The MPR 3065 is a communications receiver
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SAME BANDS & FREQUENCIES AS MODEL
MPR 3065 PLUS ADDED FEATURE OF
SVW 5.0—12.0Mcs (with Fine Tuner). Plus
62p P/P.

BATTS & EARPIECE INCL.

Styled in elegant black case with luxury
Chrome trim, soft padded speaker grille,
die-cast sides and walnut insert. Size 8½" x 11"
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Enclose 5d. stamp for reply. Trade supplied.

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Handsome teak finish cabinet 17" x 10" x 6" for above 13 x 8 units (p. & p. 35p) ..	£5.00
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all types of
TRANSISTOR EQUIPMENT



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6v., 7½v. and 9v. DC, attrac-
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Size 4½ x 3½ x 2½ in.
£3.00 P. & P. 15p.



Extra lead with plug to fit
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50p. (State model and
plug required.)

**MAINS UNIT FOR
ALL TRANSISTOR
RADIOS, ETC., USING
PP3 TYPE BATTERY. (ALSO
AVAILABLE FOR 6V.)** **£1.15** P. & P. 10p.



MAIN UNITS
For single outputs, 6v, 9v, 12v, 18v, £2.00.
For two separate outputs, 4½v + 4½v,
6v + 6v., 9v + 9v. £2.50. P. & P. 15p.
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All units are completely isolated from
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GARRARD MAG TAPE DECKS: 1½ips, 50v solenoid
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4½" PLANNAIR FANS. Complete, capacitor, ex-
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**ELECTRIC MOTORS, HOOVER OR CROMPTON
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½ h.p. 1,440 r.p.m.	£3-75	pp £1-00
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AUDIO CONNECTORS

3 pin Din Plug	18p	each
5 pin Din Plug A type, B type ..	15p	"
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3 pin Din Line Socket	18p	"
3.5mm Jack Plug Screened	10p	"
Standard Jack Plug	10p	"
Screened Standard Jack Plugs ..	15p	"
Stereo Jack Plug	18p	"
Screened Stereo Jack Plug	18p	"

pp on above items 3p.

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Mono Cartridge £4-75 pp 30p.

PHONO PLUGS: Red or Black 8p each.

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SOLENOIDS 12 VOLT PULL ACTION

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STC SEALED RELAYS DOUBLE POLE

CHANGEOVER
48v 2500 Ex-equip. 15p pp 5p.

SIEMENS MINIATURE RELAY. Double pole
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Input: 18v 500m/a 50v 150 m/a. 6v 250 m/a Output.
Size 3" x 2½" x 2½", £1.00, pp 20p. Ex equip tested.

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Diodes: 1 reed relay: 10 AZ 229 zenner ass. capacitor/
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TOGGLE SWITCHES. Single pole Double Throw
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FIBRE GLASS TAPE. 100 yd. roll: 3" 3½" wide
£1 per roll pp 20p.

PAINTON PLUG SOCKETS Type 159 series working
voltage 350v AC/DC current max. 3 amp AC/DC
7 pin plug & socket 50p pp 10p. 15 pin plug & socket
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SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE first report this month comes from Jean A. Meghriche of Elstree. The equipment used consisted of two receivers; a Jennen Trio JR60 and an R209; and two aerials; a Joystick and a 100 foot long-wire. The log included such interesting stations as:

- 4780 *La Voz de Carabobo, Ven.* at 0510.
- 4800 *Brazzaville, Congo* at 2030.
- 4825 *La Voz de las Fuerzas Armadas (Dominican Republic)* at 0500.
- 4880 *R. Comercial, Dominican Rep.* at 0450.
- 4900 *R. Conakry, Guinea* at 0530.
- 4920 *R. Caracas, Venezuela* at 0515.
- 4940 *Abidjan, Ivory Coast* at 2220.
- 4945 *R. Colosal, Colombia* at 0540.
- 4965 *R. Santa Fe, Colombia* at 0455.
- 4970 *R. Rumbos, Colombia* at 0445.
- 4985 *Voz do Oeste, Brazil* at 2340.
- 4990 *R. Barquisimeto, Ven.* at 0450.
- 4995 *R. Brazil Central* at 2305.
- 5047 *R. Lome, Togo* noted at 2300.
- 5075 *R. Sutatenza, Colombia, Colombia* at 0300.
- 11850 *Radio Ghana* at 2000.
- 15185 *Voice of Nigeria* at 0715.
- 17825 *NHK, Japan* noted at 0800.
- 17885 *Radio Havana, Cuba* at 1930.

The next reporter is **Mitch Murray** of London, NW7. The receiver is a self-built Heathkit SB 310 (wish I had a receiver like that OM!—M.C.) and a 70 foot long-wire at a height of 30 feet. The log consisted of the following:

- 9805 *Radio Cairo, UAR* at 2200.
- 11672 *Radio Pakistan* at 2000.
- 11890 *Radio Voice of the Gospel, Ethiopia*, 0530
- 15200 *Voice of Nigeria, Lagos* at 0600.
- 15250 *Radio Bucharest, Rumania* at 0700.
- 15280 *E.L.W.A., Liberia* at 0700.
- 17855 *NHK, Japan, News in English and Japanese*, 0800.

D. A. Hairon of St. Clement, Jersey has again used his Codar CR70A receiver and 100 foot long-wire aerial to good effect and has heard:

- 5960 *HCJB, Quito, Ecuador*, English at 0845.
- 6080 *RSA, South Africa* in English at 0015.
- 9550 *AIR, Bombay* in English at 2230.
- 9570 *ABC, Australia* in English at 0900.
- 9710 *HCJB, Quito, Ecuador* in English at 0630.
- 9912 *AIR, English* from 2215 to 2230.
- 11800 *R. Ceylon Commercial Sce.* English at 0230.
- 11815 *R. Brazil Central* in Portuguese at 0100.
- 15018 *R. Hanoi* in French from 1830 to 1900.
- 15125 *ABC, Australia* in English at 0700.
- 15170 *ELWA, Liberia* in Arabic at 2300.
- 15190 *Brazzaville, Congo* in French at 1845.
- 15195 *NHK, Japan* noted in English at 0700.
- 15200 *Nigeria B.C.* in English at 0800.

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

- 15290 *R. Damascus, Syria* in Spanish at 2300.
- 21670 *U.N. Radio Sce.* in English at 1800.
- 21705 *Radio Mexico, XERMX*, Spanish at 1630.

Rex Cooper of Norfolk collects second-hand domestic receivers, he has about 50 at present. He used one of them, a six-valve Philips, with a 120 foot N-S aerial and a 67 foot E-W aerial to hear the following:

- 6540 *R. Pyongyang* in English at 1945.
- 9545 *Radio Ghana* with music at 2125.
- 9550 *BBC, Far East* relay at 1915.
- 9580 *BBC, Atlantic* relay at 2115.
- 9650 *Radio Athens*, Local news in English at 1250.
- 9670 *ABC, Australia*, sports news at 0815.
- 9677 *R. Nederland, Bonaire*, English at 0807.
- 11735 *RTV Morocco* in English at 1720.
- 11800 *KBS, Kuwait*, s/off in English at 2100.
- 15220 *TWR, Bonaire*, s/off in English at 2130.
- 17750 *VOA, Monrovia*, s/on in English at 1820.

The next two reports come from New Zealand. The first is from **Gordon Keen** of Ashburton who used a five-valve domestic receiver and 40 foot long-wire to hear:

- 5990 *CBC, Canada* in English at 0620.
- 6145 *Voice of Germany, Cologne*, English at 0441.
- 9570 *ABC, Australia* in English at 0745.
- 9675 *NHK, Japan* in English at 1052.
- 9680 *ABC, Australia*, English at 0815.
- 9715 *R. Nederland, Bonaire* at 0800.
- 9745 *HCJB, Quito, Ecuador* at 0715.
- 11800 *FEBC, Manila, Philippines* in English at 1000.
- 11875 *NHK, Japan*, s/off at 1030.

The second New Zealand report comes from **John Saunders** of Paekakariki, Wellington Prov. The two receivers are Heathkit GR54 and GR64, the two aerials a 75 foot long-wire (NE-SW) and a 50 foot (E-W).

- 2410 *VL9CG, R. Goroka* noted at 1100.
- 3220 *Radio Morobe*, testing at 1000.
- 3235 *YVMP, Vargas, Venezuela* at 0440.
- 4990 *Changsha, P.R. of China* at 2021.
- 5980 *RSA, South Africa* in English at 0511.
- 6045 *R. Republic Indonesia*, English news at 0900.
- 6155 *Austrian Radio* in German at 0400.
- 6165 *XEWW, Mexico City*, fair to good at 0534.
- 7470 *Radio Hanoi* in English at 1030.
- 9680 *YVWL, R. Monagas, Ven.*, heard at 0100.
- 11735 *R. Moscow* via Vinnitsa in Spanish.
- 11865 *CBC, Canada*, s/off at 0415.
- 11925 *RNE, Spain* in English at 0315.
- 15295 *TWR, Bonaire* in Norwegian at 2200.

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

HOW time flies. Santa will be sliding down my vertical before I know where I am and that will be another year of Amateur radio gone. Even the r.f. coming from the 'JDG rig has grey hair. Anyway, a very merry Christmas to all slaves of the ether, and to the c.w. stalwarts vy mx es hp cu on 14MHz OMs.

Don't forget to listen in on the many Christmas morning nets. Almost every local gathering will be at it with favourite bands 1.8MHz and 144MHz.

One or two people have complained about 14MHz getting temperamental. It certainly closes down earlier and by about 2200hr seems to be almost dead. On the other hand some compensation has been afforded by 28MHz, which has suddenly sprung to life with a very good assortment of DX. This latter band has been kind to signals from Africa and from S. America and it has been common this past month on ten metres to hear S9 signals from EL, OD, ZE, ZS and PY.

Letter of the month award goes to **Chris Williams** (Birmingham). On two metres Chris uses a Wien "Flight 4" transistor radio which is fed into a Sony tape recorder for a "little gain". The antenna is a telescopic one attached to the set and in order to get the full benefit Chris sits in a swivel chair and rotates himself until a CQ is heard. Think, if a mobile drove round the house—he'd screw himself into the floor! On 21 and 28MHz Chris uses an EA12!

Squeaks of delight this month from **Alan Newman**, G8CXC (Portsmouth), who claims that after good weather followed by fog there came a lift in conditions on 144MHz. From the description it must have been just like 21MHz after TV hours in the summer. Most of the signals were 5 and 9, and Alan worked (not just heard) the following: F1BAP, F3DF, F3XY, PA0JHM, PA0WLY, PA0JR, PA0POP, PA0PCR, ON4TQ, ON5RE, OZ60L, DJ7CL, DM2CNK /P. Equipment was a HW17A transceiver and a 14-element parabeam at 21ft.

All the way down on 28MHz happenings were located by **Crispin Henderson**. Gear includes a B40 and 120ft. longwire-cum-inverted V. Crispin notes that no stations on ten metres were W's but goes on to report evidence of: CR6CA (c.w.), EL2BA, OD5CS, PY7BFC, ZE1BP, ZE6JL, ZS3CJ, ZS6U, 5B4IS, 9G1DY, 9J2LL (all s.s.b.), LU6DRB, PY5UI.

H. Thayer writes to say that it has been 33 years since he last sent a s.w. log. His CR70A winkled out CR3ND, CR6IY, CT2BB, EA5FQ, EA8GS, EL2CB, EL5CJ, HSIABU, IE9SEZ, MP4TDA, OD5BA, PY1DLH, PY4ABH, PY7AR, PY8LI, TU2CW, VQ9R, VS6DO, WA2BVU/4X4, ZE6JL, 4Z4GV, 9H1BW, 9Q5GE, all on 21MHz. Thanks for the log OM, see you again in another 33 years?

"How a bloke can sit at a mike blowing into it all evening I can't understand," says **Stefan Kaye** (Witney). I agree, it seems that some licensed LIDS have never heard of a screened dummy load, alas. Stefan reports 7MHz sigs from: VK3AZ, VK3HW and

VK3ZL. A quick flit up to twenty was rewarded with: TU2DB, VK2AGN, VK2ATB, VK2FZ, VK4CZ, VK9BN, ZL3JO, 5W1AU, 6Y5LA, 6Y5SR, 9Y4PL. Even 28MHz relented and parted with r.f. noises from: LU6DRB, ZP5AQ, 9J2GT, 9X5VA. All these received on an unmentioned receiver with an un-referred-to antenna—fantastic, just his bare ear-holes, how does he do it?

It's not too difficult to hear ZLs early Sunday mornings around 3.8MHz confides **David Lawley** (Gravesend). David had a go in the Cray Valley s.w.l. contest and managed to score 1147 points. (Remember your ears need a 3,000 service after each 500 points OM.) Life on 14MHz can be good if you have David's CR70A with a 75ft. inverted L. All sorts of goodies come wafting in to titivate the little lug'oles, such as: CN8CG, CP6EL, CT1QA, CT2BB, CX2AL, EA8GZ, HP1WM, IS0AWP, JY9DK, KZ5JF, MP4BJG, PY1CLI, VA2UN (special events station in Montreal), VE7DG, VK2AHH, VK3AD, VK4KS, VK5ES, VK6HE, VK7PR, W5RR, XE1IJJ, YV4WT, ZL3ABC, ZL3RB, 3V8AF, 4X4AH, 4Z4HF, 5B4IS, 5H3LV, 5Z4KL, 6Y5GB, 7Z3AB, 9H1BG, 9X5AA.

Paul Newman claims that a few early morning sessions gave interesting results. (All they give me is bags under the eyes!) Paul's Aylesbury-based BC348R and 80ft. end-fed managed to bag these on 14MHz: FG7XT, HR2RCH, KC4USU, VK2OQ, VK3BW, ZL3LY, ZL4NH, 3A2EE. Other points from Paul include winding down the i.f. and r.f. gains on 7MHz, works wonders against cross modulation from BC stations. On 3.5MHz, listen for G3YYD or G3PCG evenings around 3.78MHz. Apparently these two stations have been heard bagging some tasty DX.

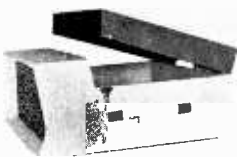
The Modular Three which was featured in Practical Wireless is now featuring as the station receiver for 14-year-old **David Keen** (High Wycombe). Connected to a 100ft. end-fed via an a.t.u., it told stores of the following on 14MHz: CT1OW, EA5FQ, EA8HA, KL7GFU, LX1BJ, M1B, PY2PA, PZ1DR, SV0WJJ, VE1YW, VK3AM, VK3DD, VK4LT, ZB2CC, ZL2AC, 4U1TU.

Lots of activity at Stevenage, where **Arthur Grisley** is busy working on the P.W. Communications Receiver (March-April, 1970). Arthur's CR70A is doing sterling service at present pulling in such items as: VE1DF, K4RD and W2TXA on 3.5MHz. On 14MHz, the log reads: CT1DA, CT2BB, EA3VC, EA6BM/M, EA7DJ, EA8MA, JX1AK, JY1, KP4CL, PY7BC1, VE1MSA, VE2WK, VK2UN, VK3AM, VK3GS, VK4XN, W2MDQ/MM, W30B/P/KV4, ZE4JW, ZL3FO, 3A2CP, 4S7PB, 4X4AE, 5Z4KZ, 9H1BG, 9K2YG, 9Q5MG.

Logs, in alphabetical order please, to arrive by the 15th of the month to:

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25/25V .. 10p	8 + 16/450V .. 20p	350 + 50/325V .. 50p
50/50V .. 10p	16 + 16/450V .. 25p	32 + 32 + 32/350V .. 43p
100/25V .. 10p	32 + 32/350V .. 25p	100 + 50 + 50/350V .. 48p

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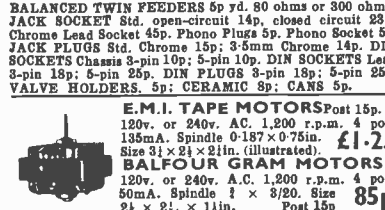
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commentary by **HENRY**

MAX GRUNDIG started in an old garage, knocking up radios without valves that could be sold as kits to circumvent oppressive regulations. Marconi had to squeeze into the corner of a shared office, while John Logie Baird at one time operated in such a clutter in his upstairs den that only one person at a time could view his flickering experiments.

So Henry feels no sense of shame when Mrs. H. sweeps open the guest room door and says: 'I'm afraid you'll have to excuse the mess. You see, he works in here at times.'

Before my visitor can get to bed I have to remove a year's collection of half-a-dozen different magazines, several boxed and unboxed amplifiers, a partially dismantled tape recorder and the remains of a surplus computer panel.

If he is a restless sleeper, like as not he will wake with a Heathkit oscilloscope across his ankles and a precarious collection of tapes tottering above his right ear. He will have to do without central heating, because I am using the corner radiator as the base of an experimental loud-speaker. If he reaches too far when groping for the light-switch, he may set bells ringing in the loft, where I also work at times, and where Mrs Henry can only



Tottering tapes above his ear.

get at me with an aural summons.

The Editor of a famous audio magazine always has a chuckle when he asks me—for the nth time—how I work. 'Standing,' says Henry, and it is true. I type this at waist level as I stand before a converted dressing table on which the typewriter carrying case makes a beautifully echoing plinth while the various papers and books acting as references are strewn around, pinned to the mirror, the picture rail and a wire-cage wall-support. A Terry lamp sings my right ear, and two Morphy-Richards hair-dryer stands are clipped to the wall to act as circuit holders.

Crazy? Not a bit of it. I only know one man who can work in a beautifully appointed room, with all his files in neat order, his instruments shelved and racked, his tools oiled and encased, his leads and plugs tidied out of view—and he is such an exception that I should not need to point his name out to you in other pages of this (and practically every other radio, television and audio) magazine.

Yet even he has the Achilles heel that preserves my sense of the risible and excuses at least some of my clutter. Recently I visited the great man, and while Mrs H. chatted woman talk, with my injunction to watch the time, as we had a further appointment, we menfolk adjourned to the workroom to indulge in technicalities.

Later, much later, I surfaced from the innards of a massive Continental colour-TV and realised that I was going to be late. I rushed back to the lounge and began to complain. 'But look,' said Mrs. Henry, all innocence, 'It's only three o'clock.'

So it was—the great man's electric timepiece, hanging on the sea-facing wall. Then he had to admit, shamefacedly, that since he had repaired it last, the darned thing occasionally **ran backwards**.

There were a few gibes about doing the roast in the fridge',



"It's only three o'clock."

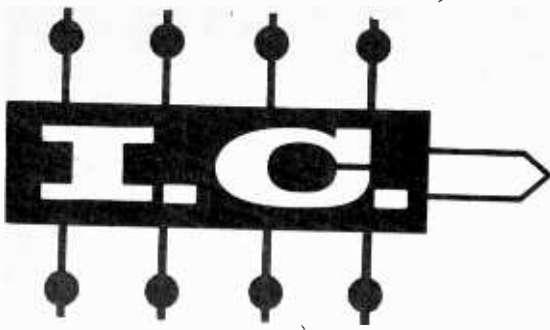
but beneath them Henry sensed that exonerating feeling that could be summed up in the great man's phrase: 'I'll do it when I get time!'

Things Henry has to do when he can find the time include making that temporary aerial joint permanent, wiring in a loudspeaker line with—ultimate luxury—sockets on the walls, and painting one or two of the pieces of test gear that still bear legends like 'McDougall's Prime Madeira Cake' and 'Gold Block—2oz'.

In the world of wireless we are used to the occasional lapse. Like when wrong components slip past final inspection and we tune in the police when trying to record the Proms. Like when beautiful electronic designs are spoiled by fine tune knobs that can only be held by the prehensile digits of an agile baboon. Like when plastic cabinets literally crack apart and can only be re-assembled by glueing.

But what pleases us most is the knowledge that our acknowledged peers are as forgetful and haphazard as we are.

Henry went to a lecture by one of this country's leading exponents of semiconductor circuit design last week. Breathlessly expectant, members of the Royal Television Society, the BBC, the ITA and the Audio Engineering Society sat in serried rows and hung upon the pundit's words. And what did he do? Lost his notes, that's all!



OF THE MONTH

L.A.J. IRELAND

Number 25

National LM370 Audio System Control

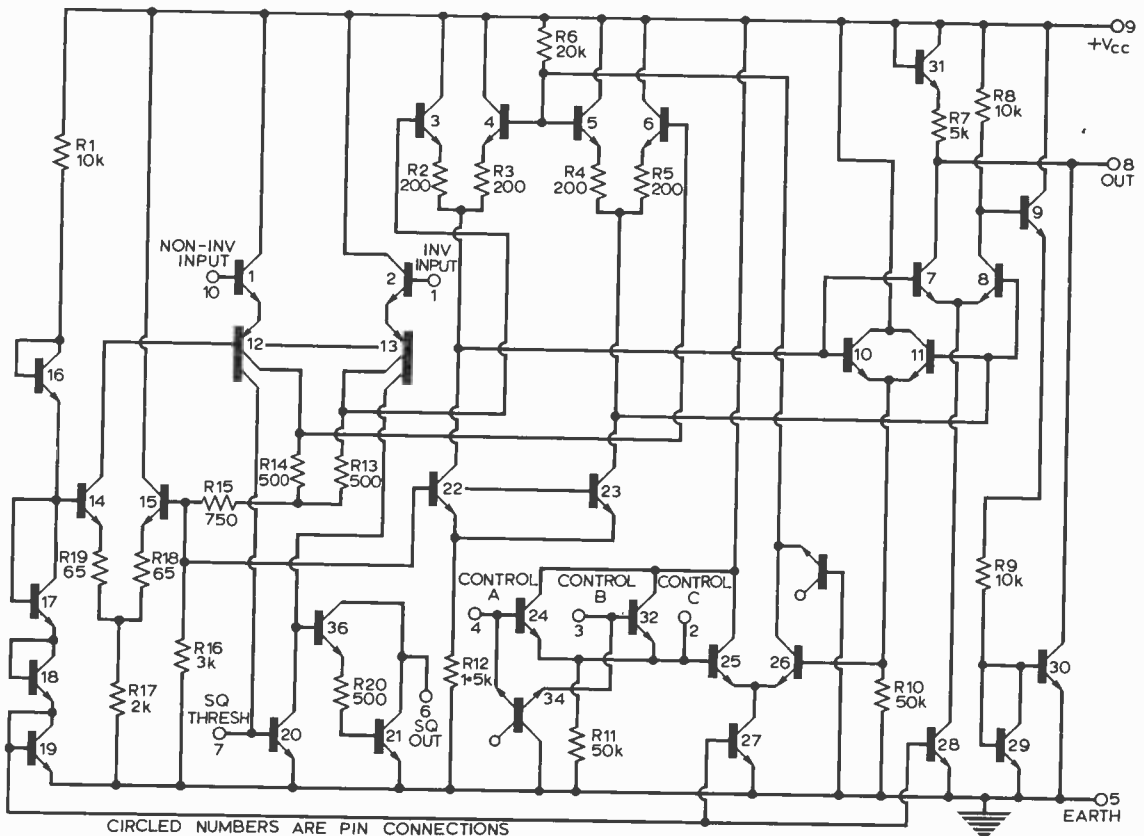
THE LM370 audio system control integrated circuit to be examined this month is a recent product of the National Semiconductor (USA) group, whose linear circuits have featured in these columns with increasing frequency. Not only should this circuit find applications in the audio field, but there are potential uses of interest to the instrumentation and communications enthusiasts also.

The unit is essentially a development of the LM101 operational amplifier, so that the comments on op. amp. applications made previously in these notes are relevant; the added capabilities of audio automatic gain control and "squelch" make it particularly applicable to the amateur transmitter's requirements.

Circuit

Fig. 1 displays the equivalent circuit of the LM370. Following standard op. amp. practice, it has a differential input and a single-ended output configuration. The modification to the conventional direct-coupled differential system of an op. amp. is introduced with transistors 4 and 5. It will be noticed that these are in parallel with transistors 3 and 6, which form part of just such a differential configuration, being driven respectively by transistors 13 and 12, and in turn driving numbers 10 and 11. When there is a low bias level applied to transistors 4 and 5,

Fig. 1: Equivalent circuit of the LM370.



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2G306	42p	2N3415	22p	40314	37p	BCY32	60p	BSX76	22p	NKT403	75p
2G308	30p	2N3416	37p	40320	47p	BCY33	25p	BSX77	27p	NKT404	62p
2G309	30p	2N3417	37p	40323	32p	BCY34	30p	BSX78	27p	NKT405	65p
2G371	15p	2N3570	11-25	40324	47p	BCY38	40p	BSY10	60p	NKT451	68p
2G374	20p	2N3572	97p	40326	37p	BCY39	60p	BSY11	27p	NKT452	68p
2G381	22p	2N3625	27p	40329	30p	BCY40	50p	BSY24	15p	NKT453	47p
2N404	22p	2N3606	27p	40344	27p	BCY42	15p	BSY25	15p	NKT453	47p
2N696	20p	2N3607	22p	40347	57p	BCY43	15p	BSY26	17p	NKT602F	32p
2N697	17p	2N3702	11p	40348	48p	BCY44	32p	BSY27	17p	NKT602F	32p
2N698	25p	2N3703	10p	40360	48p	BCY58	22p	BSY28	17p	NKT602F	32p
2N706	12p	2N3704	11p	40361	47p	BCY59	22p	BSY29	17p	NKT602F	32p
2N705A	12p	2N3705	10p	40370	37p	BCY70	97p	BSY32	25p	NKT713	25p
2N708	15p	2N3706	09p	40370	37p	BCY70	97p	BSY36	25p	NKT781	30p
2N709	62p	2N3707	11p	40406	67p	BCY71	25p	BSY37	25p	NKT10419	30p
2N718	25p	2N3708	07p	40407	40p	BCY72	17p	BSY38	22p	NKT10439	30p
2N726	30p	2N3709	09p	40408	58p	BCZ10	27p	BSY39	22p	NKT10519	37p
2N727	30p	2N3710	09p	40410	62p	BCZ11	27p	BSY40	22p	NKT10519	37p
2N914	17p	2N3711	12p	40467A	57p	BD116	11-24	BSY51	32p	NKT20329	47p
2N916	17p	2N3712	12p	40468A	35p	BD121	65p	BSY52	32p	NKT20339	47p
2N918	30p	2N3716	11-30	40600	57p	BD122	60p	BSY54	40p	NKT80111	77p
2N929	22p	2N3791	12-06	AC 107	30p	BD124	60p	BSY56	40p	NKT80112	77p
2N930	27p	2N3819	35p	AC126	20p	BD131	75p	BSY78	47p	NKT80215	82p
2N1090	22p	2N3823	97p	AC127	25p	BD132	85p	BSY79	47p	NKT80216	82p
2N1091	22p	2N3824	27p	AC128	25p	BDY60	11-37	BSY82	62p	NKT80217	82p
2N1131	25p	2N3844A	27p	AC129	25p	BDY61	11-25	BSY82	62p	NKT80218	82p
2N1132	25p	2N3845A	27p	AC129	25p	BDY62	11-00	C426	40p	NKT80219	82p
2N1302	17p	2N3855A	30p	AC187	62p	BF115	25p	C426	40p	NKT80216	82p
2N1303	17p	2N3856	30p	AC188	37p	BF117	47p	C744	30p	NKT80215	82p
2N1304	22p	2N3856A	35p	AC177	27p	BF163	37p	D16P1	37p	NKT80215	82p
2N1305	22p	2N3858	35p	ACY18	25p	BF167	15p	D16P2	37p	NKT80216	82p
2N1306	25p	2N3858A	30p	ACY19	25p	BF167	15p	D16P3	37p	NKT80216	82p
2N1307	25p	2N3859	27p	ACY20	25p	BF177	30p	D16P4	40p	NKT80216	82p
2N1308	30p	2N3859A	32p	ACY21	25p	BF179	30p	GET102	30p	OC20	75p
2N1309	30p	2N3860	30p	ACY22	20p	BF179	30p	GET113	20p	OC20	75p
2N1507	17p	2N3866	11-50	ACY28	20p	BF178	30p	GET113	20p	OC20	75p
2N1613	25p	2N3877	40p	ACY40	20p	BF178	30p	GET113	20p	OC20	75p
2N1631	35p	2N3877A	40p	ACY41	25p	BF181	32p	GET113	20p	OC20	75p
2N1632	30p	2N3900	37p	ACY49	25p	BF181	32p	GET113	20p	OC20	75p
2N1638	27p	2N3901	40p	AD140	52p	BF185	42p	GET120	52p	OC26	27p
2N1639	27p	2N3901	47p	AD149	57p	BF185	42p	GET120	52p	OC26	27p
2N1671B	11-00	2N3903	35p	AD150	62p	BF194	17p	GET873	51p	OC26	27p
2N1711	25p	2N3904	35p	AD161	37p	BF195	15p	GET880	30p	OC28	62p
2N1699	32p	2N3905	37p	AD162	37p	BF196	25p	GET887	20p	OC28	62p
2N1893	37p	2N3906	37p	AD166	42p	BF197	42p	GET888	22p	OC38	62p
2N2147	82p	2N4068	17p	AD166	42p	BF198	42p	GET889	22p	OC38	62p
2N2148	57p	2N4069	17p	AD166	42p	BF198	42p	GET889	22p	OC38	62p
2N2160	57p	2N4069	17p	AD166	42p	BF200	42p	GET889	22p	OC38	62p
2N2193	40p	2N4061	12p	AD117	25p	BF195	15p	GET897	22p	OC42	25p
2N2193A	42p	2N4062	12p	AD118	62p	BF196	25p	GET898	22p	OC42	25p
2N2194A	42p	2N4244	47p	AD119	62p	BF198	42p	GET898	22p	OC42	25p
2N2217	27p	2N4295	17p	AD124	22p	BF198	42p	GET898	22p	OC42	25p
2N2218	25p	2N4296	17p	AD125	30p	BF200	42p	GET898	22p	OC42	25p
2N2219	25p	2N4297	17p	AD126	30p	BF225	19p	GET898	22p	OC42	25p
2N2220	25p	2N4298	17p	AD127	17p	BF237	23p	MJ400	11-07	OC45	15p
2N2221	25p	2N4299	17p	AD128	37p	BF238	23p	MJ420	11-12	OC70	15p
2N2222	30p	2N4290	17p	AD129	42p	BF244	23p	MJ421	11-12	OC71	12p
2N2270	47p	2N4991	17p	AD179	73p	BF261	47p	MJ430	11-02	OC71	12p
2N2297	30p	2N4992	17p	AD180	73p	BF261	47p	MJ430	11-02	OC71	12p
2N2368	17p	2N5035	47p	AD181	42p	BFX12	22p	MJ440	8P	OC72	12p
2N2369	17p	2N5027	52p	AD182	42p	BFX13	22p	MJ480	97p	OC74	32p
2N2369A	47p	2N5028	57p	AD183	42p	BFX29	30p	MJ481	11-25	OC75	22p
2N2410	12p	2N5029	57p	AD184	42p	BFX30	30p	MJ490	11-00	OC76	22p
2N2483	27p	2N5030	42p	AD185	42p	BFX42	37p	MJ491	11-00	OC77	30p
2N2484	37p	2N5031	42p	AD186	42p	BFX44	37p	MJ800	42-17	OC81	20p
2N2489	22p	2N5172	45p	AD187	25p	BFX68	67p	MJ820	60p	OC83	25p
2N2540	22p	2N5175	45p	AD188	27p	BFX85	32p	MJ851	73p	OC84	25p
2N2613	35p	2N5176	45p	AD189	27p	BFX86	25p	MPP102	42p	OC139	32p
2N2614	30p	2N5222A	30p	AD190	27p	BFX87	27p	MPP103	37p	OC170	30p
2N2646	52p	2N5245	45p	AD191	27p	BFX88	27p	MPP104	37p	OC171	30p
2N2696	32p	2N5246	45p	AD192	27p	BFX89	27p	MPP105	37p	OC171	30p
2N2711	25p	2N5249	47p	AD193	27p	BFX91	27p	MPP106	37p	OC171	30p
2N2712	25p	2N5265	23-25	AD194	25p	BFX92	27p	MPP107	37p	OC171	30p
2N2713	27p	2N5266	22-75	AD195	11-25	BFY11	42p	MPP108	37p	OC200	40p
2N2714	30p	2N5267	22-82	AD196	42p	BFY17	22p	NK T0013	47p	OC201	40p
2N2865	62p	2N5305	37p	AD197	42p	BFY17	22p	NK T126	27p	OC202	75p
2N2904	30p	2N5306	37p	AD198	42p	BFY18	22p	NK T127	27p	OC203	42p
2N2905	37p	2N5307	37p	AD199	42p	BFY19	32p	NK T128	27p	OC205	90p
2N2905A	37p	2N5308	37p	AD200	42p	BFY20	60p	NK T135	27p	OC207	75p
2N2906A	27p	2N5309	37p	AD201	42p	BFY21	42p	NK T137	32p	OCP71	42p
2N2907	30p	2N5310	37p	AD202	42p	BFY24	45p	NK T210	30p	ORP61	50p
2N2923	15p	2N5355	37p	AD203	42p	BFY25	25p	NK T211	30p	ORP61	50p
2N2924	15p	2N5356	37p	AD204	42p	BFY26	25p	NK T212	30p	ORP61	50p
2N2925	15p	2N5366	32p	AD205	42p	BFY28	50p	NK T213	30p	ORP61	50p
2N2926	25p	2N5367	37p	AD206	42p	BFY30	50p	NK T215	30p	ORP61	50p
Green 14p	2N5457	37p	AD207	42p	BFY31	50p	NK T216	30p	ORP61	50p	
Yellow 12p	2N5458	37p	AD208	42p	BFY32	50p	NK T217	30p	ORP61	50p	
Orange 12p	2N5459	37p	AD209	42p	BFY33	50p	NK T218	30p	ORP61	50p	
2N3011	30p	2N8102	60p	BC152	17p	BFY56A	57p	NK T225	22p	T1850	17p
2N3012	30p	2N8103	25p	BC157	20p	BFY75	50p	NK T229	30p	T1851	12p
2N3053	18p	2N8104	25p	BC158	11p	BFY76	42p	NK T237	35p	T1852	12p
2N3054	46p	2N8105	32p	BC159	18p	BFY77	57p	NK T238	35p	T1853	12p
2N3055	62p	2N8106	35p	BC160	62p	BFY78	57p	NK T240	27p	T1856	22p
2N3133	30p	2N8107	32p	BC161	11p	BFW58	27p	NK T241	27p	T1857	27p
2N3134	30p	2N8108	32p	BC162	11p	BFW59	25p	NK T242	20p	T1858	27p
2N3135	25p	2N8109	32p	BC163	11p	BFW60	25p	NK T243	62p	TIP29A	50p
2N3136	25p	2N8110	32p	BC164	11p	BPX25	11-85	NK T244	17p	TIP30A	50p
2N3137	25p	2N8111	32p	BC165	11p	BPX26	11-80	NK T245	30p	TIP31A	50p
2N3138	25p	2N8112	32p	BC166	11p	BPX27	11-45	NK T246	30p	TIP32A	50p
2N3139	25p	2N8113	32p	BC167	11p	BPX28	11-45	NK T247	30p	TIP33A	50p
2N3140	25p	2N8114	32p	BC168	11p	BPX29	17p	NK T248	30p	TIP34A	50p
2N3141	25p	2N8115	32p	BC169	11p	BPX30	17p	NK T249	30p	TIP35A	50p
2N3142	25p	2N8116	32p	BC170	12p	BPX31	17p	NK T250	30p	TIP36A	50p
2N3143	25p	2N8117	32p	BC171	11p	BPX32	17p	NK T251	30p	TIP37A	50p
2N3144	25p	2N8118	32p	BC172	11p	BPX33	17p	NK T252	30p	TIP38A	50p
2N3145	25p	2N8119	32p	BC173	11p	BPX34	17p				

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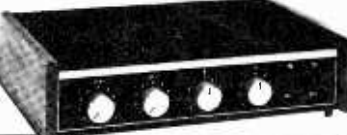
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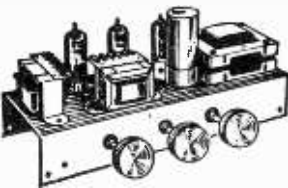
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they are cut off, and do not influence the performance of the differential amplifier system; however, with increasing bias they begin to conduct, drawing off available emitter current from transistors 3 and 6, and shunting the signal through them.

Eventually, as in the very similar system employed in the National LM373 i.f. strip described last month, the signal transistors are fully cut off, and the only signal passed is a residual leakage. The consequence is the availability of the extremely wide gain control range of 80dB. This gain control can be secured through the application of a variety of signal sources to one or other of the gain control inputs, accessible at pins 3 or 4 of the 10-pin TO-5 package.

Squelch Applications

A "squelch" feature is a system whereby a signal channel is muted until a preset input level is attained, whereupon full gain is made available. In audio systems it is a useful feature in a noisy environment; a public address system fitted with squelch, for example, will not respond to background crowd noises, but immediately the microphone is exposed to clear speech the channel opens fully. It also is commonly employed in transceiver operation, with the loudspeaker muted until a transmitted signal is detected.

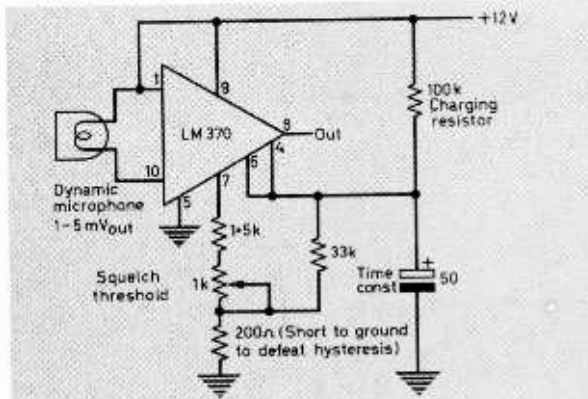


Fig. 2: Circuit using the LM370 in a pre-amplifier to provide squelch with 'hysteresis'.

A further refinement is possible, in which a relay is energised synchronously with the squelch feature; such a relay can operate a tape transport mechanism or transmit/receive changeover, so effecting the function of a voice operated switch. Finally, the LM370 squelch is designed with "hysteresis," that is, that whereas the feature operates immediately the input signal rises above the preset threshold, the cut-off is slightly delayed; this prevents cut-off and holds the channel open between syllables and words in speech, or transient gaps in other forms of signal.

The squelch effect is initiated through transistors 20, 36 and 21 acting as a signal level detector and overriding the automatic gain control through one or other of the control inputs. In the quiescent state, transistor 20 is saturated; an input signal reduces the collector current, turning on transistors 36 and 21, which is a large geometry (and hence high current) type. At pin 6 is connected a large capacitor, charged through a resistor from the d.c. positive line, and this is discharged through the transistor.

If one of the automatic gain control inputs is

connected to pin 6, this voltage drop results in the availability of the full amplifier gain. On the cessation of the input signal, and saturation of transistor 20, the external capacitor takes some time to charge, bringing up the gain control input voltage and reducing the amplifier gain by 80db. This contrasts with the almost instantaneous discharge of the capacitor at the onset of a signal, and provides the hysteresis feature.

Other Uses

A few points on the application of the LM370 are worth noting. The input circuit consists of a differential pair of emitter followers, so that the input voltage may rise to that of the d.c. supply line, while the common mode effect regulates the output d.c. level. This is the explanation for the rather unusual biasing arrangement shown in the application diagrams for use with dynamic microphones. Also, the output impedance is relatively high, so that a number can be joined in a mixer arrangement; even more attractive is the combination of this feature with the squelch operation already discussed, to provide a multiple access public address system, in which noise from all inputs is adequately suppressed, yet any one is immediately effective when required.

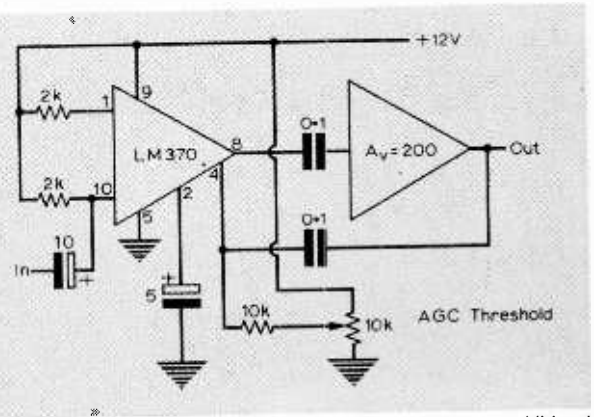


Fig. 3: An a.g.c. system using built-in detection, driven by an additional op. amplifier.

The prime function of pin 2 is to smooth the automatic gain control bias applied to transistors 4 and 5 when an audio or r.f. signal is applied to the input pins 3 and 4, rather than a d.c. bias, to regulate gain. It is also possible to effect signal suppression by application of the output of a logic circuit to a gain control input, but this is more likely to be of interest to the commercial multiplex operator than to the amateur.

A more likely requirement is as a remote gain control; since a simple d.c. bias is all that is needed, it is possible to site the volume control several yards from the preamp. With the LM370, for example, a remote bias control, regulating the voltage at pin 3 or 4, can be attached to a microphone so that the user can regulate output from a stage or platform himself. This is obviously impracticable with the conventional volume control, in which long leads carrying audio signals would introduce uncontrollable instability.

In the field of testgear, one of the problems about the design of audio signal generators is the distortion of waveform due to variation of gain as the operating

frequency is varied; the automatic gain control feature of the LM370 abviates this problem. AM modulation of an r.f. carrier can be accomplished using the gain control input (without decoupling at pin 2) as the audio injection point, with a constant r.f. applied to pin 1.

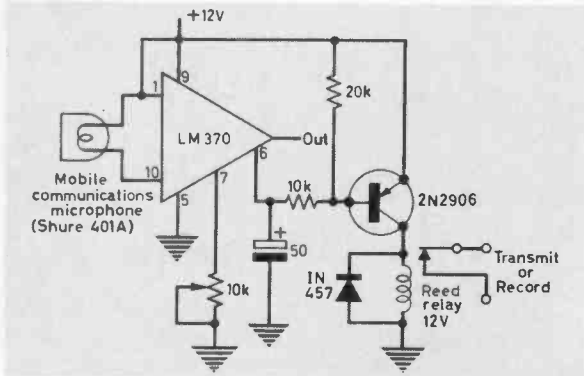


Fig. 4: Here the LM370 is incorporated in a voice-operated switching system (VOX).

From these remarks, some idea of the challenge to ingenuity presented by this new device should be possible; it is available from all National distributors, including: Athena Semiconductor Marketing Co. Ltd., 140 High Street, Egham, Surrey; or Rastra Semiconductors Ltd., 275 King Street, Hammersmith, London W.6.

TELEVISION

JANUARY ISSUE

FAST-ACTING VISION AGC

There are various requirements of a vision a.g.c. system. It must give a stable picture, while it is desirable that it should be able to act sufficiently fast to counter aircraft flutter. Keith Cummins considers the problems of a.g.c. loop time-constants and shows the great advantages of a gated system. He concludes with a fast-acting gated black-level stable circuit for use with his *Constructor's 625-line Receiver*.

TIME-SAVING REPAIR HINTS

Time is money in TV servicing. This month in *Workshop Hints* Vivian Capel suggests some time-saving techniques but warns about the dangers of adversely affecting the performance and reliability of equipment.

CONSTRUCTOR'S CIRCUITS

Field timebase and power supply circuits and also an alternative video circuit for single-standard use are given.

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Our charming hostess Lydia arranges issues of "Television" magazine next to which can be seen the free neon mains tester screwdrivers that were given away with each issue purchased at the Exhibition.

A general overall view of the Practical Wireless and Television magazines' stand.



Visitors to the stand adjust the P.W. Workshop Oscilloscope (April 1971 issue).



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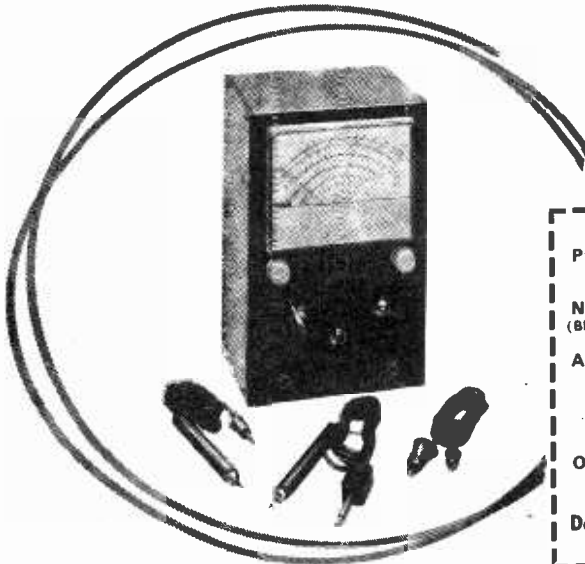
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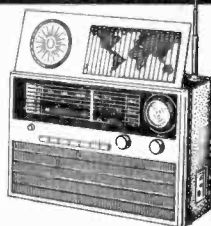


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This is a genuine high quality low distortion (0.2%) stereo amplifier incorporating two of the latest Plessey integrated circuit amplifiers each with its own separate 3 transistor pre-amp plus 11 transistor main-amp and built in thyristor protector circuit in case of wiring accidents. With a total maximum power of up to 6 watts r.m.s. (8Ω load 3w/channel), this amplifier has more than enough power to rock the average living room. The circuit features Volume, Balance and tone controls, has a separate on/off switch, and requires only a source of 14v a.c. to be fully operational. Input is designed to suit most crystal pick-ups and frequency response is 50-15KHz. Price £6.50

Also Dual Tone Control Model, with mains Transformer Price £8.20

and Mini Discotheque three colour lamp driver attachment, has three bright 6w lamps, fun for any party! at £5.20

Cheques, P.O.s to

THE AUTOTRON COMPANY, HIXON, STAFFS

BAKER 12in. REGENT

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to advantage with any Radio, Amplifier or Television receiver.

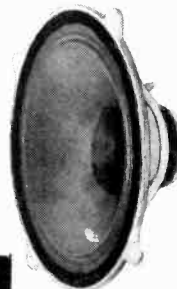
Maximum Power 15 watts
Bass Resonance 45 c.p.s.
Flux Density 12,000 gauss
Voice Coil impedance 3 or 8 or 15 ohm models

£7

Useful response 45-13,000 c.p.s. POST FREE
Nett weight 5 lbs.

GUITAR MODEL "GROUP 25" £7
25 watt rating

Latest catalogue 5p with enclosure plans.



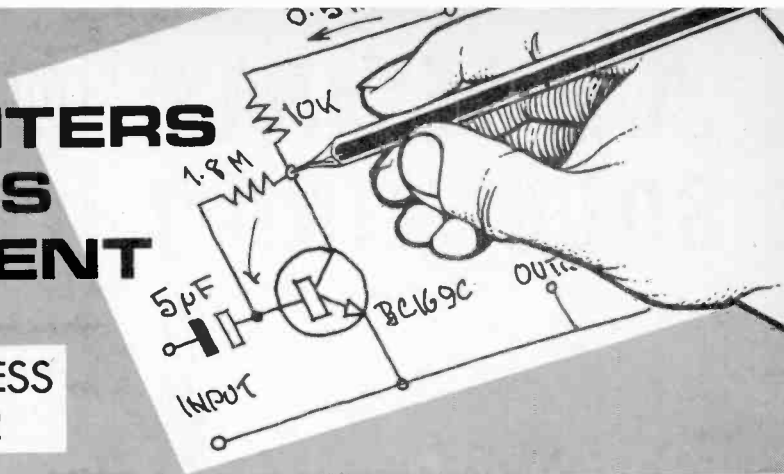
Baker Reproducers Ltd

Bensham Manor Road Passage, Thornton Heath, Surrey. 01-684-1665

EXPERIMENTERS CIRCUITS SUPPLEMENT

presented with

PRACTICAL WIRELESS
JANUARY 1972



This supplement is aimed at those readers who only require a circuit in order to tackle a project. The circuits included here cover many fields and many of them may be considered as "standard" circuits; in most cases reliability has been preferred to ingenuity. No constructional data is given (with one exception) but the usual rules regarding layout should be observed: keep outputs away from inputs; transistors carrying large currents should be fitted with heat sinks; earthing points should be kept to a minimum, especially in the case of the higher powered amplifiers.

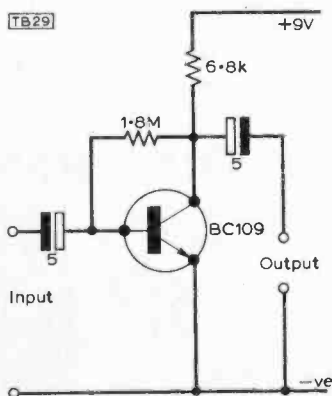
In some simple circuits certain components values (usually bias resistors) may have to be altered to suit the particular device used. The working voltage of capacitors is not generally given; if in doubt ensure that the working voltage of all the capacitors is at

least as high as the supply voltage. A variety of power supply circuits is included and these may be used with the circuits shown, though in many cases batteries may also be used.

All resistors can be 5 or 10 per cent tolerance with a rating of $\frac{1}{8}$ or $\frac{1}{4}$ W except where stated. In many cases alternative transistors may be used with no change in component values but those specified are usually the cheapest and most widely available. No highly specialised components are used and most component suppliers who advertise in Practical Wireless should be able to supply all the parts.

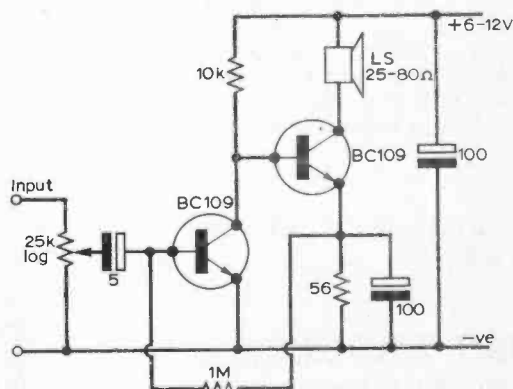
We regret that we are unable to answer correspondence relating to construction, modifications or the availability of components though we would welcome general comment and criticism.

1: ONE TRANSISTOR PREAMPLIFIER



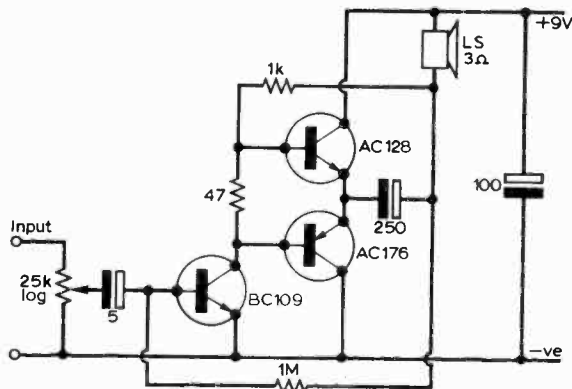
A general purpose audio preamplifier which will provide good gain for weak signals. Input and output impedance are both about $50k\Omega$ but, unless used for high quality purposes, mismatch on either will not be serious. Transistor bias resistor may have to be altered to suit the gain of the individual device. Signals from less than 1mV to nearly 500mV can be handled. Current taken is about 1mA and the preamplifier can be powered from either the circuit it is feeding or from a battery.

2: 50mW AUDIO AMPLIFIER



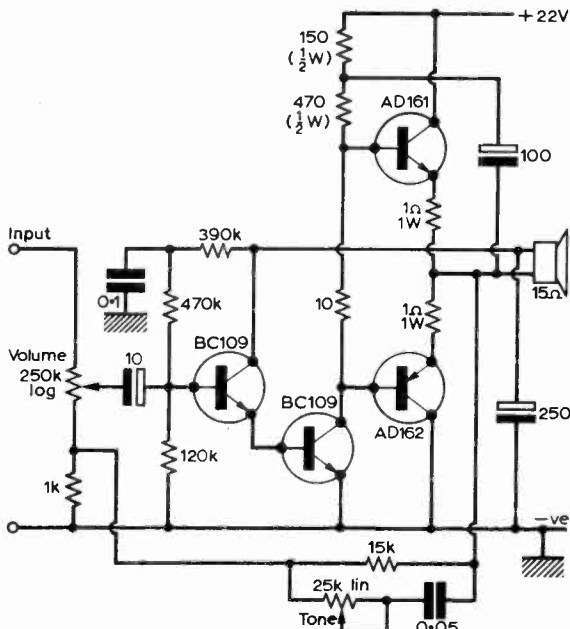
A simple, inexpensive audio amplifier providing about 50mW from an input as low as 25mV; input impedance is about $25k\Omega$. The value of the $10k\Omega$ resistor may have to be changed to suit the individual device. Low impedance speakers may be used in conjunction with a transformer. Distortion level is high making the circuit only suitable for simple radios, intercoms etc. Quiescent current is typically 10mA.

3: 500mW AUDIO AMPLIFIER



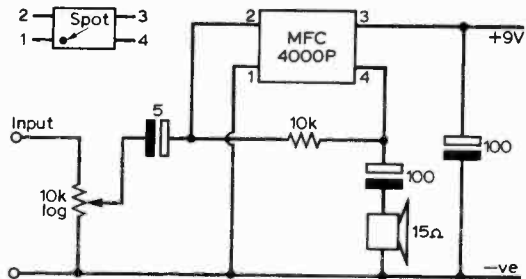
Complementary pair amplifier providing about 500mW output from a 50mV input. The output transistors should be a matched pair and may be changed for a wide variety of other similar germanium transistors. The bias resistor for the BC109 may have to be individually selected. Supply voltage should not exceed 9V and the output transistors should be fitted with heat sinks.

4: 3W AUDIO AMPLIFIER



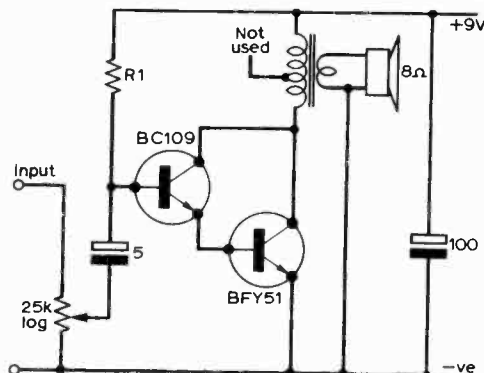
Reasonable quality audio amplifier with an output of about 3W and with maximum distortion of 2 per cent. Speaker impedance may be altered to 8Ω, but no lower. Quiescent current is about 20mA but peaks exceed 200mA and thus the amplifier is not suitable for battery operation. Output transistors should be a matched pair. Input impedance is high and will match a ceramic or crystal pickup. If this is found to overload the amplifier, better results will be achieved by feeding the input via a 1MΩ resistor. Output transistors should be fitted with a heat sink. Improved bass response can be achieved by increasing the value of the 250μF capacitor.

5: I.C. AUDIO AMPLIFIER



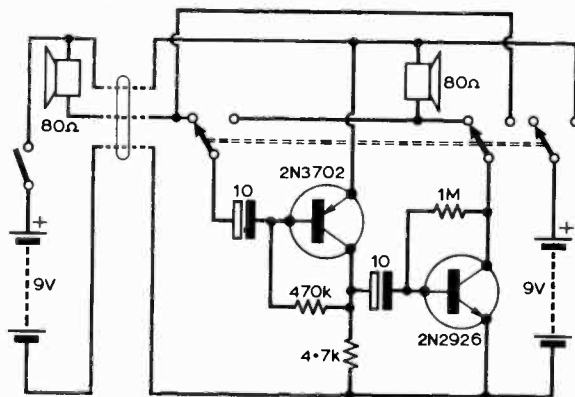
An ultra simple i.c. amplifier using a device costing about £1. Input impedance is about 10kΩ. Any tendency to high frequency instability can be cured by connecting a 500pF capacitor between points 1 and 2. 8Ω speakers may also be used. Output is of the order of 250mW.

6: DARLINGTON AUDIO AMPLIFIER



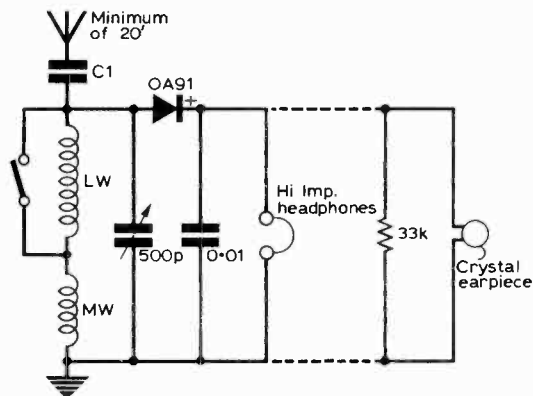
An unusual high gain amplifier. R1 must be individually selected and should be as high as possible, compatible with an undistorted output, and will probably be in the range 470kΩ to 4.7MΩ. Output transformer can be Eagle type LT700, the centre tap on the primary being ignored. Ensure that the quiescent current does not exceed 30mA; if it does, increase the value of R1. Volume control can be higher in value if necessary.

7: TWO TRANSISTOR INTERCOM



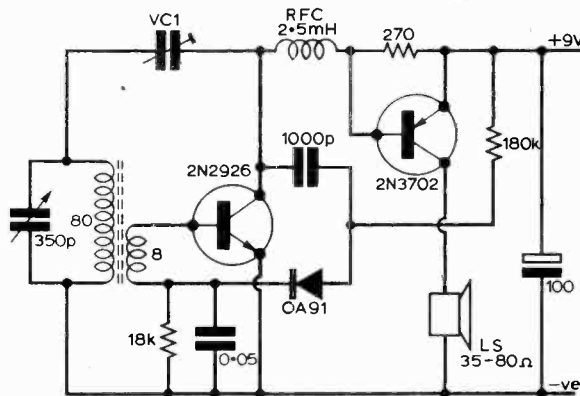
A two station intercom, one being the master, the other the slave. The two are joined by a three-way cable. Only high impedance speakers may be used, ideally 75-80Ω but they may be as low as 40Ω. Bias values for the transistors should be individually selected.

8: CRYSTAL SET



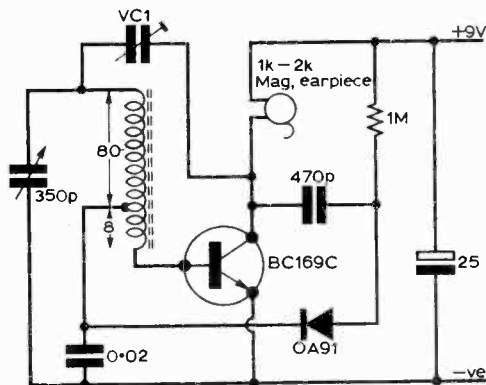
Basic crystal set circuit. C1 may lie between 50pF and 1000pF and will depend on aerial length. The coil can be any crystal set coil such as the Repanco DRX1. For medium wave use the long wave winding should be shorted out. Detector diode may be any good germanium type. Headphones should be high impedance type, at least 1000Ω impedance. The 0.01μF capacitor may not be needed. A cheaper alternative to magnetic headphones is a crystal earpiece across a resistor. A good earth connection should be used, but not the mains earth.

10: TWO TRANSISTOR LS RADIO



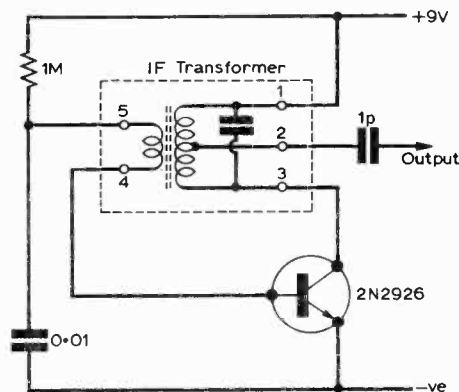
This circuit will provide very acceptable loudspeaker reception of local stations though the simplicity of the circuit does not make the fitting of a volume control practical. Ferrite rod aerial as for the One Transistor Radio but with two separate windings. The bias for the 2N2926 must be taken from the battery side of the 270Ω to avoid negative feedback. VC1 comprises two short lengths of wire twisted together. The 180kΩ resistor may have to be modified to suit. Any "colour" of 2N2926 may be used but the higher gain versions such as the "green" will usually be better.

9: ONE TRANSISTOR RADIO



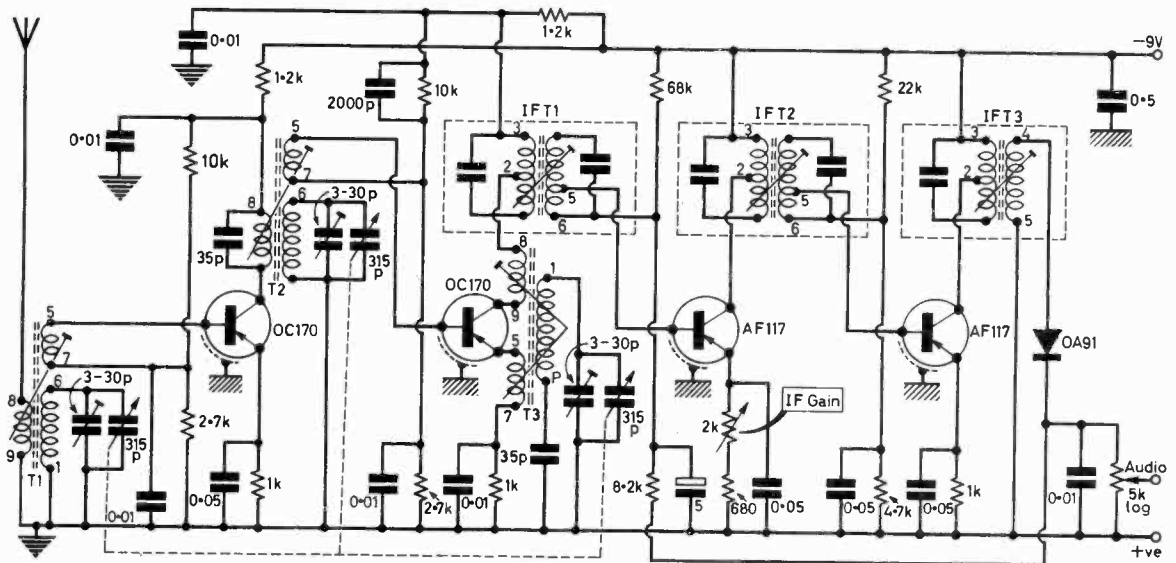
A simple reflex regenerative receiver, suitable for local station reception. VC1 is made up from two short pieces of wire twisted together. Ferrite rod aerial should be as long as possible and not less than 3in. with a diameter of 1/4in. Turns should be close spaced and comprise 88 turns tapped at 8 turns. Magnetic earpiece should have an impedance of at least 1000Ω. The 1MΩ resistor may have to be selected.

11: B.F.O.



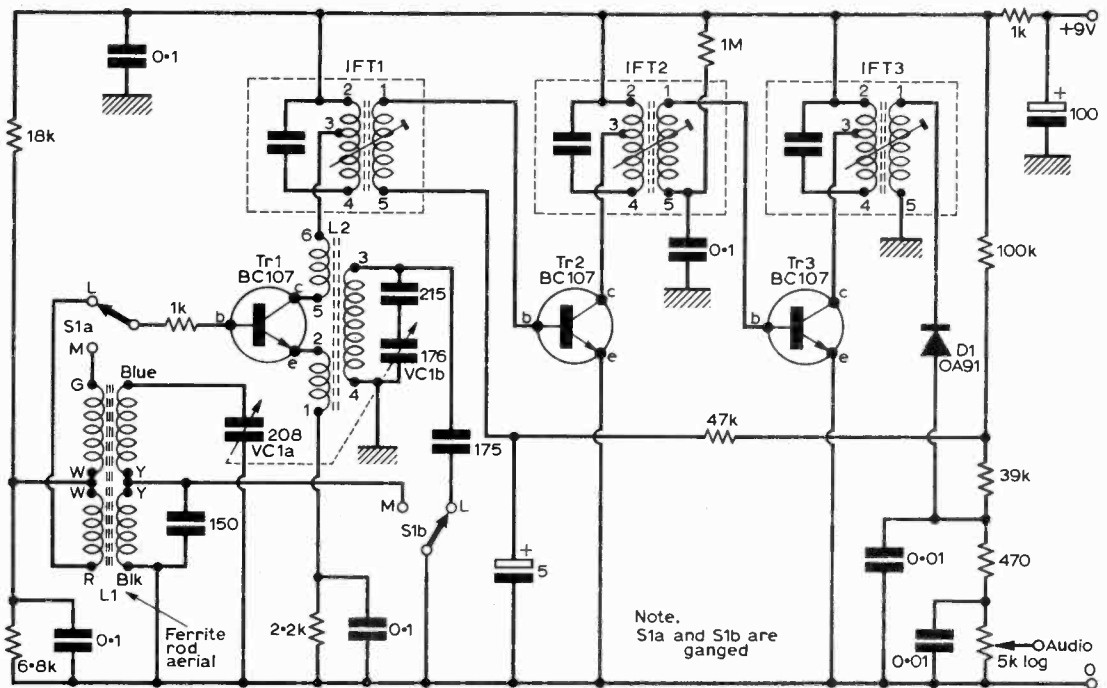
Simplest form of beat frequency oscillator, the core of the i.f. transformer should be adjusted to zero beat with the receivers i.f. For variable operation a 15pF variable capacitor should be connected across pins 1 and 3 and the core readjusted to give zero beat. Circuit is equally suitable for 465kHz or 1.6MHz operation with the appropriate i.f. Pins numbers refer to Denco IFT.14 (465kHz) or IFT.17 (1.6MHz).

12: ALL-BAND RADIO



This all-band receiver is based upon the Denco range of plug-in coils and covers 150kHz to 31MHz. Colour coding is Blue for T1, Yellow for T2 and Red for T3 (465kHz i.f.). The value of padder capacitor Cp is given with the coils, being connected to a different pin on each range.

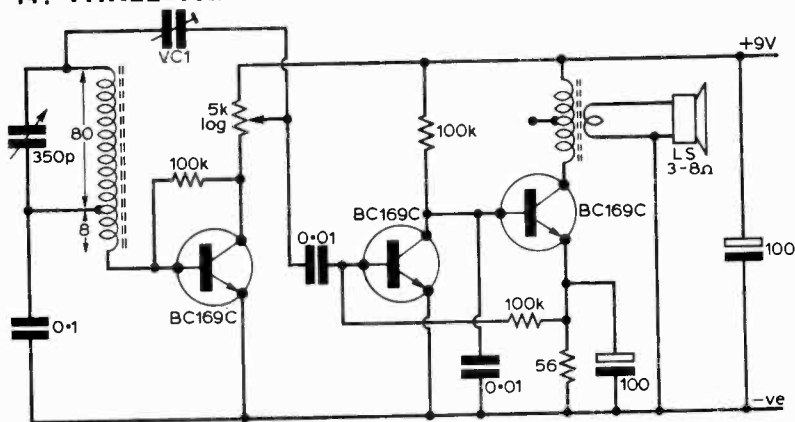
13: TWO-BAND RADIO



Note.
S1a and S1b are ganged

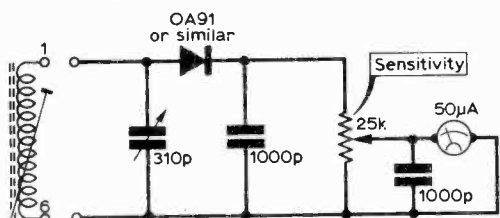
In this m.w./l.w. receiver the values of the tuning capacitors match the Weyrad RA2W ferrite rod aerial. IFT1/2 can be Weyrad Type P51/1 and IFT3 Type P50/3V. The 39kΩ resistor in the resistor chain across the supply should be adjusted in value for optimum results.

14: THREE TRANSISTOR RADIO



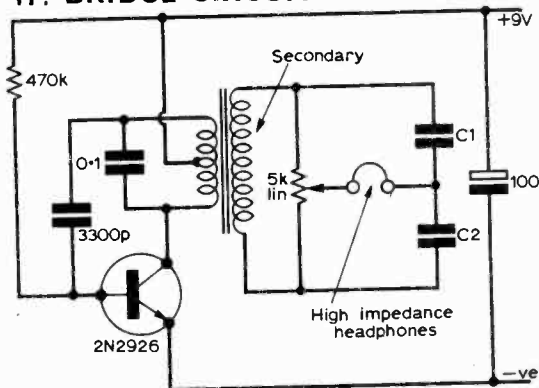
A highly practical receiver circuit giving coverage of local and several continental stations with volume and regeneration on the same control. The aerial and VC1 are as for the One Transistor Radio. The output transformer can be an Eagle LT700, ignoring the centre tap on the primary. The 100kΩ resistor in the amplifier section may have to be altered to suit. VC1 should be carefully adjusted for best operation; it should start to operate only at the higher volume settings.

15: FREQUENCY CHECKER



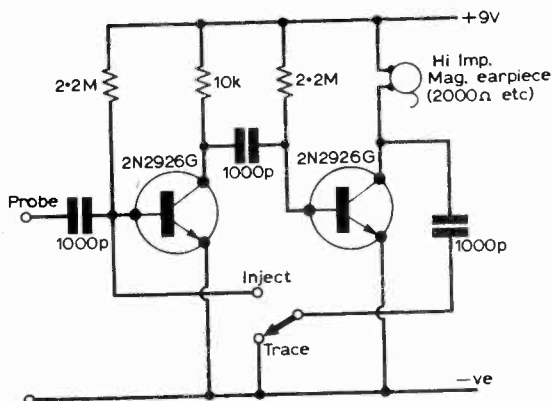
Useful for checking the approximate frequency of oscillators in receivers or transmitters, frequency multiplier chains and overtone oscillators. Use Denco plug-in coils (Ranges 1 to 5, Blue or Yellow) to cover 150kHz to 31MHz, using main winding only. Calibrate by loosely coupling coil to a few turns of wire connected across low impedance output of a signal generator. Tune for maximum meter reading and mark dial of frequency checker. For transmitter applications only, use less sensitive meter.

17: BRIDGE CIRCUIT



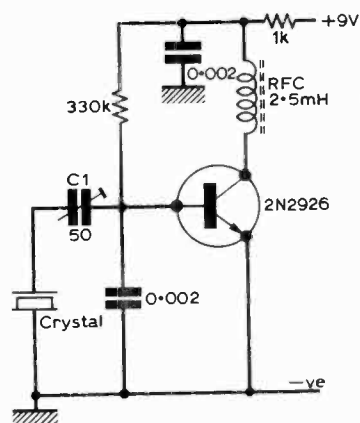
The transistor is connected as an audio oscillator, using an Eagle LT700 audio transformer in the collector. The secondary (which normally goes to the speaker) goes to a linear pot, as shown. The ratio between the two parts of the pot, from the slider is proportional to the values of C1 and C2 when no signal is heard in the phones. Theory of bridge circuits is too complex to explain here; if in doubt consult library books or past issues of P.W.

16: SIGNAL INJECTOR TRACER

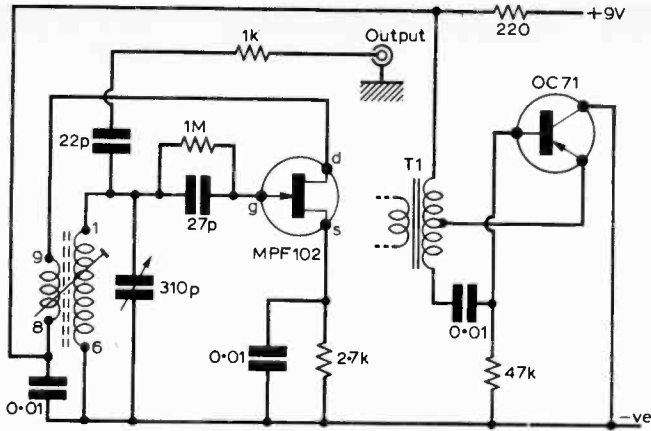


This circuit will provide a nominal square wave output in the audio range on "Inject", the harmonics of which should be heard at several MHz. On "Trace" the non-linear operation of the amplifier will detect r.f. signals which will be smoothed by the 1000pF which is switched to the negative line.

18: CRYSTAL OSCILLATOR



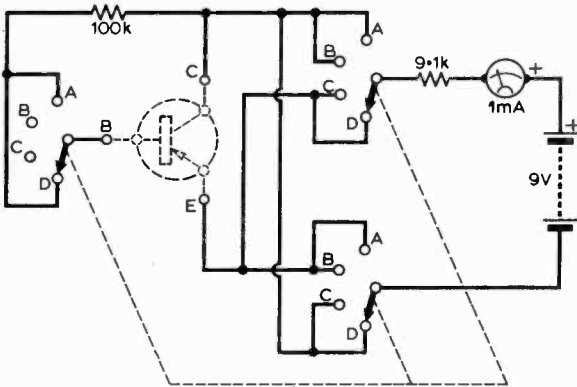
A simple circuit that will oscillate with a wide range of crystals. Connect several different types of crystal holder in parallel to improve versatility. Capacitor C1 adjusts crystal frequency over small range for setting to standard frequency transmissions when the unit is used as a crystal calibrator.



19: SIMPLE SIGNAL GENERATOR

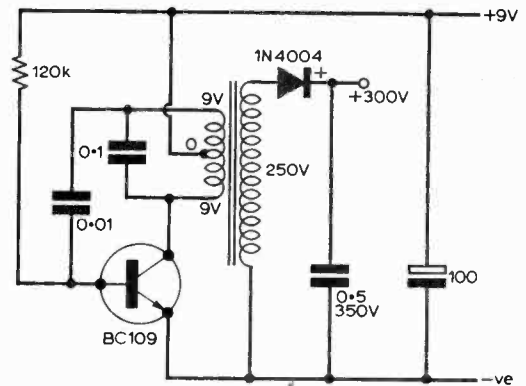
This simple signal generator will provide a modulated r.f. output over a wide range of frequencies using standard plug-in coils. A switch can be inserted in the supply lead to the OC71 to cut the modulation when this is not required.

20: TRANSISTOR TESTER

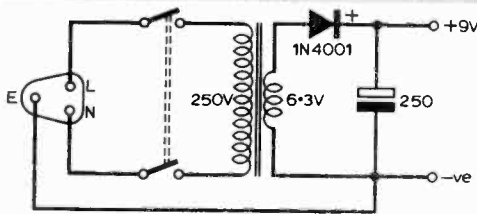


Switch is three pole, four way. Position A is for NPN transistor gain, B is NPN leakage, C is PNP leakage and D is PNP gain. The battery, meter and the 9.1k resistor form an ohmmeter circuit measuring the "resistance" of the transistor with either bias or no bias applied to the collector. The higher the meter reading on 'gain', the higher the gain of the transistor but only relative readings are possible. An excellent circuit for the checking of surplus transistors.

21: HIGH VOLTAGE SUPPLY



A 9V battery of the PP3 type can be made to provide 300V d.c., albeit at a high internal impedance (i.e. it will not be dangerous though it can inflict an unpleasant jolt). A 9-0-9V mains transformer is connected in reverse with a transistor using a Hartley oscillator configuration. The frequency of operation may be controlled by varying the value of the 120k resistor. The 0.5μF capacitor must have a working voltage of at least 350V.

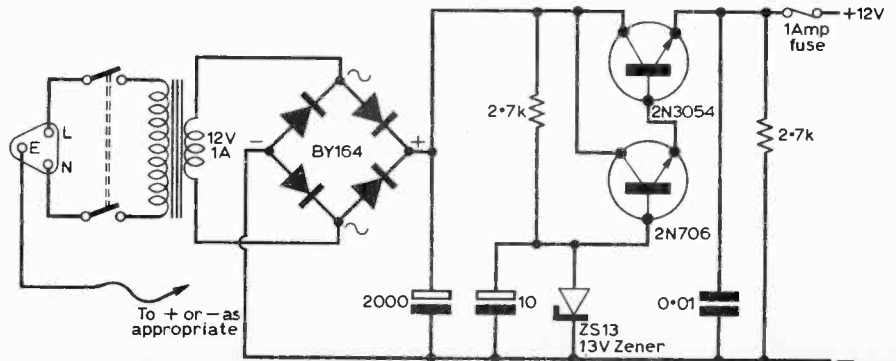


22: BATTERY ELIMINATOR

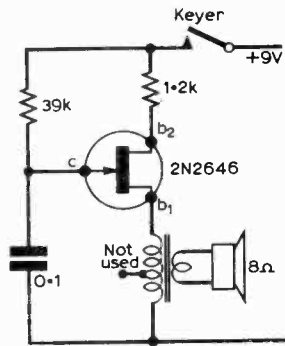
A simple battery eliminator can be made using a valve heater transformer. A wide variety of different types of rectifier diode may be used in place of the 1N4001. Include a low value resistor (say 10Ω) in series with the rectifier since, on switch-on, the uncharged reservoir capacitor will look like a short circuit and the resistor will limit the initial current.

23: REGULATED PU

The regulated output voltage of this unit will be approximately 1½V less than the voltage rating of the zener diode. The maximum regulated current is about 500mA. Note: the zener is drawn incorrectly, the bar (positive) should be connected to the 10μF capacitor and the base of the 2N706.

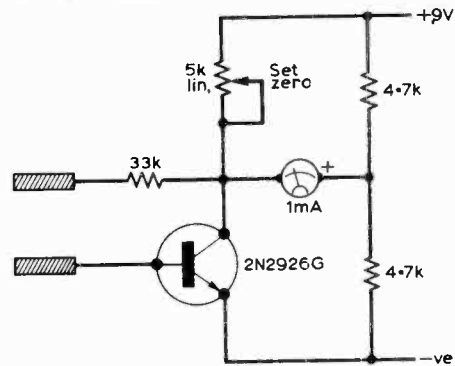


24: MORSE PRACTICE OSCILLATOR



The circuit comprises a unijunction relaxation oscillator at a fixed frequency. Transformer may be an Eagle LT700 but may not be needed; try connecting the speaker in place of the primary. Frequency may be altered by changing the value of the 39kΩ resistor.

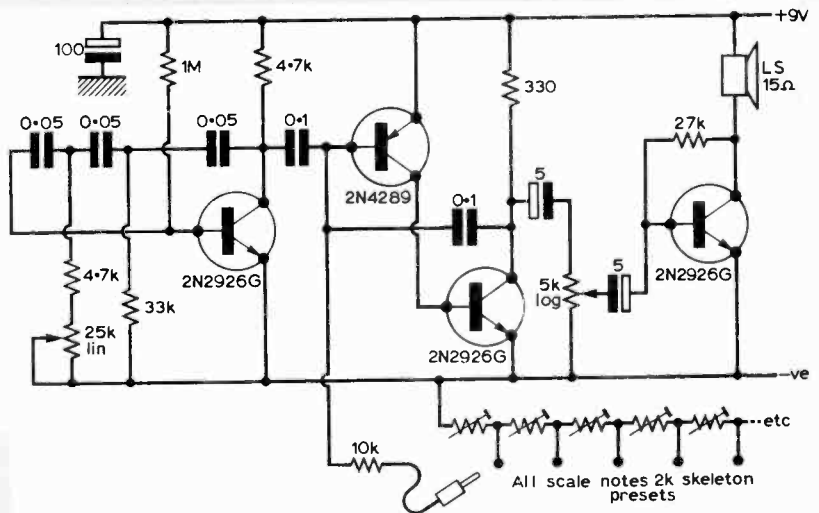
27: LIE DETECTOR



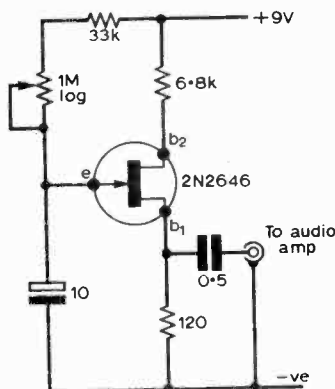
The two probes shown are held in the hands and the skin resistance applies bias to the transistor. The 5kΩ pot is set for zero deflection on the meter. When the "subject" is embarrassed or lies, sweating on the hands takes place, increasing the bias to the transistor and upsetting the bridge balance.

25: ELECTRONIC ORGAN

This circuit comprises three distinct sections. On the left is a phase shift oscillator producing a tremolo frequency which is fed into the main note-forming oscillator (the centre two transistors) 2N4289 and 2N2926. The note scale is made up from a series of 2kΩ preset pots in a chain from the negative line and the probe after the 10kΩ resistor selects one of these. Output from this stage, which is a mixture of the main note plus tremolo, is coupled to a single transistor amplifier feeding a loudspeaker which should have an impedance of at least 15Ω.

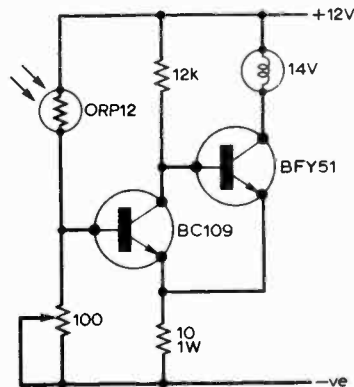


26: METRONOME



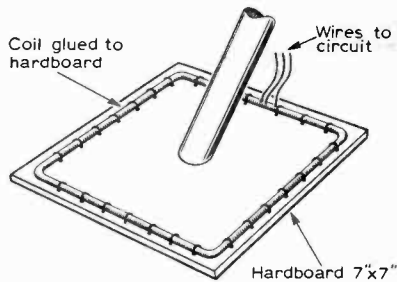
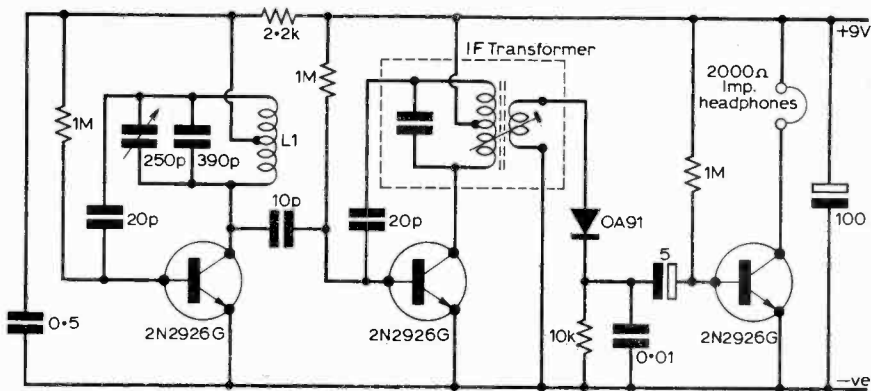
A simple oscillator can be built using only a charging circuit and a unijunction transistor. Varying the 1MΩ resistor will give a beat rate ranging from one every several seconds to several per second. The output shown gives a short lived pulse at the correct interval; a saw-toothed output is available from the emitter. Output impedance is low and output level is about 100mV.

28: AUTOMATIC PARKING LIGHT



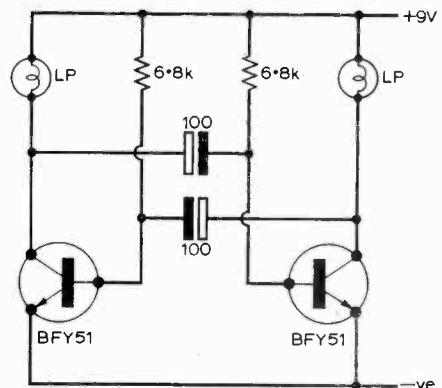
Circuit is Schmitt trigger controlled by the ORP12, light dependent resistor, and the pot. When light falling on the LDR falls below a certain level (controlled by the pot) the bulb will light. When light level increases again to a certain value, the bulb goes out. The circuit is only suitable for fairly low wattage bulbs and the BFY51 must be fitted with a heat sink.

29. METAL LOCATOR

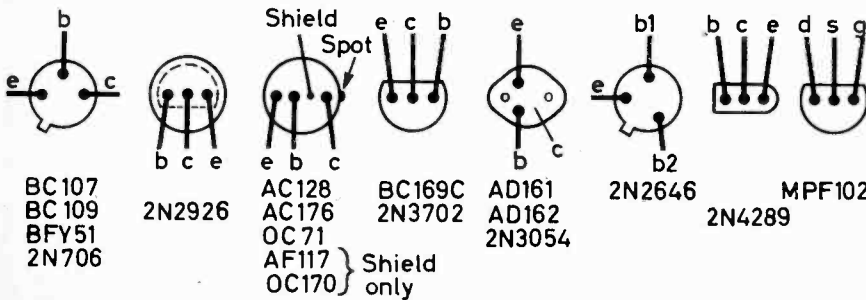


The circuit comprises two oscillators, both working at about 465kHz, one using an i.f. transformer and the other an inductor which acts as the search coil (L1). The two are coupled by a low value capacitor (10pF). A beat note is produced if the two oscillators are working closely together and this is detected by the diode and fed to the headphone amplifier. The search coil oscillator is tuned by a 250pF variable capacitor. The search coil comprises 22 turns of wire (any gauge between 24 s.w.g. and 36 s.w.g. enamel) centre tapped. The wire should be wound on a temporary former, then taped and stuck with glue to a piece of hardboard. The coil size should be 6in. x 6in. and the hardboard a little larger, say 7in. x 7in. Headphones should ideally have an impedance of 2000Ω but may be in the range 250Ω to 4000Ω.

30. LIGHT FLASHER



Basic multivibrator circuit with a light bulb in the collector of each transistor. Bulbs will flash alternately; (when one is on, the other will be out). The rate of flashing is dependent on the values of the electrolytic capacitors and on the 6.8kΩ resistors which may be altered for a faster or slower rate.



To assist the constructor transistor lead-out connections for all the circuits in this supplement are given on the left.

Build yourself a TRANSISTOR RADIO

NEW! ROAMER 10 WITH VHF INCLUDING AIRCRAFT

10 TRANSISTORS, 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER BAND. VHF AND LOCAL STATIONS AND AIRCRAFT BAND

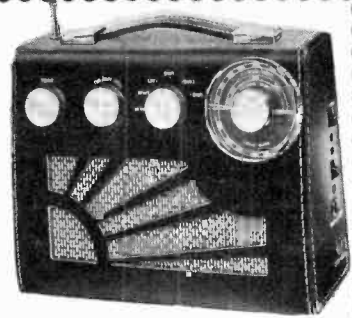
Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. Switched Earpiece Socket complete with Earpiece. 10 Transistors plus 3 Diodes. 7in x 4in Speaker. Air Spaced ganged Tuning Condenser with VHF section. Volume on/off, Wave Change and Tone Control. Attractive Case in black with silver blocking. Size 9" x 7" x 4". Easy to follow instructions and diagrams. Parts price list and easy build plans 80p (FREE with parts).

Total building cost

£8-50

P. P. & Ins. 50p

(Overseas P. & P. £1)

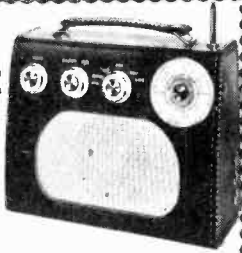


ROAMER EIGHT MK I

NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. Switched earpiece socket complete with earpiece. 8 transistors plus 3 diodes. 7in. x 4in. Speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans 25p (FREE with parts).

Total building cost **£6-98** P. P. & Ins. 41p (Overseas P. & P. £1)



ROAMER SEVEN MK IV

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, including Micro-Alloy R.F. Transistors. 7 x 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 16p (FREE with parts). Earpiece with plug and switched socket for private listening, 30p extra.

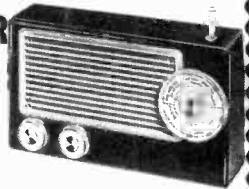
Total building costs **£5-98** P. P. & Ins. 41p (Overseas P. & P. £1)



ROAMER SIX

6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra M.W. band for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/2in. approx. Easy build plans and parts price list 16p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

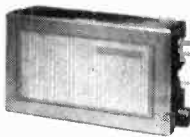
Total building costs **£3-98** P. P. & Ins. 26p (Overseas P. & P. £1)



POCKET FIVE

3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5 1/2 x 1 1/2 x 3 1/2in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs **£2-23** P. P. & Ins. 21p (Overseas P. & P. 63p)

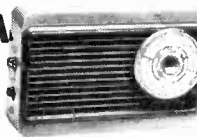


TRANSONA FIVE

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3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser volume control, fine tone 3in. moving coil speaker. Attractive case with red speaker grille. Size 6 1/2 x 4 1/2 x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

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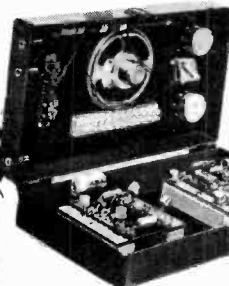
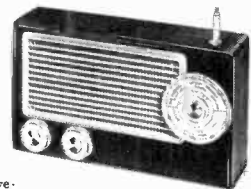


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PW.37



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PRECISION FAN CO (SMITHS INDUSTRIES) DOUBLE CENTRIFUGAL FAN / BLOWER. This is a beautifully balanced particularly quiet running unit giving approx. 90 cubic ft./min. The motor is a 2 pole shaded pole Mycalex, drawing only 240 ma on run. Weight 240 lbs. Sizes: case dia. 3 1/4 ins. width (case only) 3 1/2 ins. Width overall (inc.) 5 1/2 ins. Aperture 3 1/2 ins. x 1 85 ins. Offered well below makers price at £2-95, P. & P. 25p.



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"MAGNETIC DEVICES" Mains Solenoid. 2" x 1 1/2" x 1 1/2" approx. 2lb. pull. Plunger Travel 1 1/2". New in makers boxes; offered at half original cost. 75p. P. & P. 25p.

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L.T. TRANSFORMERS. Prim. 0-110-240v. Sec. 4-5-0-4-5v. at 1 amp. Size: 1 1/2" x 1 1/2" x 1 1/2". 60p. P. & P. 15p.

Prim. 220/240v. Sec. 0-5-10-15-20v. at 2 amps. £1.25. P. & P. 15p.

Prim. 200/240v. Sec. 0-1-5-5-8-60 at 3-5 amps plus 0-90 at 100 ma. Wax impregnated with screw term. blocks. Weight 10 lbs. £3-60, plus 40p P. & P.

"WODEN." Prim. 10-0-200-240v. Sec. two separate windings 6v. at 4 amps each. £2-50, plus 30p P. & P.

"WODEN." Prim. 0-10-200-220-240v. Sec. 34-36-38v. at 600va, £7-50, plus 50p P. & P.

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EAB92	50p	EF184	35p	PCF808	75p
EB91	15p	EF1200	75p	PCF200	75p
EB93	50p	EL34	57p	PCL81	47p
EB94	50p	EL41	57p	PCL82	47p
EB98	45p	EL42	55p	PCL83	65p
EBF80	45p	EL84	25p	PCL84	42p
EBF83	45p	FL85	40p	PCL85	42p
EBF89	30p	FL86	40p	PCL86	42p
EC81	30p	EL90	35p	PFL200	57p
EC82	25p	EL95	35p	PL36	55p
EC83	30p	EL90	35p	PL81	£3-00p
EC84	20p	EM31	25p	PL82	40p
EC85	40p	EM90	40p	PL83	42p
EC86	50p	EM94	35p	PL84	35p
EC88	37p	EM97	55p	PL80	75p
EC89	55p	EY61	40p	PL84	75p
ECF80	35p	EY96	35p	PY33	60p
ECF82	35p	EY81	35p	PY80	35p
ECF83	75p	EY98	40p	PY81	27p
ECF801	65p	EZ41	42p	PY82	27p
ECF802	65p	EZ80	25p	PY83	35p
ECI85	60p	EZ81	40p	PL84	75p
ECI84	65p	GZ34	65p	PY80	75p
ECI81	25p	KT86	£1-60p	PY801	57p
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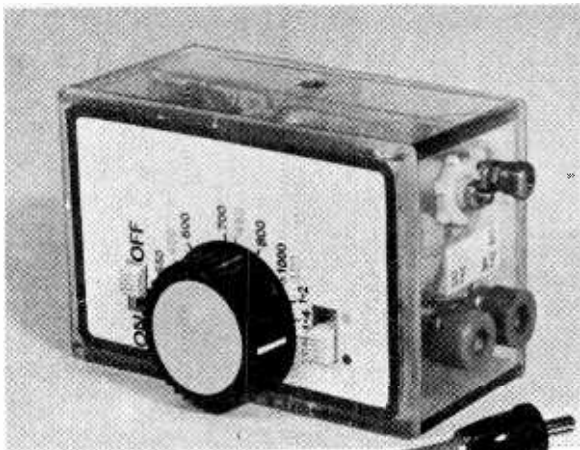
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	OC29	65p	IN21	17p	2N5109	£2-00	AP118	65p	CRB120	35p
	OC35	50p	IN21B	25p	40362	60p	AP127	17p	CRB130	40p
	OC38	42p	IN25	60p	82303	50p	AP139	30p	CRB135	45p
	OC44	17p	IN43	10p	3P100	67p	AP178	48p	CRB140	45p
	OC45	16p	IN70	7p	3P85	35p	AP186	40p	CRB3/05	30p
	OA73	10p	OC70	12p	IN702-7258	£1-15	AFY191	15p	CRB3/20	35p
	OA74	10p	OC71	15p	IN823A	£1-30	3N139	£1-75p	CRB3/50	45p
	OA79	10p	OC72	25p	I2M75	35p	3N140	90p	CRB35/025	65p
	OA81	10p	OC73	30p	I2M710	33p	3N154	90p	617M	75p
	OA91	7p	OC76	25p	I2T7	87p	3N169	£1-45p	6K7K	25p
	OA90	7p	OC76	25p	I2T7	87p	3N169	£1-45p	6K7K	25p
	OA92	10p	OC81	25p	I2T8	65p	6R75	45p	6K7G	25p
	OA210	25p	OC81D	90p	2G385	15p	12P68	75p	6K8G	45p
	OA211	37p	OC81DM	90p	2G403	15p	10D1	16p	6K8GT	45p
	OA230	55p	OC82	25p	IN4775	50p	40594	£1-37p	6K8T	45p
	OA2301	50p	OC82	25p	IN4777	55p	40595	£1-37p	6K9T	45p
	OA2302	50p	OC82DM	30p	2N9178	37p	40598	£1-45p	6K70	25p
	OA2306	48p	OC83	25p	2N9184	37p	40598	£1-45p	6K70	25p
	OA2307	47p	OC83B	15p	2N1304	25p	40609	£1-48p	6K70T	25p
	OA2308	47p	OC84	35p	2N1306	25p	AC126	25p	6K70T	25p
	OA2313	38p	OC122	50p	2N1307	25p	AC127	25p	6K70T	25p
	OA2323	35p	OC139	25p	2N1247	45p	AC128	25p	6K70T	25p
	OA2325	60p	OC140	37p	2N2904	75p	AC176	25p	6K70T	25p
	OC22	50p	OC170	25p	2N2909	65p	AC176	25p	6K70T	25p
			OC171	30p	2N3035	25p	AC177	30p	6K70T	25p
			OC22	50p	2N3054	50p	AC178	25p	6K70T	25p
			OC22	50p	2N3054	50p	AC178	25p	6K70T	25p



ALL valves guaranteed

6B6	20p	12K5	55p	967	80p
6C4WA	75p	13E7GT	70p	967	£1-00p
6C5	40p	12R8GT	45p	1822	£1-00p
6J5GT	25p	12Q7GT	30p	2611	55p
6J6	20p	12B6T	35p	5983	£1-15p
6J7G	35p	1487	75p	6087	50p
6J7M	40p	19A45	40p	6080	50p
6K7	25p	19C8	£4-55p	6084	45p
6K7G	25p	19G6	£1-50p	6085	45p
6K7GT	25p	19H4	£5-00p	6086	£1-37p
6K8	25p	20P4	£1-00p	6140	£1-50p
6K8T	45p	21A6GT	40p	8029	£2-25p
6K8GT	45p	30C12	75p	8031	25p
6K9	25p	30C17	80p	9002	50p
6K9GT	45p	30F5	84p	9003	15p
6L6	37p	30FL1	70p	9006	15p
6L6GT	37p	30PFL12	92p	U.R. Tubes	
6R7	35p	30PFL13	50p	VCR7	£4-50p
6R7GT	35p	30PFL14	75p	VCR7	£4-50p
6R8	35p	30L15	65p	VCR7	£4-50p
6R8GT	35p	30L17	80p	VCR7	£4-50p
6R9	35p	30P12	80p	VCR7	£4-50p
6R9GT	35p	30P19	30p	VCR7	£4-50p
6V6	35p	30PFL1	70p	5FP7	£1-20p
6V6GT	35p	30PFL13	92p	8B1	£0-00p
6X4	27p	30PFL14	75p	8B1	£0-00p
6X5	45p	30PFL15	85p	8B1	£0-00p
6X5GT	45p	30PFL16	85p	8B1	£0-00p
6X6	30p	30PFL17	85p	8B1	£0-00p
6X6GT	30p	30PFL18	85p	8B1	£0-00p
6X7	30p	30PFL19	85p	8B1	£0-00p
6X7GT	30p	30PFL20	85p	8B1	£0-00p
6X8	30p	30PFL21	85p	8B1	£0-00p
6X8GT	30p	30PFL22	85p	8B1	£0-00p
6X9	30p	30PFL23	85p	8B1	£0-00p
6X9GT	30p	30PFL24	85p	8B1	£0-00p
6Y4	30p	30PFL25	85p	8B1	£0-00p
6Y4GT	30p	30PFL26	85p	8B1	£0-00p
6Y5	30p	30PFL27	85p	8B1	£0-00p
6Y5GT	30p	30PFL28	85p	8B1	£0-00p
6Y6	30p	30PFL29	85p	8B1	£0-00p
6Y6GT	30p	30PFL30	85p	8B1	£0-00p



AF/RF Mini-probe

If an amplifier or receiver does not operate, the quickest way to localise the fault is generally by making stage-by-stage checks, working backwards from the output stage. This rapidly shows that part of the circuit where the fault lies.

The pocket sized mini-probe generator described here is suitable for this purpose, is completely self-contained and only $3\frac{1}{4} \times 2\frac{1}{8} \times 1\frac{5}{8}$ in. in size. An integral prod provides the following outputs:

- (1) Audio to test a.f. stages.
- (2) Modulated r.f. over about 380-550kHz for testing i.f. stages.
- (3) Modulated r.f. over about 550-1500kHz, to test mixer and r.f. circuits.

No long wave band coverage (except to 380kHz) is provided, because if a receiver is working on m.w. but not on l.w., investigation will in any case be confined to those parts of the circuit in use on l.w. only; l.w. aerial winding, switching, l.w. oscillator coil and padder, and any other item in this part of the circuit.

Circuit

This is shown in Fig. 1; the MPF102 is the r.f. oscillator Tr1, and with S1 open VC1 tunes L1 over the range of about 550-1500kHz, or the usual medium wave band. With S1 closed, C2 is in parallel with VC1, and the range is about 380-550kHz, to include the band around 455-470kHz required for i.f. tests in receivers. Output is via the isolating capacitor C6, to the r.f. output socket.

The OC71 is an audio oscillator Tr2, giving a.f. output via C7 to the a.f. output socket, and also modulating the r.f. oscillator. A test prod or probe is inserted in socket r.f. or a.f., to suit the part of the circuit under test.

Construction

The case is made from $\frac{1}{8}$ in. thick Perspex. The two ends are $1\frac{7}{8} \times 1\frac{3}{8}$ in. and the sides are $3\frac{1}{4} \times 1\frac{5}{8}$ in.

while the top and bottom are $3\frac{1}{4} \times 2\frac{1}{8}$ in. The pieces form a box having external dimensions of $3\frac{1}{4} \times 2\frac{1}{8} \times 1\frac{5}{8}$ in.

The pieces should be cut accurately. One $3\frac{1}{4} \times 2\frac{1}{8}$ in. piece is put aside and the other pieces cemented together to form the case. Joints may be smoothed with a small file when the cement or solvent is hard.

Capacitor VC1 and the two switches are screwed to the top of the case. L1, the sockets for the probe, and an optional 6BA earthing terminal, are fitted to one end. Most of the circuit is assembled on an insulated panel. The back is finally secured in place with two screws.

It is helpful to use transparent material, because

F. G. RAYER

connections can more easily be seen when wiring the equipment. If the material used is not $\frac{1}{8}$ in. thick, dimensions of some of the pieces will have to be changed to allow for this.

The small variable capacitor listed VC1 actually has two sections, one of 78pF and the other 192pF. These are wired in parallel to give 270pF. Any 300pF or similar capacitor would be suitable provided it is small enough to fit in the case.

L1 is a medium wave coil as used for valve equipment. If a different coil is fitted, it might be necessary to try reversing connections to 8 and 9, Fig. 1, to secure oscillation, or even to change the number of turns on this winding.

T1 is a small a.f. driver transformer, and connections shown are for the one listed. It is likely that other transformers might function, but it might be necessary to reverse connections to one winding, or to modify component values.

Should other transistors be to hand, any tried need to be of similar general type to those shown.

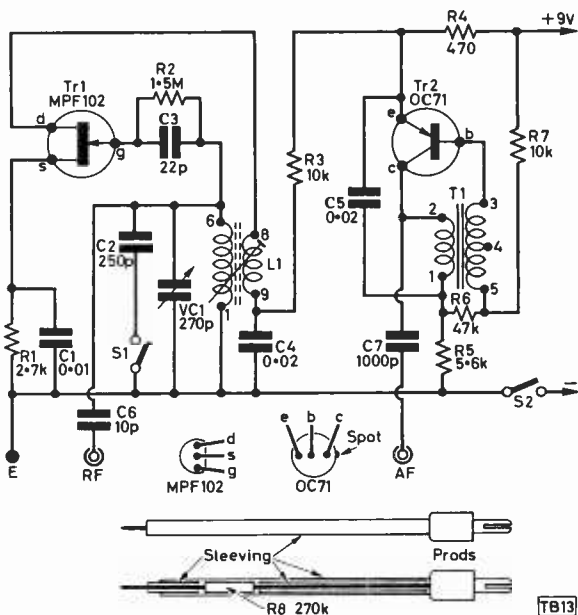


Fig. 1 : Complete circuit of Mini-probe with details of prods.

T813

It would be wise to hook them temporarily into circuit, to see if they are suitable, before assembling in the small case.

Assembly

Fig. 2 is the layout of the mini-probe. The switches and VC1 are held with small countersunk bolts. Holes are drilled for L1, "earth" terminal E, and sockets, and L1 and the r.f. socket are inserted.

It is then possible to wire up this portion of the equipment, using sleeving on all leads. Leave projecting wires which will pass up to R2 and C3, the drain "d" of the f.e.t., negative line, and from R3.

The a.f. oscillator and other parts of the circuit are assembled on a piece of $\frac{1}{16}$ in. Perspex just under $3 \times 1\frac{7}{8}$ in. with a cut-out 2×1 in. to take the PP3 battery. Transparent material here also makes it easier to see where leads run.

Holes for leads are made with a $\frac{1}{16}$ in. drill. There is a reasonable amount of free space for components. Connections are of 26s.w.g. tinned-copper wire, in 1mm sleeving.

A holder is fixed with adhesive for the MPF102 which is not inserted until wiring is completed.

When the small panel is wired, lower it into position, allowing the projecting wires mentioned to pass up through holes. Cut and solder these leads in place.

The a.f. output socket can then be put in, and wired to C7. The "E" terminal is also fitted and connected. A piece of stout card about 2×1 in. is cut to place over the back of VC1, where the battery rests.

Battery leads are short pieces of thin flex, and the insulated top of an old battery can be used as a

★ components list

Resistors:

R1	2-7k Ω	R5	5-6k Ω
R2	1-5M Ω	R6	47k Ω
R3	10k Ω	R7	10k Ω
R4	470 Ω	R8	270k Ω

All 10% \pm W

Capacitors:

C1	0-01 μ F	C5	0-02 μ F
C2	250pF S.M.	C6	10pF
C3	22pF S.M.	C7	1000pF
C4	0-02 μ F		

All disc or miniature types

VC1 192-78pF (Jackson SD2)

Semiconductors:

Tr1 MPF 102 Tr2 OC71

Miscellaneous:

L1, Range 2 (Yellow) Denco valve type coil.
T1, audio transformer, (Home Radio TR64).
Slide switches, miniature (2). Transistor socket, 3-lead for Tr1. Knob, sockets (2).

battery connector. Be sure to follow the polarity shown on the battery which will be in use, not taking polarity from the old battery fasteners (which will now be reversed).

Testing

Close S2 and temporarily connect phones from the a.f. socket to "E", or make a connection from the a.f. socket to an a.f. amplifier. An audio tone should be heard. If not, check connections etc. in the OC71 part of the circuit.

Open S1 and place the mini-probe near a receiver, which is tuned to find the signal. If none is heard, check the r.f. part of the circuit. When the signal is heard, rotate the core of L1, meanwhile keeping the signal tuned in on the receiver. Continue until the lowest possible frequency is reached (core fully in L1) and lock the core with a 6BA nut. The variable capacitor listed has trimmers, and these are half unscrewed.

Notes

Two pieces of $\frac{1}{4}$ in. thick Perspex about $1\frac{1}{2} \times 3\frac{3}{8}$ in. are tapped for 6BA screws and screwed inside the case, as in Fig. 2. These hold the wired panel in place. The back is attached by running 6BA countersunk screws through it into the tapped holes, or self-tapping screws could be used.

One of the prods is a length of 14s.w.g. wire soldered to a plug which can be inserted in either socket, for maximum a.f. or r.f. output, as required. Sleeving is put over the stout wire, Fig. 1. The second consists of the attenuator resistor R8, enclosed in sleeving. This prod is used when a reduced output is wanted.

Either prod is placed in the required socket, and the mini-probe is held in the hand, so that the prod point can be touched on appropriate circuit points. For many tests, the earth return (E) connection is not necessary.

Where the output proves too great, the attenuator

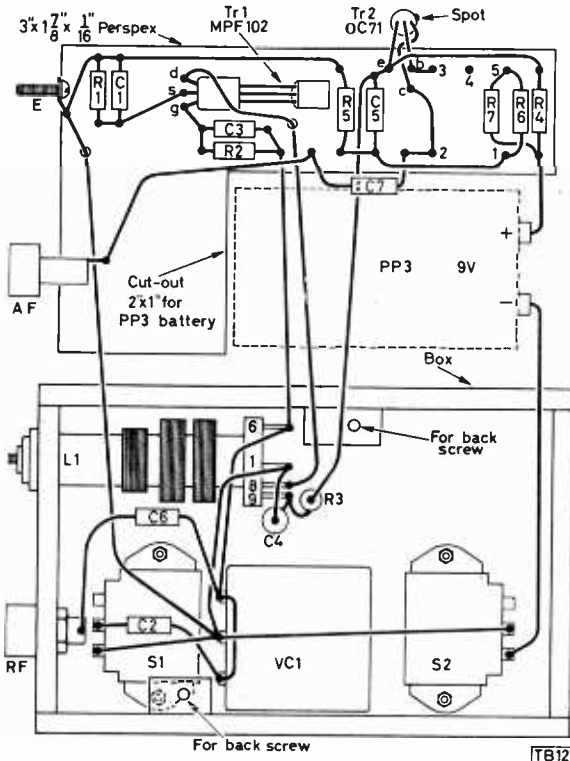


Fig. 2 : Constructional details. The upper component panel fits into the main box, below.

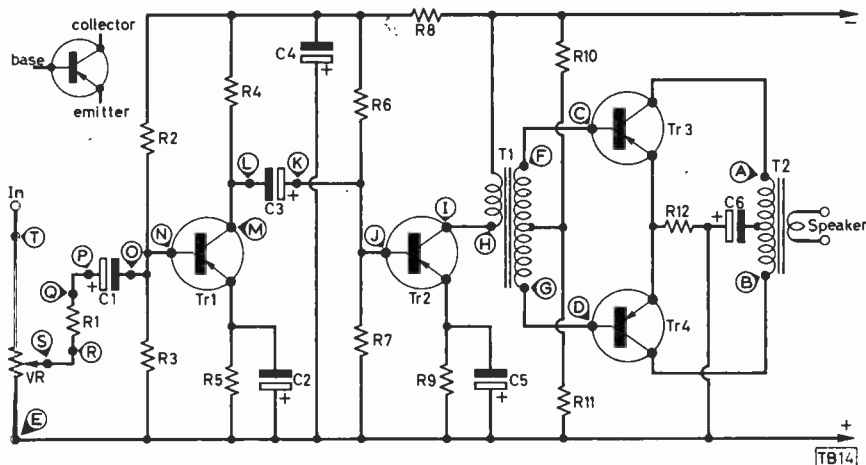
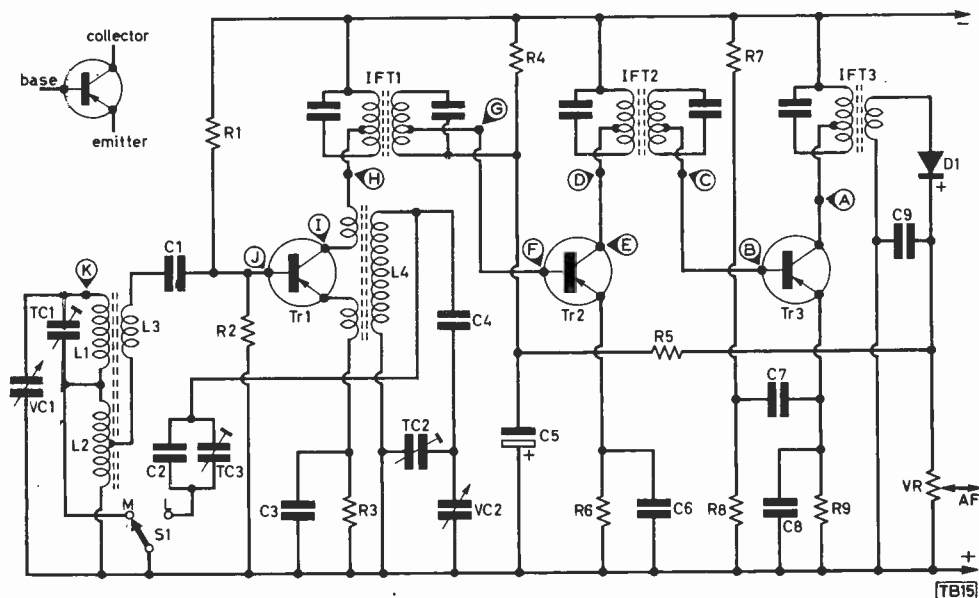


Fig. 3: (above) Circuit of a typical audio amplifier. A connection should be shown between the negative side of C6 and the negative supply line. Fig. 4: (below) shows the r.f. and i.f. stages which would precede the audio amplifier.



probe may be inserted. In some i.f. and r.f. tests, it is sufficient to place the tip of the probe near an insulated lead in the receiver.

Constructors who are not familiar with this method of circuit testing will probably find the details which follow helpful.

AF tests

Fig. 3 is the circuit of a typical a.f. amplifier, or the a.f. section of a receiver. These tests work backwards from the loudspeaker, and the generator tone ceases to be heard when the faulty item or stage is introduced. Checks made could be as below:

(1) Generator a.f. prod to A, and generator E to B. If no tone is heard, T2, speaker, or connections to it are defective.

(2) Generator E to circuit E, AF prod to C or D. If no tone is heard, Tr3 and Tr4 are not working. Suspect R12 and transistors.

(3) Prod to F or G. If signal ceases, there may

be a break between F-C or G-D. Look for defective joints or cracked foil of circuit board.

(4) Prod to H. If no tone is reproduced, T1 is suspect.

(5) Prod to I. If no tone, conductor from I-H is suspect.

(6) Prod to J. If no tone is heard, suspect Tr2, R9.

(7) Prod at K. If tone ceases, conductor K-J is defective.

(8) Prod at L. If tone ceases, C3 is suspect.

In the same way, proceed to M, N, O, P, Q, R, S and T. When the tone heard in the speaker ceases, the last item—foil conductor, capacitor or stage—introduced is at fault, so is checked in detail.

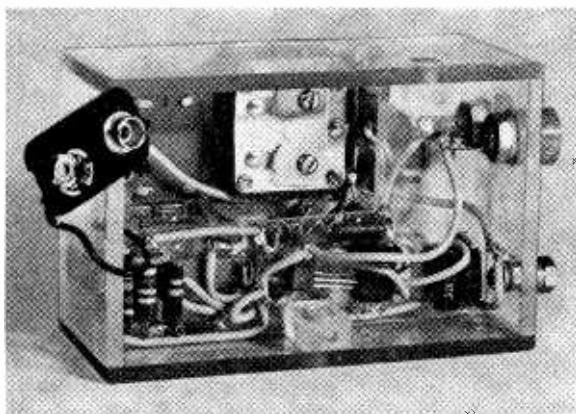
When introducing an extra transistor, such as moving the prod from I to J, or from M to N, the additional amplification should increase the volume. Except for tests where there is little amplification (as for the output stage) the earth lead can be omitted, the mini-probe simply being held to bring the prod on to the required circuit point.

With circuits giving a lot of amplification, and having no volume control, remove the ordinary prod and put in the attenuator prod if volume is too great. Always keep loudspeakers within reasonable limits to avoid overloading output or other stages.

IF tests

Assuming a.f. tests have been made up to the volume control VR in Fig. 3, thus proving the a.f. section is working, place the prod in the r.f. output socket of the mini-probe. Touch the prod on A, Fig. 4, and tune the mini-probe to the receiver i.f., as indicated by the tone in the loudspeaker. If no tone is obtainable, suspect i.f.t.3, D1 and connections to these items as well as C9.

If a tone is heard, proceed to B, C, D, E, and so on, in the manner explained earlier. When signals cease, the defect is in that part of the circuit just introduced. For example, if the tone is heard with the prod on F, but not on G, the conductor from G-F is suspected. But if heard at G, but not with the prod at H, i.f.t.1 is defective.



A view of the finished Mini-probe, with the PP3 battery removed. The components in the foreground are mounted on the perspex sub-panel

These tests continue to I and J. If signals are heard with the signal at intermediate frequency injected at J, then the whole i.f. amplifier is working. When proceeding from B to F, and on to J, considerable amplification should become apparent, and it may suffice merely to put the prod point near the insulation of the leads or components in question. Otherwise use the attenuator prod.

Mixer tests

Assuming the circuit has been proved to work up to point J as explained, set S1 for m.w. reception, put the prod on K, and tune the mini-probe and receiver to the same frequency, trying to hear the tone. If it is heard, and the receiver is newly built, the only fault may be wrong adjustment of L1 on the ferrite rod, or the core of L4, or trimmers TC1 or TC2. If so, try to align in the usual way. Should no tone be heard, try adjusting the core of L4 and position of L1 on the ferrite rod. If this has no result, it is probably easiest to check L1, L3, L4 and other windings with a meter, for open circuit.

When m.w. reception has been obtained but l.w. results are not achieved, the fault must lie in those

items which are in use on l.w. only. That is, L2, TC3 and C2, in Fig. 4, including connections to S1, or in the adjustment of these items.

To some extent the faults to look for depend on the individual situation. As example, in a newly-built receiver which has never worked, a lead may be omitted. But where an existing receiver has failed, the fault is in a component, joint, foil conductor, or other item which has deteriorated.

In general, such tests take only a very short time indeed. Systematic tests and examination to locate the exact cause are then localised to a few components or connections.

Calibration

It is useful to have a card scale on the mini-probe, marked in frequencies. For the higher frequency range, place the mini-probe near a receiver. Tune the latter to various frequencies, adjust the mini-probe to the same frequency, and mark its scale.

For the lower frequency range, the extreme h.f. and l.f. markings can be found from the l.f. end of the m.w. band of the receiver, and the h.f. end of the l.w. band. Then tune the mini-probe to a known frequency, such as 400kHz, and the receiver to twice this; that is 800kHz. Move mini-probe and receiver tuning together, to 900kHz on the receiver, which is 450kHz on the mini-probe.

In the same way, 500kHz and other markings can be found, by having the receiver tuned to the second harmonic, or twice the mini-probe frequency.

The scales are really intended as signal-generator markings for receiver calibration, but are useful when checking r.f. stages.

CQ! CQ! CQ! CQ! CQ! CQ! CQ!

ISSUES WANTED

- ...September 1969 to December 1969 issues of P.W. and the February 1968, May 1969 and September to December 1968 issues of P.E. I will consider any offer.—K. Senthil-Lohath, 105 Graham Road, London, S.W.19.
- ...the back issues of P.E. for July, August and September 1968.—S. Lumb, 4 Rydall Street, Holbeck Leeds, LS11.9LF.
- ...the issues of P.W. containing plans for a videophone which could be connected to the speaker leads and operated lights according to the frequency of the sound.—T. Cousins, 82 Bentley Lane, Leeds 6
- ...Jan., March, June, Sept., Oct., Nov., and Dec. 1969 issues of "Television". Will purchase all of 1969 if possible.—S. V. Fisher, 146 Hilton Street, Springfields, Wolverhampton, WV10.0LF.
- ...Practical Wireless for March 1969 containing article on the F.M. Tuner part 2.—V.E.W. Stewart, 17 Levysdene, Guildford, Surrey.
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INFORMATION WANTED

- ...any gen at all on the Minilitter receiver MR44.—R. Perrow, G3ZZT, 17 Wearmouth Drive, Sunderland.
- ...information on adding an S-meter to R107 and using RF24B as a 15 metre converter.—N. Thornley, 58 Norman Road, Northampton NN3 2SG.
- ...circuit diagram for solid state a.m. and/or f.m. low power transmitter or information as to where to find one.—Denis Duggan, Nutley House, Glasheen Road, Cork, Ireland.
- ...any information on Govt. surplus crystal tester, monitor, crystal type 2 ref. number 10T/11390, serial No. 28421.—J. Nonesley, 16 Surrey Street, Latchford, Warrington, Lancs.
- ...circuit details on ex-W.D. mine detector Mk. 4 or issues of magazine in which information appeared.—B. R. Ward, 21 Nursery Road, Hoddesdon, Herts.
- ...circuit diagram of Geloe 2-metre converter using ECC88. The i.f. is part No. 2713 and I would like to know the frequencies of it. The variable capacitor is numbered 5812 and the chassis 5810.—Bernard Panneton, 1018 Jean Bochard, Boucherville P.Q., Canada.
- ...a service sheet or a Bestone tape recorder advertised by Hamillon Radio. I cannot find model number marked, but valves are EZ80, ECC83, EL84, DM70.—A. J. Greenfield, 114 Eton Road, Burton Upon Trent, Staffordshire.
- ...service sheets or other information on v.h.f. receiver type 715 made by BCC of Wembley and Juliette receiver NA 5018A.—D. S. Marshall, 6 Glyn-y-Mor, Llanbedrog, Caernarvonshire, N. Wales.
- ...data on the 3BP1 scope tube. I am designing a scope/Rx or i.f. amp. using the Rx/ind APN 9 chassis, etc.—K. Apps, 42 Egremont Road, Exmouth, Devon.
- ...any gen on mods to the R107 receiver.—C. J. Bigger, Chapman House, Oakham School, Oakham, Rutland.
- ...details of and the manufacturer of r.f. and i.f. modules for general coverage receiver construction.—I. J. Carruthers, 114 Lingmoor Way, Carlisle, CA1 3LL.
- ...any information on Dumont 2507 A5 c.r.f.—L. A. Badenhorst, c/o 18 Unvoti Street, Stillfontein, Transvaal, Republic of South Africa.
- ...service sheet for a Bush transistor serial number 918/00434 v.h.f. medium, long and bandspread waves.—T. Kelly, 59 Glentow Road, Whitthall, Dublin.
- ...blueprint for the Strand amplifier.—N. Hodgson, 84 Lansbury Drive, Hayes, Middx.
- ...any information on where I may be able to obtain a replacement speed-change pulley wheel for Balfour Princess tape recorder.—W. R. Kennon, 14 Newbold Avenue, Chesterfield, Derbyshire.
- ...wiring circuit for a Powerflash Electronic Timing Light and anyone who can supply the parts.—Ian Kelton, 40 Craigpark Drive, Glasgow, E.1, Scotland.



IN NEXT MONTH'S

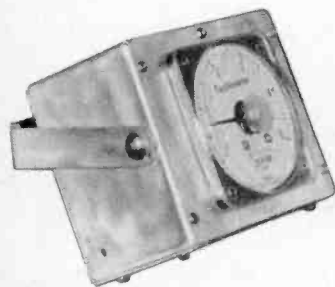
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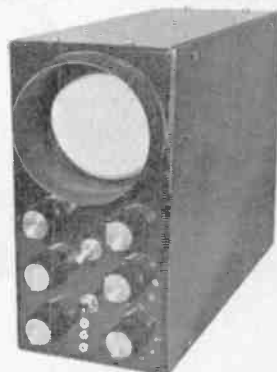


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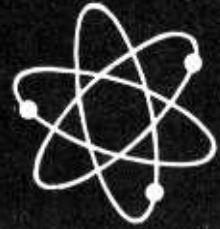
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CASCODE AMPLIFIERS

IAN WILSON

THE units to be described are versatile and adaptable amplifiers suitable for use as pre-amplifiers, high-gain oscilloscope amplifiers or an add-on "front end" for t.r.f. receivers.

Basics

The skeleton circuit diagram of a cascode amplifier is shown in Fig. 1. A cascode amplifier is basically a grounded-cathode triode amplifier directly coupled to a grounded-grid triode amplifier. The basic advantages of a cascode are that the circuit has a gain

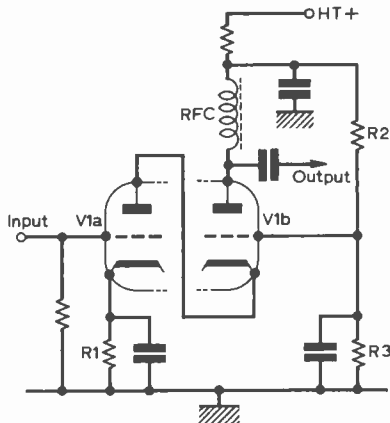


Fig. 1. Basic cascode amplifier circuit.

comparable with that of a pentode, but with very low noise characteristics, and a wide frequency range; the circuit is simple to set up and operate.

The basic circuit of Fig. 1 works as follows. A signal is fed into the grid of V1a acting as a grounded-cathode amplifier with the necessary bias being developed across R1. The output from V1a appears across V1b which acts as an anode load. The amplified signal appears at the anode of V1b, which acts as a grounded-grid amplifier giving a current gain of less than unity but considerable voltage gain. The grid of V1b is raised above earth by the potential divider R2, R3, as V1b cathode is approximately 50 volts above chassis. In operation, V1b grid is slightly negative with respect to the cathode.

There are several points which make it essential for the valve employed to be specially designed for cascode operation. It must have a high heater-cathode voltage rating, a very low noise value and it must not be microphonic. Suitable valves are (for 6.3v operation) ECC84, ECC88 and ECC189.

It is possible to run a PCC84 on slightly reduced

heater voltage (its rated V_h is 7V) but this is not recommended as it may affect the characteristics. It should be possible to find a suitable small heater transformer which will, slightly over-run, provide the necessary voltage. Current drain is 0.3A with PCC84, 0.36A with the 6.3V valves.

Practical Circuits

Two modifications of the basic circuit will be described.

Aperiodic RF Amplifier. In Fig. 2, the output load of V1b is a radio-frequency choke. The output is fed via C5 to the tuned grid of the first stage of the t.r.f. receiver. Any signal appearing on V1a grid will be amplified and appear across the r.f.c. The amplifier acts as an excellent isolating unit to prevent the possible low impedance of an aerial being reflected across the tuned circuit, which may be the only means of increasing the selectivity.

Reaction in the receiver may be controlled very critically so that maximum Q is obtained. The unit takes a current of 13 mA at a voltage of 260. Circuit values are for an ECC84 valve.

The unit may be constructed on any convenient small chassis, or built into an existing receiver. Layout is not very critical for low frequency operation, but it is advisable to screen the leads to V1b from the input leads, and the reaction section of the

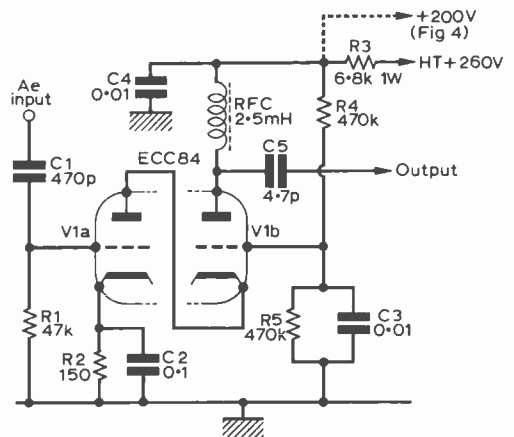


Fig. 2. Untuned cascode amplifier.

receiver. This simple addition to an existing "stand-by" set will do much to improve the defects inherent in a simple design.

Tuned RF Amplifier. This version of the basic unit is a high-gain tuned amplifier with provision for gain

control and a.g.c. connection, Fig. 3. The advantages of this amplifier are utilised to the full in this version of the design. The noise factor of the first stage in a multi-stage receiver has a great bearing on the noise generated in the receiver. Frequency changers often have a very high noise value, so any low-noise amplification before this stage represents a significant improvement in performance.

The circuit is basically as before but the input is tuned (this function can be incorporated in the design of the receiver, or the pre-amplifier may be separately tuned) improving receiver selectivity.

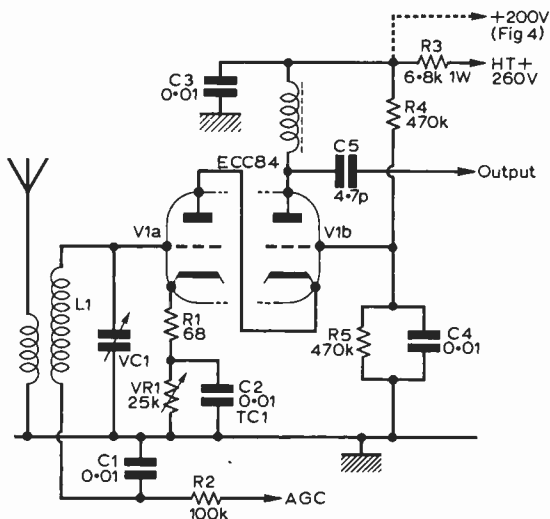


Fig. 3: Tuned RF amplifier with a.g.c. and gain control.

The gain control is VR1, which controls the grid bias on V1a and hence the mutual conductance of the valve. Once again, the output is taken direct to the "hot" end of the first tuned circuit, which may need some slight re-trimming as a result.

If it is not desired to have a.g.c., the lower end of L1 is earthed, and C1 and R2 are unnecessary. Once again, the current drain is 13mA at 260V.

Power Supplies

If the amplifier is required to be a self-contained unit, some form of h.t. and l.t. supply is needed. A simple power supply is shown in Fig. 4. Alternatively, the amplifier may take its power from the main receiver. If this has a live chassis, great care should

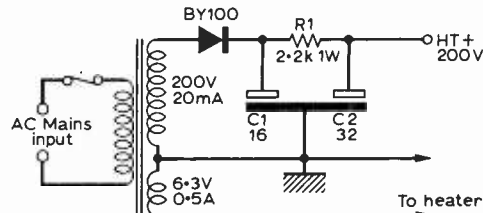


Fig. 4: Suitable simple power supply for cascode amplifier.

be taken to ensure that no accessible parts are alive on the amplifier. If a separate supply is used, the two chassis must **NOT** be connected together: an isolating capacitor of 0.1µF at 350V must be interposed. In this case, the a.g.c. will be in operative, since no d.c. connection exists between the two. ■

PHILIPS DNL

The Dynamic Noise Limiter is a phase-compensated active noise suppression circuit which can be used with cassette recorders and cassette players without affecting their compatibility. It can also be used with a record player or a tape recorder when used in conjunction with a separate amplifier. DNL has been developed by the Dutch laboratories of Philips who have designed a circuit which

is effective only during replay for the prime reason that the circuit should benefit all users of Compact Cassettes.

The operation of the DNL is one of a steep low-pass filter operating in the absence of high signal frequencies. It is tripped by high frequencies in such a way that high frequency signals above a certain level will by-pass the filter action.

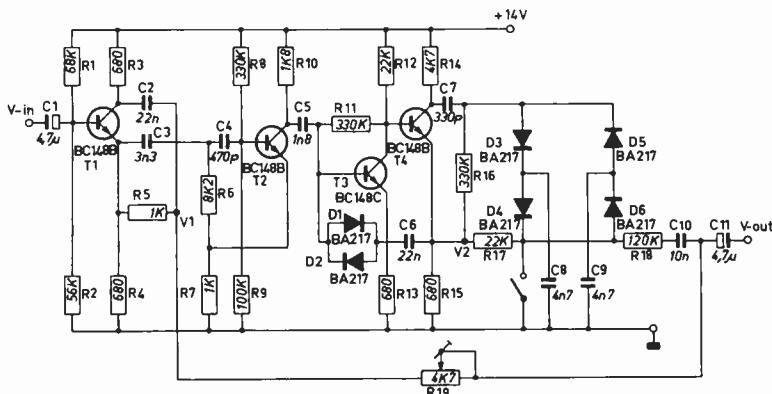
The DNL splits the input signal into two—both parts are identical and contain low, middle, and high frequencies as well as the tape hiss. One goes into the "all-pass

filter" which changes the signal into opposite phase without influencing the character of the sound. The other goes through a filter that eliminates the lower and middle frequencies of the signal. Only the high frequencies above 4kHz are allowed to pass through. These frequencies are processed so that when the passage of music becomes softer the higher frequencies and the noise are made stronger. Since the two signals are now in opposite phase the "processed" high frequencies cancel out the "unprocessed" frequencies of the signal that went through the "all-pass filter."

The two signals in the two channels are then put together to form one output signal.

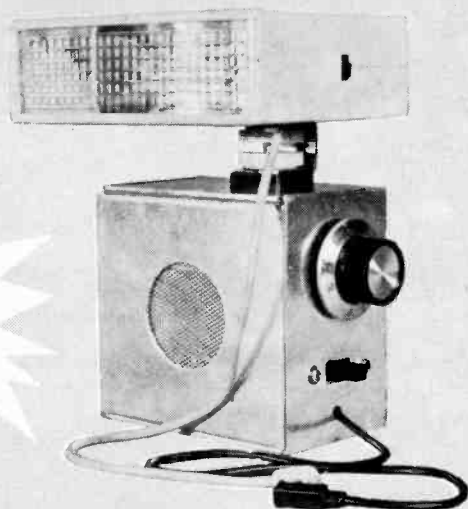
Unweighted measurements show that the DNL provides a ratio improvement of more than 10dB at 6kHz and 20db at 10kHz.

Philips say that the DNL will be available as an accessory suitable for all existing cassette recorders early in 1972 and priced at £7.80. In late 1972, Philips will also make available a stereo cassette recorder and deck with a switchable DNL facility built-in as part of the unit.



SOUND TRIGGERED FLASH

W. LANGLEY



MANY readers will have an interest in photography as well as in electronics and the device described here will enable some interesting and unusual shots to be taken. The total cost of building the sound triggered flash unit described here is not high and money will not be wasted even if only a few shots are attempted. Note that this device is only suitable for electronic flash guns and although it should be possible to arrange for the SCR to apply a voltage to a flash bulb, this has not been tried.

Those who have commented on the unit have suggested that it could have applications as a burglar alarm; the sensitivity can be set to such a level that a flash will be produced by the noise made by a burglar. This should certainly be a strong deterrent and it has few of the disadvantages of the conventional type of bell-type burglar alarm since accidental triggering will not be so objectionable or so serious. If this is attempted a mains power supply giving 9V d.c. will be needed for the trigger unit as the batteries will not last all that long under continuous operation.

The sensitivity of the unit is variable over a considerable range, a feature very necessary for a device of this type.

THE CIRCUIT

The complete circuit is shown in Fig. 1 and is basically a d.c. coupled amplifier. Instead of a conventional microphone, a small high impedance loudspeaker is used in reverse as the transducer. This is very sensitive and rather cheaper than a microphone. However, this has to be coupled to a low impedance input to provide a decent match and so this is connected to the emitter of a common-base transistor configuration. The typical input impedance of such a stage is about 50Ω and so a good match is achieved; there is also high voltage gain in such a stage.

R1 acts as the collector load and the signal is applied directly to the base of TR2 which is arranged as a conventional common-emitter amplifier. Base

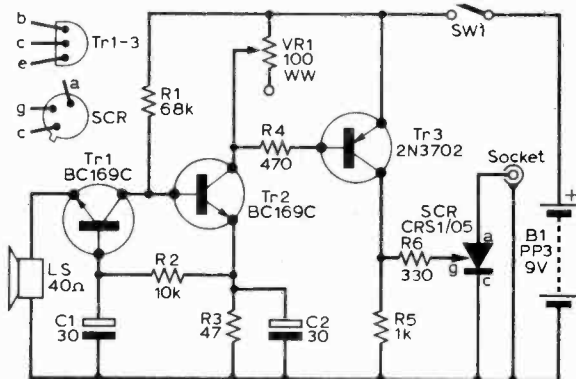


Fig. 1 The circuit of the flash trigger unit. VR1 acts as the sensitivity control.

★ components list

Resistors

R1 68k Ω R4 470 Ω
R2 10k Ω R5 1k Ω
R3 47 Ω R6 330 Ω
All $\frac{1}{4}$ or $\frac{1}{2}$ W, 5 or 10% types.
VR1 100 Ω linear, wirewound pot.

Capacitors

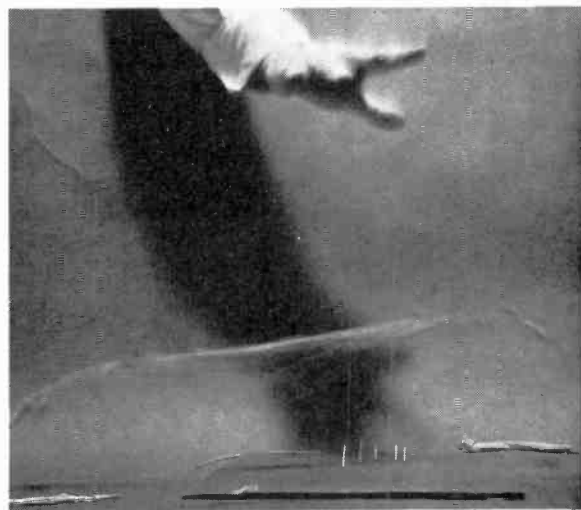
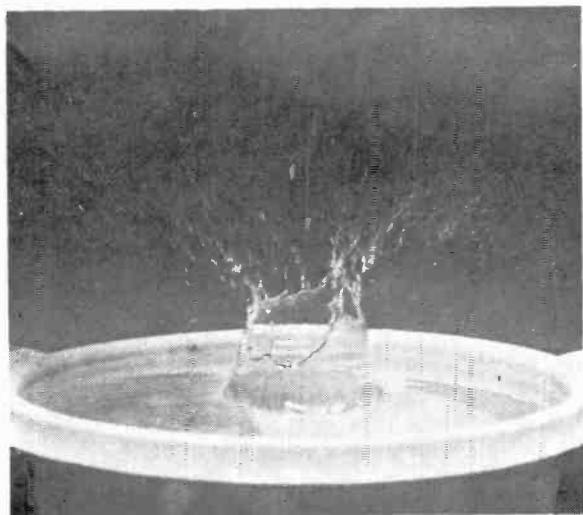
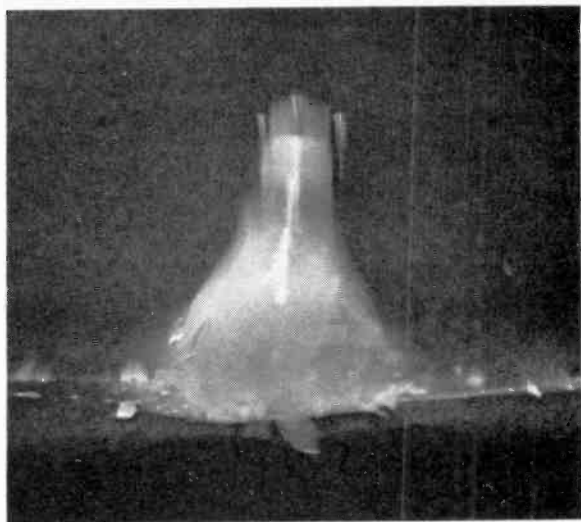
C1 30 μ F 10V C2 30 μ F 10V

Semiconductors

Tr1 BC169C Tr3 2N3702
Tr2 BC169C SCR CRS1/05

Miscellaneous

Loudspeaker, 25-80 Ω miniature type; on-off slide switch; battery, 9V PP3; chassis to sizes shown; 3mm co-ax socket—see text; accessory shoe; Veroboard—see text.



Some experimental photographs taken using the prototype which illustrate the action. Top left shows a champagne cork leaving the bottle, the "pop" triggering the flash. Top right shows a light bulb at the instant of shattering. Bottom left is the splash made when a ball is dropped into water while next to this is a balloon in the process of bursting; the pins onto which the balloon was dropped can be seen clearly. The pieces of rubber shown are from previous shots. The rubber from the bursting balloon is still in a stretched shape (the balloon was a 'sausage' type).

bias for Tr1 is taken from the emitter of Tr2 via R2. C1 stabilises the base voltage of Tr1 and C2 decouples R3, so preventing negative feedback from reducing the gain. By arranging the base bias for the first transistor in this way, d.c. stabilisation is achieved.

The collector load of Tr2 is VR1, a 100Ω wirewound potentiometer; by varying this the bias level for the third transistor is controlled and this affects the sensitivity. If the value of VR1 is very low, Tr3 will only conduct when relatively high currents pass through it. If VR1 is set to such a level that Tr3 is nearly conducting, the slightest increase in current will switch it on.

R4, with VR1, forms a potential divider applying the bias to Tr3. The collector load of Tr3 is R5 and it is the voltages developed across this that control the operation of the circuit.

The potential at the collector of Tr3 is applied to the gate of the SCR via R6.

With VR1 set at the correct position, Tr3 will only

conduct sufficiently on high peaks of sound and in some ways it is acting as a limiter.

The switch contacts of the flash gun must be wired the correct way around across the SCR. If there is any doubt about which is positive (which connects to the anode) this can be measured using the volts range of a multimeter.

With insufficient potential applied to the gate of the SCR, this has a very high resistance but this falls to practically nothing as soon as the potential on the gate reaches the necessary level.

When a sound wave of the required level strikes the cone of the loudspeaker, a small potential is developed in the speech coil causing Tr1 to conduct more which in turn causes Tr2 to pass more current, increasing the potential across VR1. As VR1 forms part of the base-emitter circuit of Tr3, as soon as the potential in that circuit exceeds about 0.6V (silicon transistors are used here), Tr3 conducts causing the voltage at the junction of R5 and R6 to rise to or above the critical level and the SCR is

switched on.

One of the characteristics of the SCR is that it remains on even if the gate triggering voltage is removed and it can only revert to its high resistance state when the potential across the anode and cathode (marked a and c in Fig. 1) is removed. The potential is removed when the flash occurs and so the SCR automatically reverts to its non-conducting state.

The 9V supply is provided by a small PP3 battery which is quite sufficient to operate the trigger unit.

CONSTRUCTION

The majority of the components can be mounted on a small piece of Veroboard, 0.15in. matrix, 12 x 8 holes, the copper conductor strips running across the short way. Clearance is provided at one end to allow for the fitting of an aluminium angle bracket which holds the component board inside the chassis. Only one break in the conductor strip is necessary, this being underneath R6. The layout is shown in Fig. 2.

Five connections are needed to the component board. One is provided by a short wire fitted with a solder tag which connects to the negative strip. This solder tag fits under the mounting screw and this provides the negative supply line. There are four other connections and Veropins can be inserted to provide these. Two of these go to VR1, one to the loudspeaker and the fourth directly to the flash gun socket.

The circuit can be built into a small aluminium chassis fitted with a drop in lid. The size is not of course critical, though the dimensions shown in Fig. 3 are about right. The loudspeaker is mounted on the lid and the whole lot glued using Araldite or some similar adhesive. The siting of the on-off switch and VR1 can be seen from the drawings and the photographs. A solder tag should be fitted to the chassis to provide the common negative point; this is best fitted on the screw holding the battery clamp which can be cut out from some scrap aluminium of thin gauge.

The top of the chassis can be fitted with a photographic accessory clamp; these are available from several photographic suppliers. They are provided with very small screws without nuts and the simplest

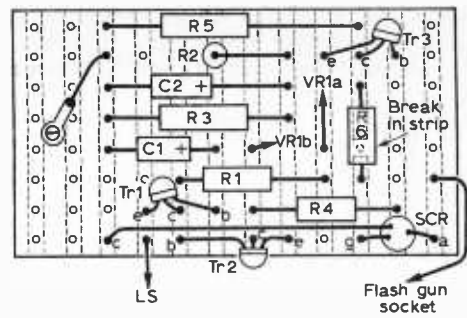


Fig. 2 : The component layout on Veroboard. The long cathode lead of the SCR should be sleeved. The solder tag screw also fits through the mounting bracket.

way of fitting this is to drill two very small holes and self-tap the screws into these.

3mm. co-ax sockets which are used for flash fittings seem hard to buy; if these are available or can be purchased one could be fitted to the chassis as the output socket. The author used an extension lead fitted with both male and female sockets. One end was cut off and the loose wires soldered inside the chassis. The connector then runs out through a hole, providing a longish lead to which to connect the flash gun lead. This can be seen from the photograph.

A calibrated knob should be used for VR1. Note

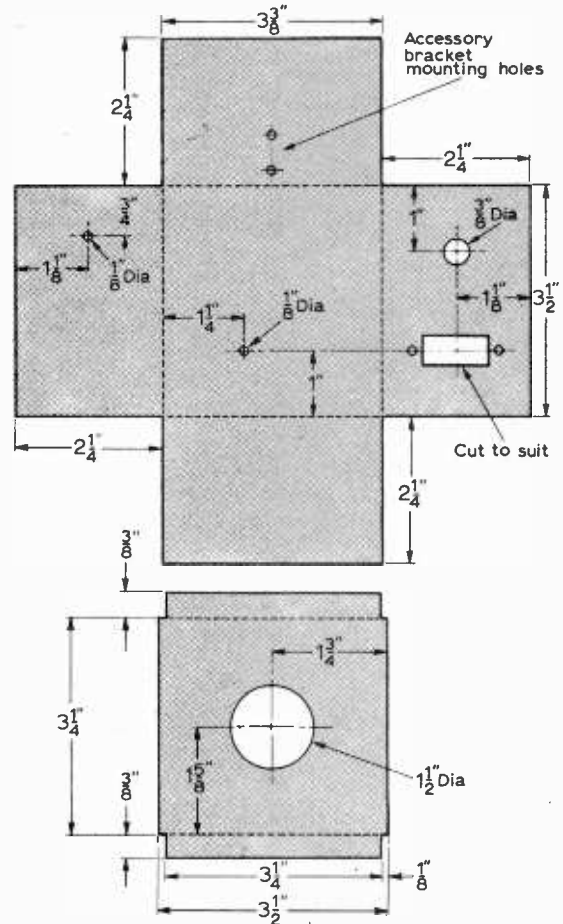
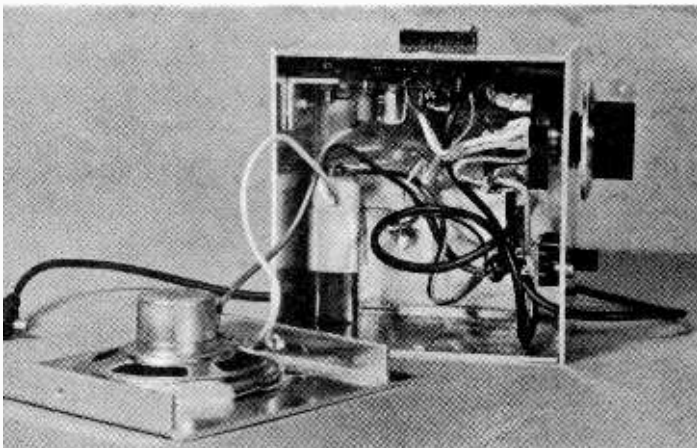
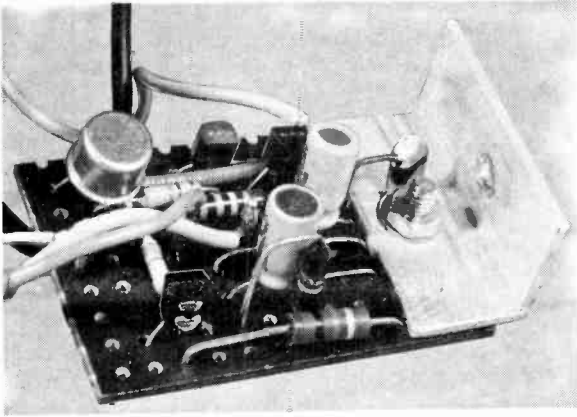


Fig. 3 : The metalwork details. The cut-out for the on-off slide switch should be made to suit.



A view of the prototype with the front panel removed. The component board can be seen edge-on at the top.

that VR1 must be a wire wound type; the original use of a carbon track type was a failure and the positive action of a wire wound type is much preferable



The component board with the wires attached, compare this with Fig 2.

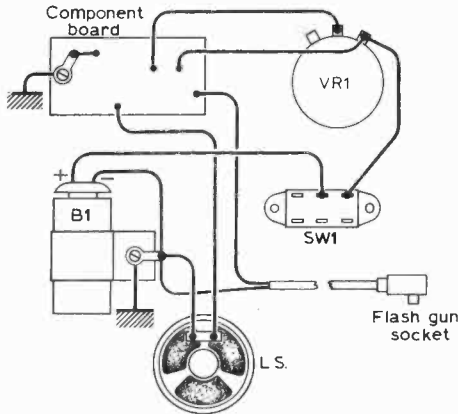


Fig. 4 : The wiring details.

The uses of such a device are many and varied. The action of operation is extremely rapid and the slight delay from the making of the sound to the actual flash is not electronic but solely due to the time taken for the sound waves to reach the unit. The closer the unit to the sound source, the less the delay.

Those who are experts in photography will not need any advise on how to use this device but for those with less expertise, operation should be as follows.

All subjects should be photographed in subdued light—the darker the better. The flash gun should be charged up and a dummy run made, if this is practical, this will ensure that the sensitivity control is correctly set. If a dummy run is not practical it should be possible to estimate the approximate loudness of the sound that will be produced and the hands can be clapped to provide a sound of roughly equal loudness. Normal movement and conversation are quite possible without any danger of the flash being accidentally triggered except on the most sensitive settings.

When all is ready the flash gun should be charged, the shutter of the camera opened, the sound made and the shutter closed. Obviously the shorter the shutter remains open the better.

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ROPING IN THE XYL

by
ROGER SCOTTO 9H1BZ

The author explains how to keep the XYL happy by making her feel at home in the shack.



Wireless Widows of the world unite!

IN these days when the emancipation of women is nearly complete, it is sad to reflect that many hams regard an XYL in the shack with horror. Indeed, many hams earnestly believe that an XYL's place is in the home and definitely not in the shack.

The "WW Club"

I too, unfortunately, used to share this out-dated and dim view until it came to my knowledge that my XYL, together with others, was planning to open a Wireless Widows' Club to rival our local Radio Club. She maintained that many War Widows have in the past formed War Widows Clubs up and down the country. So, she concluded with impeccable logic, why not a Wireless Widows Club . . . After all, she said, there is no difference between a Wireless Widow and a War Widow.

Hams who are keen on marriage statistics (not vital!) could ferret out information of XYL's who during the last twenty-five years or so have consulted their Marriage Guidance Counsellors and asked for assistance in dealing with this problem or, worse still, ended up in the Divorce Court, pleading unlimited cruelty.

"No, my husband does not booze with his pals late at night nor does he run about with other birds. Worse still, he shuts himself in his shack and does not come out till late at night. During lunch he has a far away look on his face and keeps murmuring strange numbers."

"What sort of numbers, Ma'am?" I imagine the Marriage Counsellor asking.

"Well, I think . . . 6146, 5763,

6062 . . ." replies the aggrieved XYL.

Brother, are you guilty of this abominable crime? Search well into your soul. Are you guilty or not guilty?

If you are, then the best thing to do is to try to mend things before tackling that AR88 or CR100. Your marriage depends on your action.

When I proposed to my XYL and told her I needed her, she was, like all daughters of Eve, glad I said so. However the full meaning of those words came to



. . . a far away look on his face.

me when I got to know about this Wireless Widows' Club business. So, resolving to end up my marital conflicts regarding my hobby, I put down on a piece of paper, why I needed my XYL in the shack.

1. XYL's are handy creatures to switch off the Big Switch in case of an accident or similar emergency. So, I took my XYL into my confidence and showed her

the why's and wherefores of the B.S.

2. When soldering, XYL's are indispensable things to hold the components while you apply solder with one hand and the soldering-gun with the other.

3. Having your XYL on your side would prevent rows about the "junk" around the house. To all uninitiated XYL's, all the marvels of a ham station are, in their untutored opinion, just plain junk which should be disposed of on the nearest available rubbish dump as soon as possible. So, with this elementary psychology deeply implanted into my mind, I approached my XYL very diplomatically (I had to take her out to her favourite boutique!) and explained the marvels of a QSO with an elusive DX station.

While on this point, remember to treat them intelligently and not, as some unimaginative ham wrote, that XYL's are crafty beings. I shudder to think what his XYL could have done to him had she typed his article.

4. When going downtown to buy some radio components, take the XYL. She should know where the best shops are so that in case you are held up at your office for overtime work, you could phone her to skip off to so and so's radio shop and get hold of those components for your project which you have just started.

Horror of horrors, I have personally come across some XYL's who did not know the physical difference between a resistor and a valve.

"How should I know? My husband never tells me," is an often quoted excuse. Alas, fellers, too true, too true!

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2N1302	19p	ACY40	17p	BFX29	31p
2N1303	19p	ACY41	16p	BFX84	25p
2N1304	26p	ACY44	31p	BFX85	32p
2N1305	26p	AD142	60p	BFX87	29p
2N1306	33p	AD149	58p	BFX88	26p
2N1307	33p	AD150	60p	BFY50	23p
2N1309	36p	AD161	33p	BFY51	20p
2N1613	23p	AF162	36p	BFY52	23p
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2N2218	34p	AF117	22p	BYX38-300	38p
2N2218A	44p	AF118	82p	BYX38-300R	38p
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2N2369A	19p	AF126	22p	EA403	10p
2N2483	35p	AF127	22p	EB383	10p
2N2484	42p	AF139	33p	EC401	18p
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2N2905	44p	ASY27	36p	NKT212	25p
2N2905A	47p	ASY28	27p	NKT213	25p
2N2924	20p	ASY29	36p	NKT214	23p
2N2925	22p	AU111	87p	NKT217	50p
2N2926	11p	B30C250	24p	NKT261	21p
2N3053	27p	BI912	66p	NKT271	18p
2N3054	60p	B5041	72p	NKT274	18p
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2N4058	13p	BC153	19p	OC41	42p
2N4059	10p	BC169	11p	OC44	42p
2N4060	11p	BC177	14p	OC70	21p
2N4061	11p	BC178	13p	OC71	38p
2N4062	13p	BC179	14p	OC75	40p
2N4128	27p	BC182L	11p	OC81	25p
2N4284	15p	BC183L	10p	OC81D	25p
2N4286	15p	BC184L	11p	OC83	12p
2N4289	15p	BC186	42p	OC84	25p
2N4291	15p	BC212L	16p	F346A	25p
2N4410	24p	BC213L	16p	SC231	10p
2N4991	62p	BC214L	16p	SD1	10p
2N5062	61p	BC257	9p	SD4	12p
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40251	89p	BC269	17p	W02	35p
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C	1/4W	10%	4.7-10M	E12	1	0-8	0-7
C	1/2W	5%	4.7-10M	E24	1-2	1	0-9
C	1W	5%	4.7-10M	E12	2-5	2	1-9
MO	1/2W	2%	10-1M	E24	4	3-5	3
WW	1W	10% ± 1/20 Ω	0-22-3-9	E12	7	7	6
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WW	7W	5%	12-10K	E12	9	9	8

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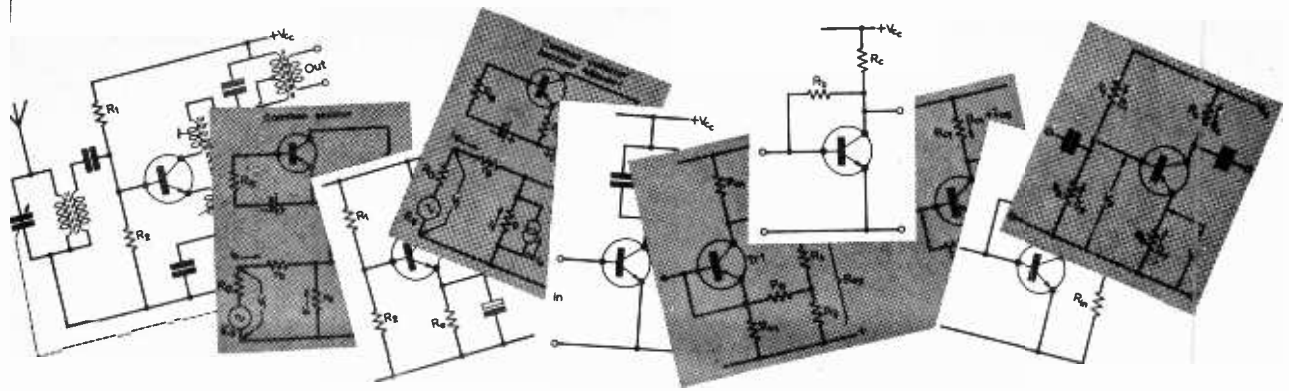
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TRANSISTOR CIRCUITRY for beginners

H.W. HELLYER

PART 4

Practical Circuits

Eyes down, look in! This month we get down to the circuits that are in use, what they are made of, how they work, and what we can do—shameless us!—to copy them. Fortunately for our consciences such people as Mullard, Texas, Motorola and Ferranti publish their circuits freely, and just so long as you do not propose to swing into production with a multi-million-pound factory, will raise no objection to you copying them. We must also give them credit where it is due.

First, we must turn to Mullard. Their design department has for years been suggesting circuitry that the amateur can emulate and the professional employ. Many a commercial design has been based on a Mullard original—sufficiently changed for it to be removed from suspicion of plagiarism. We shall not attempt to disguise our indebtedness, but publish, Fig. 14, the basic voltage amplifier that was built around the BC148, 149 and, in some cases, the BC147 transistors. These are lockfit versions of the 107, 8 and 9 series.

The 'Lockfit' configuration, whatever the brochures may tell you, was a method of strengthening the lead-out wires of the basic transistor so that mass production methods of fitting them into preset hole patterns could be used. These are plastic-encapsulated silicon planar epitaxial transistors—and if you have read the previous three parts, there should be no need for me to describe them in further detail.

No need, either, to elaborate too much on the operation of this circuit, for we have already dealt with this, in its development form, in the AF Circuit section of our wallchart. But, because this is going to be one of our basic building bricks, and will need alteration and adaptation for special purposes, let's take a closer look at how it works, and the values of components, voltages and currents.

In Fig. 14 we use two BC148 transistors with d.c. feedback loops from the emitter of Tr2 to the base of Tr1 and from Tr2 collector to Tr1 emitter. These give stabilisation against temperature variations. To get different voltage gains, and to achieve different

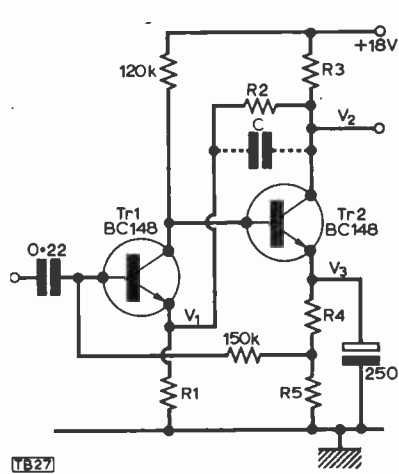


Fig. 14: Basic voltage amplifier by Mullard based on their 'Lockfit' series of transistors, BC147, 148 and 149. Table below gives component values for various gain figures.

A_v	10	20	30	40	dB
R_1	4.7	1.5	1.5	1.0	k Ω
R_2	12	15	56	180	k Ω
R_3	1.8	2.2	2.2	2.2	k Ω
R_4	470	560	330	680	Ω
R_5	1200	470	270	220	Ω
C	—	—	—	10	pF
V_1	3.4	0.97	0.4	0.15	V
V_3	10.8	9.3	9.3	9.7	V
V_2	5.6	3.55	2.3	3.4	V
Z_{in}	145	140	135	110	k Ω
Z_{out}	63	140	260	700	Ω

The frequency response of all the amplifiers is from below 20Hz to above 20kHz.

impedance values for both input and output, we have to alter component and voltage values.

The total distortion of this family of amplifiers, for gain figures from 10 to 40dB, provided the output voltage is kept below a volt at 1kHz, is less than 0.1%. If you want higher output voltages than this,

you must suffer greater distortion, up to 1%. The noise figure, referred to the input, is less than a microvolt for all four versions of this basic circuit.

The accompanying table shows the alteration of components, the voltage changes, and the altering impedances that are inevitable (see previous notes). All these amplifiers have a frequency response from below 20 to above 20,000Hz, so can be safely used as boosters or buffers for hi-fi circuits.

Having said that, allow me to jump in quick with a proviso. . . . Buffers are little bits of add-on circuitry, true building bricks, that will occupy us somewhat in our next part, where some original designs will be described in detail, down to the last splodge of solder.

Buffer Amplifiers

In the author's daily work, buffer amplifiers are taken for granted. Matching item A to item B, where both sensitivity and impedance could have been designed by a malicious ill-wisher, requires these odd two-or-three-transistor packages to be part of our regular work. We use peg-board, Veroboard and tag-strips, as convenient for construction, but for the regular jobs a printed circuit board with an 8-way

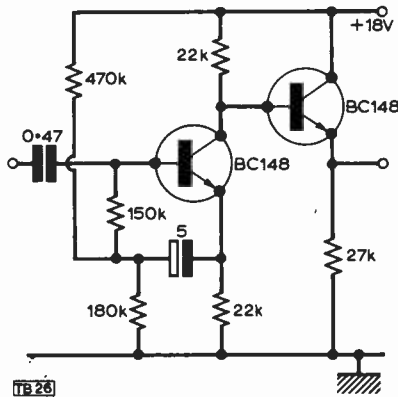


Fig. 15: Buffer amplifier development of Mullard circuit. A common-emitter with large negative feedback drives an emitter-follower. Input $Z=3.6M\Omega$, output $Z=250\Omega$. Voltage gain is unity and response 20Hz to 20kHz.

connector strip. Details of three building bricks that should be of assistance to amateurs will follow.

Returning to this month's basic circuit, we have our first variation, the buffer amplifier by Mullard Ltd., in Fig. 15 and we find a different requirement and a different set of conditions. Here, we are not so much interested in voltage gain as in impedance matching.

Take the example, a practical problem for many of us, of trying to match a tape recorder to an audio system or radiogram. So many times the latter has a high impedance output, sometimes as much as a megohm. The available voltage from a radio signal with 30% modulation, or a gramophone record, will give a 'standard' output of around 100-200mV. In fact, the 'Line' output aimed at by responsible makers is more like the studio 0dB level of 775mV. But we will stick to practice, not wishful thinking. . . .

This 100-200mV is at a fairly high impedance, probably over 500k Ω . It is a hopeless task trying to match it to the Auxiliary or Radio input of the average tape recorder, which likes to 'see' about 10k Ω and will fully modulate the tape, with Record Level gain at maximum, with something like 100mV. So, between the two pieces of equipment, we have to put a buffer amplifier. This will accept the input from a high impedance source, and feed, from its own low impedance output, any piece of apparatus ten times or more its own impedance.

To digress—it is a good rule of thumb to feed 'low into high by a factor of ten'. In other words, a 10k Ω output will drive a 100k Ω input if the voltages are suitable, and the load will have no appreciable effect upon the source. Once we have those conditions, "potting" down a voltage is a simple matter.

The buffer amplifier, then, need have no gain. It is primarily an impedance-matching device. In other words, it has unity gain. It has a high input impedance and a low output impedance. Between the two, it should impose no great strain upon the signal, i.e., there should be no loss, little noise contribution and negligible distortion. Believe me, this glib limitation is very hard to achieve. The Mullard buffer amplifier depicted in Fig. 15 has an input impedance exceeding 3M Ω and an output impedance of 250 Ω . It has an output noise figure of less than 0.5% with voltages up to 2.5V, a frequency response, again from 20Hz to 20kHz and a distortion percentage, varying with the output voltage, but less than 0.1% at outputs of less than a volt, only 1.5% at 2V rising to 0.4% at 2.5 volts output.

These simple circuits are no trouble to build. Except for their having been designed to a standard format, so that the line voltage of 18V is not easily changed, they are very adaptable. In any case, for anyone contemplating a permanent set-up, a pair of PP9 batteries will power this range of pre-amplifiers for almost as long as their shelf life.

In my own workshop, the need for a 20dB gain matching pre-amplifier has arisen sufficiently often for me to knock up the version of Fig. 16.

Before leaving this talk-in, however, allow me to commend to your notice the microphone amplifier developed from Mullard's original voltage amplifier.

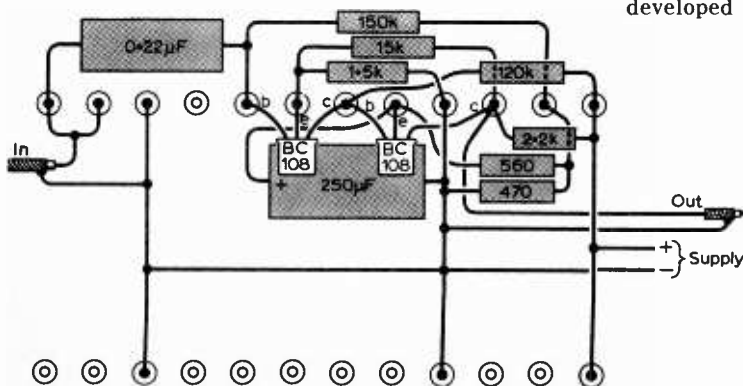


Fig. 16: Full size layout of the 20dB version of Fig. 14: built on a tagboard and mounted in a 2oz tobacco tin (Gold Block!) with a screened socket at each end. Built in just 21 hours the amplifier gave a measured gain of 19.5dB and an output of nearly 2V before exceeding specification for distortion. Power supply was two PP9 batteries in series.

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AAZ17 10p	BD132 80p	OC24 60p	2N1306 25p
AC107 35p	BDY11	OC25 40p	2N1307 25p
AC126 30p		OC26 25p	2N1308 25p
AC127 25p	BDY17	OC28 60p	2N1309 25p
AC128 25p		OC29 60p	2N1313 20p
AC176 20p	BDY60	OC35 50p	2N1417 75p
AC187 25p		OC36 60p	2N2160 60p
AC188 25p		OC42 40p	2N2217 25p
AC197 30p		OC43 50p	2N2218 20p
AC198 25p		OC44 15p	2N2218A
AC199 25p		OC45 12p	
AC200 25p		OC29 60p	2N2219 25p
AC201 25p		OC71 12p	2N2219A
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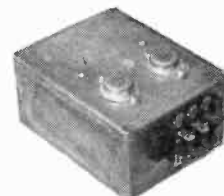
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*Wharfedale Melton 2/pr.	£70.00	£50.00	CARRIAGE AND INSURANCE ON ABOVE ITEMS £1.00		
*Celestion Ditton 15/pr.	£76.94	£60.00	ALL ITEMS GUARANTEED. AFTER SALES SERVICE. PRICE LIST ON REQUEST.		
*Wharfedale Dovedale 3/pr.	£90.00	£65.00	STEREO TUNER AMPS		
CARRIAGE FREE					
CARTRIDGES					
*Sonomone 9TA/HC Dia	£3.75	£2.00	*Leak Stereofetic/30	£131.03	£94.00
*Goldring G850 Dia.	£6.27	£4.00	*Leak Stereofetic/70	£143.53	£103.00
*Goldring G800 Dia.	£12.55	£6.50	CARRIAGE £1.00		
*Shure M44.7 Dia.	£9.84	£7.50	BOLTON		
*Goldring G800E Dia.	£18.16	£11.00	OPEN 9.00-5.30 Monday-Tuesday		
*Shure M55E Dia.	£12.52	£9.50	9.00-8.00 Thursday-Friday		
*Shure M75E/2 Dia.	£20.57	£14.00	9.00-4.00 Saturday		
CARRIAGE FREE					
TURNABLES					
*Garrard SP25 Mk. 3	£15.85	£10.50	CLOSED ALL DAY WEDNESDAY		
*McDonald MP60	£15.20	£10.50	CLOSED 1.30-2.30 Except Saturday		
*Goldring GL69/2	£27.60	£19.50			
*Goldring GL69/2/P	£36.21	£26.00			

PRACTICAL WIRELESS ELECTRONIC IGNITION SYSTEM



This Capacitor-discharge Electronic Ignition system was recently described in Practical Wireless and has proved extremely popular. We are able to offer the kit in two forms; the Standard kit containing the electronic components only, enabling the customer to tailor these to his own layout, or the De-luxe version containing a ready-drilled roller-trimmed printed circuit board and fully machined die-cast case with electrical connection block. Each kit is supplied with a custom wound transformer, first-grade components and full construction details. Suitable for 12V. systems only, pos. or neg. earth. All components available separately. Case size 4 1/2" x 3 1/2" x 2" Complete assembly and wiring manual 25p, refundable on purchase of kit kit.

Price : Standard kit ... £7.25 post free
De-luxe ... £8.75 post free
Trade enquiries invited. Mail order only.

DABAR ELECTRONIC PRODUCTS

88a, LICHFIELD STREET, WALSALL, STAFFS. WS1 1UZ
Tel. Walsall 34365

This device, see Fig. 17, has a voltage gain adjustable between 13 and 40dB, with correspondingly worse distortion, between a limit of less than 0.1% at 13dB gain and 0.5% at 1V out for the higher gain limit. The input impedance varies from 145 to 120kΩ while the output impedance is 47ohms at the 13dB end and 120ohms at the 40dB end of the gain range.

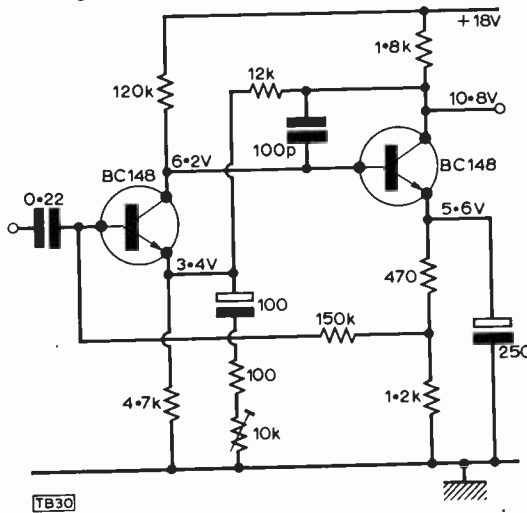


Fig. 17: This microphone amplifier is a further adaption of the circuit shown in Fig. 14.

Frequency response is very near that of the previous circuits, and in this, as in many other pre-amplifier circuits, much depends on the actual construction.

This is a vital matter, and the subject of layout, wiring, component choice and tolerances will exercise us more than a little in subsequent contributions.

Wallchart Comments

One or two things that are "exercising" me at the moment concern the previous contributions, and in particular the wallchart with which we kicked off this series. I apologise for a couple of errors that crept in, because my tardy submission left the editor no time for final proof-checking. In the top left block, first section, headed **BIASING CIRCUITS**, the statement should correctly be $V_{ce} = V_{cc} - I_c R_c$ (not R_b as printed).

In the block below this, headed **RF CIRCUITS** we find a beautiful short-circuit of the output (a.g.c. section) by the omission of a resistor between the "AF out" point and the positive terminal of C.

Because of the revised layout of the wallchart, the need to make it as attractive as possible as well as informative, several vital formulae were omitted. These will be included where appropriate to the subject, as now, where we are considering input and output impedances.

Returning to that top left section of the wallchart, we find a final remark about the effect of one stage on the next. When stages are coupled as shown (the second stage input impedance here represented by R_{in}) the effective a.c. load impedance of the first stage, R'_L and R_c in parallel with the input to the second stage, can be calculated from:—

$$R'_L = \frac{R_o \cdot R_{in}}{R_c + R_{in}}$$

There is a voltage-derived feedback due to R_b . Feedback current is proportional to output voltage. This reduces input impedance and overall current gain in the same ratio. The reduction factor is:—

$$\frac{1}{1 + \frac{h_{fe} \cdot R'_L}{R_b}}$$

Another factor that must not be forgotten is the internal resistance of the transistor. After all, it is an integral feature of its operation! So we have to take into account that unseen effective emitter resistance (see Fig. 18), which we shall label r_e to distinguish it from R_e , the external one. In the thumbnail

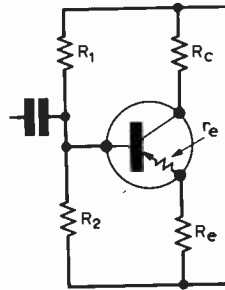


Fig. 18: The effective input impedance of a common-emitter stage depends on taking into consideration the internal emitter resistance r_e of the transistor.

[TB31]

circuit of Fig. 18, R_1 , R_2 and $(r_e + R_e)$ are all in parallel. If we ignore base bias for initial calculations, the input impedance will be

$$R_{in(min)} = (R_e + r_e)(h_{fe(min)} + 1)$$

and an easy way of determining r_e is to divide the collector current (mA) into 27, thus,

$$r_e = \frac{27}{I_c}$$

Given these few straws, our building bricks begin to form a structure. As a final bonus this month, Fig. 19 shows a single transistor buffer-amplifier as used by a famous amplifier maker. It offers three output voltage levels and impedances, and the figures hold true for matches into greater than 25kΩ

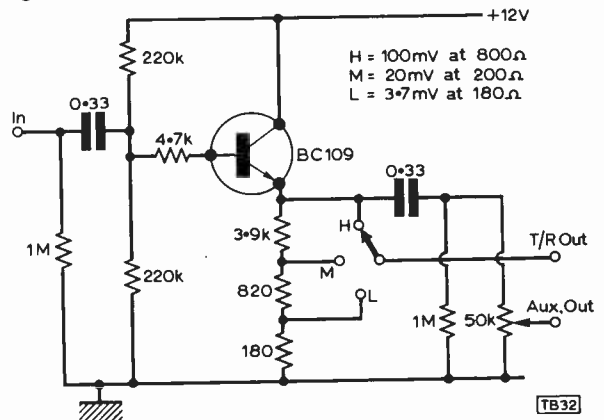


Fig. 19: A single-stage matching and buffering amplifier with one common and three switchable outputs.

load. The levels are given when the input is from a radio tuner reproducing a programme at 30% modulation, i.e., an average level. This, like our original voltage amplifier this month, is a simple thing to construct and works effectively. It is useful when one wishes to add a tape recording facility without upsetting the existing circuit.

TO BE CONTINUED

Ad-Vice

It is surprising how many people confuse "bass" with "base." For example, see your adverts in the Nov. issue, p. 557 ROC, the R446; p. 575 R&TV Reliant Mk. IV amplifier with "separate base and treble controls." Perhaps BASS and TREBLE might remind them of the local BAR. Page 556 again ROC, the R.142 tape unit has recording level metres, which at 39.3 inches, is, well, a large stretch! On p. 559, from Bi-pre-pak, it is possible to bulk-buy SILICON PLANAT diodes or A AMP plastic diodes whilst the prices of "Brand new carbon resistors"—Thacker's p. 648 seem curious.

It is a long time since I saw the classic "Geranium or Silicone" devices—but really, you have been turning out some top-grade articles of late, and it is a pity I have had no time to write a tirade against the i.c.—BAN THEM!

I like your index to advertisers but errors or inconsistencies still need ironing out.—**James W. Robson** (Newcastle upon Tyne).

Novel Door Alarm

Your readers may be confused by an error in Mr. Cross's article "Novel Door Alarm" (Sept. issue page 420) concerning the action of diodes D1 and D2. It was stated that "when Tr1 is switched on, diode D1 conducts." However quite the opposite is the case, for D1 can only be forward biased if its cathode is negative with respect to its anode. But D1 cathode is at the same potential as Tr1 base and D1 anode at the same potential as Tr1 emitter (via VR2 or VR3). Hence D1 is only forward biased when the base-emitter junction or Tr1 is reverse-biased and Tr1 therefore off. A similar state of affairs holds for D2 and Tr2.

The circuit relies for its operation on the fact that in a multi-vibrator of this type the base of the "off" transistor is actually swung negative with respect to the emitter. If this were not so, the diodes shown would never conduct at all. It is thus D2 that

provides the additional discharge path (via VR2 and VR3) for C2, and D1 that provides it for C3.—**G. Ashby**, (London, E.7.)

The Author replies: "I would like to thank Mr. Ashby for pointing out the mistake I seem to have made in the description of the Novel Door Alarm's circuit. His description is quite accurate, although to simplify things, substituting the word D2 for D1 in the top line of the second column, would help clarify the description, and I apologise if any readers have been confused. I would also like to take this opportunity to give details of the reed switch and its coil. The coil is a Radiospares Type 1. with a resistance of 800 ohms, and the switch is a Radiospares Type 13, which is a changeover type. Both these items should be available at any Radiospares stockist. I hope that this has clarified any problems that readers may have had."—**D. Cross**, (Hemel Hempstead, Herts.)

The "Rocket"

During the war I served with the R.E.s. The only way we used to find mines was with a bayonet! Metal detectors were not obtainable and we were front line spearhead troops. An officer of ours was a radio ham and he produced our first detector. A wooden picture frame with a length of conduit attached. This led to a half size biscuit tin in a pack on our backs from whence came the phones. The parts were second-hand radio parts and difficult to obtain. I don't know the circuit (I only wish I did). Although a poor looking job it was extremely efficient and could detect a piece of silver paper up to 18in. deep, finding a mine 8in. in diameter was easy. We used to very often get a strong signal and after digging about 4ft. deep uncover an ex latrine with tins thrown in and then filled up. After a lot of use we got to know how deep the metal was or the size of it. Many people owe their lives to our "ROCKET MINE DETECTOR" named after the 6th Rocket Field Sqdn.

Readers must of course learn how to sweep an area, and we used the following method:

Put the left foot forward, the search coil should now be swung round to the right. Step the right foot forward and the coil should now be to the left. Walk along like this and a big area can be swept cleanly. Drop a marker on a signalled spot each time and when the sweep is finished go back and have a dig.

There are still plenty of mines on some remote beaches and if you find one its your duty to inform the police not ignore it, so happy hunting.—**C. Horton**, (Birmingham 37).

Dying Breed

It would seem that I am an offspring of a dying breed. Although born some time after the dreaded transistor I am an ardent valve lover, however, I am unable to find any friends of my own age who share my affections for the faithful old thermionic device.

All my equipment, which I have built myself, is fully "valverised" and includes a double-beam oscilloscope, a five channel pre-amp and mixer, several audio amplifiers and a stabilised h.t. power pack. I gain much pleasure from working with valves and wonder if I really am a "loner", as most publications would have me believe, or if I do have a few silent "relatives" somewhere.—**D. Ll. O. Smith**, (Herts).

The Ugly Head

I see from M. Lerner's letter in the December issue that the Beginners' Licence has reared its ugly head again.

I have seen chaps of Mr. Lerner's age, also studying for "A" or "O" Levels, finding time to study and pass the RAE and become proud holders of G8, G3 and G4 call signs.

My advice to this young man is forget an easy way out and buckle down to the job and do what others in his position have done and will continue to do. *Verb sap* young man.—**B. J. Clark**, **G3BEC**, (Hon. President, Yeovil A.R.C.)

Here the matters rests!—[Editor]

ELECTRONIC VALVES

0A2	0-88	6SL7GT	0-85	DY87	0-55	PCU88	0-55
0A3	0-45	6SN7GT	0-85	DY802	0-50	PCU89	0-50
0B2	0-35	6SR7	0-40	EM8CC	0-65	PCU189	0-55
0B3	0-60	68Q7	0-40	E180F	0-95	PCU805	0-85
0C3	0-38	6T8	0-35	E101F	2-90	PCF800	0-80
1B3GT	0-88	6U4GT	0-40	EABC90	0-55	PCF80	0-30
1C3F1	0-20	6V6GT	0-38	EAF42	0-55	PCF82	0-35
1L4	0-20	6X4	0-30	EBC33	0-50	PCF84	0-50
1R4	0-35	6X5GT	0-35	EBC41	0-55	PCF86	0-60
1R5	0-35	6X8	0-55	EBC81	0-30	PCF87	0-85
184	0-27	6Y6G	0-85	EBF80	0-40	PCF80	0-50
185	0-25	7Y4	0-60	EBF83	0-40	PCF82	0-50
1T4	0-25	8W6	0-50	ECF89	0-30	PCF805	0-75
1U4	0-27	10C2	0-50	EC53	0-50	PCF806	0-70
1U5	0-50	10D1	0-50	EC86	0-60	PCF808	0-75
1V2	0-45	10D2	0-40	EC88	0-60	PCH200	0-70
1X2B	0-40	10F1	0-90	EC90	0-38	PCL81	0-50
2D21	0-85	10F9	0-50	EC91	0-38	PCL82	0-85
3E2B	0-35	10F18	0-45	EC92	0-35	PCL83	0-65
3E2B	2-15	10V7	0-45	EC93	0-50	PCL84	0-45
3FP1	2-75	10LD11	0-60	EC8010	2-25	PCL85	0-40
3Q4	0-40	10P13	0-55	EC8020	0-60	PCL86	0-45
384	0-35	10P14	1-10	EC8030	0-30	PCL88	0-90
3V4	0-45	12A15	0-60	EC8040	0-30	PCL80	0-98
5R4GY	0-60	12A26	0-40	EC83	0-30	PCL801	0-70
5Y4C	0-38	12A15	0-45	EC85	0-30	PL600	1-50
6U4CB	0-42	12A25	0-42	EC86	0-40	PF86	0-60
5Y4G	0-42	12A76	0-80	EC88	0-40	PF818	0-85
5Y3GT	0-82	12A77	0-38	EC89	0-20	PF1200	0-70
5Z3	0-60	12A16	0-30	EC91	0-20	PL33	0-35
5Z4G	0-40	12A17	0-30	EC92	0-35	PL36	0-65
6J30/2L	0-75	12A76	0-38	EC93	0-35	PL81	0-50
6AB4	0-85	12AV7	0-50	ECF86	0-20	PL82	0-45
6AF4A	0-50	12AX7	0-80	ECF86A	1-50	PL83	0-45
6AG7	0-40	12AY7	0-70	ECH42	0-70	PL84	0-40
6AH6	0-60	12B4A	0-55	EH81	0-30	PL302	0-90
6AJ8	0-30	12BA6	0-85	ECH83	0-40	PL504	0-60
6AK5	0-80	12BA7	0-35	ECH84	0-45	PL508	0-90
6AK6	0-57	12B9	0-85	ECH84	0-40	PL801	0-90
6AL3	0-43	12BH7	0-40	ECL81	0-45	PM84	0-50
6AL5	0-32	12BY7	0-55	ECL82	0-35	PY31	0-80
6AM5	0-32	12K5	0-55	ECL83	0-65	PY33	0-63
6AM6	0-38	12K7GT	0-85	ECL84	0-55	PY80	0-30
6AQ5	0-55	12Q7G	0-30	ECL85	0-55	PY81	0-80
6AQ6	0-35	12S87	0-35	ECL86	0-40	PY82	0-30
6AR5	0-35	12V7	0-80	ECL800	0-60	PY83	0-38
6AR6	0-40	20D1	0-45	EF37A	1-50	PY88	0-40
6AR11	1-25	20L1	1-10	EF37A	0-60	PY500	1-00
6AS5	0-35	20P1	0-50	EF39	0-40	PY800	0-60
6AS7G	0-30	20P4	1-10	EF40	0-50	PY801	0-60
6AT6	0-20	20P5	1-20	EF41	0-50	YZ30	0-35
6AU6	0-35	25L6GT	0-45	EFA0	0-25	QV2-6	2-15
6AV6	0-30	25L6GT	0-45	EFA0	0-25	QV3-10	1-25
6AW8A	0-55	25Z4G	0-30	EFA8	0-55	5-25	
6BA6	0-25	25Z6GT	0-65	EFA8	0-55	QQV03-20A	
6BE8	0-30	30A5	0-45	EFA8	0-55	5-25	
6BF5	0-30	30A3	0-40	EFA8	0-55	QQV06-4A	
6BF8	0-60	30C1	0-30	EF89	0-28		
6BH5	0-45	30C15	0-80	EF91	0-38		
6BL6	0-45	30C17	0-85	EF92	0-40	TT21	2-65
6BK7A	0-55	30C18	0-75	EF97	0-65	TT22	2-60
6BN5	0-43	30F5	0-85	EF98	0-65	U18/20	0-75
6BN6	0-40	30FL1	0-70	EF99	0-65	U25	0-75
6BQ5	0-25	30FL12	0-92	EF183	0-30	U26	0-75
6BR5	0-65	30FL14	0-75	EF184	0-35	U31	0-45
6BS7	1-20	30L1	0-40	EF800	1-00	U37	1-50
6BW6	0-55	30L15	0-85	EF804	1-25	U52	0-38
6BW7	0-70	30L17	0-80	EK90	0-30	U76	0-30
6BX6	0-25	30P12	0-80	EL33	1-25	U78	0-30
6BZ6	0-35	30P19	0-80	EL34	0-50	U91	0-75
6C4	0-28	30R1	0-70	EL35	0-50	U91	0-35
6CGT	0-30	30PL13	0-92	EL41	0-55	U281	0-40
6CB6	0-30	30PL14	0-90	EL42	0-58	U282	0-40
6CD6GA	1-15	35A3	0-55	EL81	0-55	U301	0-40
6C7	0-50	35A5	0-75	EL83	0-42	U404	0-40
6CH6	0-55	35B5	0-65	EL84	0-28	U501	1-00
6CL0	0-50	35C5	0-40	EL85	0-45	UABC80	0-85
6CW4	0-62	35D5	0-70	EL86	0-40	UAF41	0-55
6CY5	0-43	35W4GT	0-50	EL90	0-35	UAF42	0-50
6C77	0-65	35W4	0-30	EL95	0-35	UBC41	0-50
6D3	0-45	35Z3	0-60	FLR03	1-00	UBC81	0-40
6DC6	0-75	35Z4G	0-30	EL82	1-50	UBF80	0-40
6DE6	0-45	35Z5GT	0-80	EL822	0-90	UBF89	0-35
6DQ6B	0-62	50A5	0-70	EL520	0-75	UBL1	0-50
6DS4	0-75	50B5	0-45	EM34	0-90	UBL21	0-60
6EA8	0-58	50C5	0-40	EM71	0-75	UC92	0-35
6EH7	0-80	50CD6G	1-65	EM80	0-40	UCC55	0-40
6EJ7	0-35	50L6GT	0-60	EM81	0-60	UCF80	0-55
6EW6	0-85	85A2	0-40	EM84	0-35	UCH21	0-60
6F1	0-70	90A9	2-40	EM85	1-00	UCH42	0-70
6F5	0-50	90AV	2-60	EM87	0-55	UCH43	0-75
6F6G	0-30	90C1	0-60	EN91	0-35	UCH81	0-35
6F11	0-38	90CV	1-25	EY51	0-40	UCL41	0-60
6F13	0-38	90T	0-50	EY80	0-45	UCL82	0-35
6F14	0-65	813	3-75	EY81	0-35	UCL83	0-60
6F15	0-60	866A	0-75	EY83	0-55	UF41	0-60
6F18	0-45	8642	0-65	EY86	0-40	UF42	0-60
6F23	0-80	6080	1-50	EY87	0-43	UF43	0-60
6F24	0-75	6146	1-50	EY88	0-43	UF80	0-85
6F25	0-75	6380	1-25	EZ40	0-45	UF85	0-80
6F26	0-35	6870	2-50	EZ41	0-45	UF89	0-35
6F28	0-60	6989	2-15	EZ80	0-60	UL41	0-65
6J4	0-65	7189	0-75	EZ81	0-28	UL84	0-30
6J5GT	0-30	7360	1-00	GY501	0-80	UM84	0-20
6J7	0-45	7586	1-25	GZ30	0-40	UY1N	0-50
6K6GT	0-55	7895	1-25	GZ31	0-38	UY11	0-65
8K7	0-35	9002	0-35	GZ32	0-48	UY41	0-45
8K8G	0-35	9003	0-50	GZ33	0-70	UY82	0-50
8K25	0-75	AZ1	0-48	GZ34	0-60	UY85	0-30
8L8GT	0-45	AZ31	0-55	HABC80	0-40	W729	0-60
6L7	0-40	CB11	0-80	HK90	0-35	Z759	1-85
6L18	0-45	CB131	0-90	KT66	2-05	Z803U	0-90
6LD20	0-40	CY31	0-35	KT88	2-00		
6N7GT	0-40	DAF96	0-42	N78	0-45		
6P1	0-60	DP98	0-42	PABC80	0-45		
6P25	1-25	DK40	0-55	PC86	0-60		
6P28	0-65	DK92	0-50	PC88	0-60		
6Q7	0-40	DK96	0-42	PC97	0-50		
6RA7	0-40	DL96	0-42	PC90	0-48		
68G7	0-35	DM180	0-85	PC84	0-40		
68K7	0-35	DY86	0-38	PC85	0-40		

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2N388A	62p	2N3702	17p	ACY18	25p	AF127	17p	BC184	22p	BFY52	22p
2N614	30p	2N3704	22p	ACY19	25p	AF139	37p	BC187	28p	BX21	27p
2N697	20p	2N3705	20p	ACY20	25p	AF178	45p	BC213L	26p	OC25	50p
2N698	25p	2N3711	20p	ACY21	25p	AF179	45p	BCY32	37p	OC26	32p
2N706	12p	2N3819	35p	ACY22	20p	AF180	52p	BCY58	22p	OC28	62p
2N930	27p	2N3826	30p	ACY28	20p	AF181	42p	BCY70	20p	OC29	75p
2N1132	32p	2N3905	37p	ACY40	20p	AF186	56p	BD113	78p	OC35	40p
2N1303	17p	2N3914	P.A.	ACY41	25p	AF236	42p	BD121	65p	OC36	62p
2N1305	25p	R.C.A.	ACY44	40p	ARY28	25p	BD123	82p	OC42	25p	
2N1306	25p	40253	P.A.	AD140	40p	BC107	15p	BD124	62p	OC44	20p
2N1307	25p	40398	P.A.	AD142	58p	BC108	15p	BD131	97p	OC45	12p
2N1711	25p	40458	P.A.	AD149	57p	BC109	15p	BD132	97p	OC46	15p
2N2147	72p	2N4061	22p	AD160	62p	BC113	27p	BF115	85p	OC70	15p
2N2160	77p	2N4082	22p	AD161	67p	BC114	37p	BF117	47p	OC71	12p
2N2614	10p	2N4286	17p	AD162	67p	BC115	37p	BF160	P.A.	OC72	13p
2N2646	57p	2N4291	17p	AF102	58p	BC116	62p	BF162	P.A.	OC74	32p
2N2905	40p	2N4307	30p	AF106	42p	BC116A	67p	BF163	35p	OC75	22p
2N2926	20p	2N4317	30p	AF114	25p	BC117	39p	BF167	25p	OC76	22p
Green	14p	2N4326	20p	AF115	30p	BC118	32p	BF173	32p	OC77	27p
Yellow	12p	2N4327	20p	AF116	25p	BC134	57p	BF178	35p	OC78	25p
Orange	12p	2N4328	20p	AF117	25p	BC148	P.A.	BF179	72p	OC81	20p
2N3053	20p	2N4329	20p	AF118	60p	BC136	P.A.	BF180	35p	OC81D	20p
2N3055	75p	2N4331	20p	AF119	20p	BC137	P.A.	BF181	32p	OC83	25p
2N3391	20p	2N3055	75p	AC187	62p	BC138	P.A.	BF184	25p	OC84	25p
2N3392	20p	2N3901	20p	AC188	37p	BC142	30p	BF194	22p	OC139	32p
		2N3922	20p	AC189	37p	BC143	30p	BF195	27p	OC140	32p
				AC187	62p	BC147	17p	BF196	42p	OC170	32p
				AC188	37p	BC148	35p	BF197	31p	OC171	20p

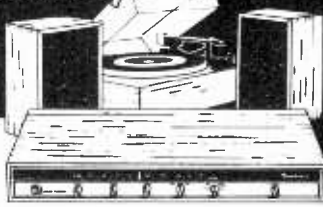
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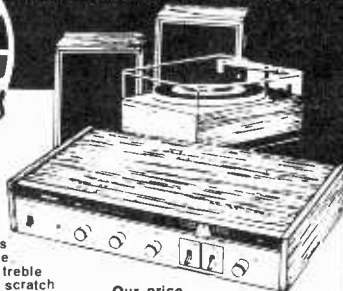
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OUR CURRENT LIST (see heading) includes more details of all above plus cartridge replacement table, many unrepeatable Special Offers, and cable, croc, clips, Volume controls Din plugs, CO-Ax, standard, miniature, phono plugs, sockets and adaptors. Tape Recording and Record Player accessories, panel and Test meters and equipment, Multimeters, min. motors, test prods, switches-rotary, toggle, slide, cabinet, lamp, etc., electrolytics, terminals. Veroboard, valve holders, extension aerales for cars and portable sets, ind. lamps and bulbs, diode, mikes, telephone amplifiers and pick-ups, dials, drive cord, Inter-coms, sub (testing) boxes, Stereo Headphones etc. etc.

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ALTHOUGH you may not be interested in building a metronome for its intended purpose of beating the time for musicians, small modifications to the circuit enable it to give out any audio frequency by increasing the rate of the beats. As shown the circuit will range over a beat every two seconds to ten per second (10Hz). If C1 is lowered in value this range will be much higher and the circuit becomes an audio oscillator. Don't confuse this with what is normally called an audio oscillator which gives out true sine waves and usually square waves. The waveform produced by this circuit is far from pure—after all if it was you wouldn't be able to hear it below about 40Hz.

There are a large number of circuit configurations for producing audio oscillations but they all rely on changing the phase 360° and feeding it back to the input. The attraction of the one shown in Fig. 1 is that it will produce a considerable output from a single transistor using only a few components.

THE CIRCUITS

The transistor Tr1 is arranged very much like the output stage of a simple amplifier with R1 and VR1

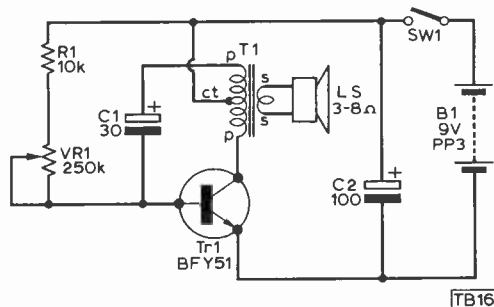


Fig. 1: The circuit of the Take 20 Metronome.

providing the bias and with an output transformer in the collector circuit to match the impedance to feed a loudspeaker. All we are doing different is to use a transformer with a centre tapped primary (they are nearly all sold with this), using only half of the primary and feeding back the signal produced in the other half of the primary to the base of the transistor via a capacitor, here shown as C1. C2 decouples the supply and SW1 is the on-off switch. Signals produced in the collector of Tr1 will be induced into both the secondary of the transformer and into the other winding, in this case 360° out of phase with the original signal. The rate of oscillation depends on the value of C1 and also, in the case of this circuit, upon the value of the bias resistor which is made variable. R1 has to be included otherwise at one end of the

No. 32 METRONOME

★ components list

Tr1	BFY51	20p
R1	10kΩ, ½W, 10% type	1p
VR1	250kΩ lin. pot with switch	24p
C1	30µF, 12V—see text	6p
C2	100µF, 12V	6p
T1	Transistor output transformer, Eagle LT700	20p
LS	6 x 4in. 3Ω loudspeaker	15p
		92p

Prices are those recently advertised in Practical Wireless and may have changed. No allowance is made for minimum order costs or for postage and packing; these points should be checked carefully before ordering.

travel of VR1 the base would be connected directly to the positive supply line causing the transistor to blow.

CONSTRUCTION

A simple layout drawing is shown in Fig. 2 using a short length of tag board; these are usually pro-

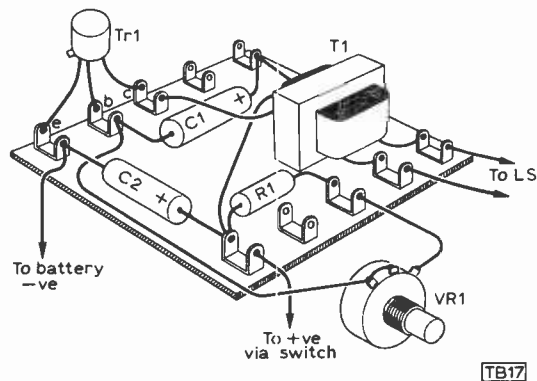


Fig. 2: A suggested component layout on a small piece of tagboard.

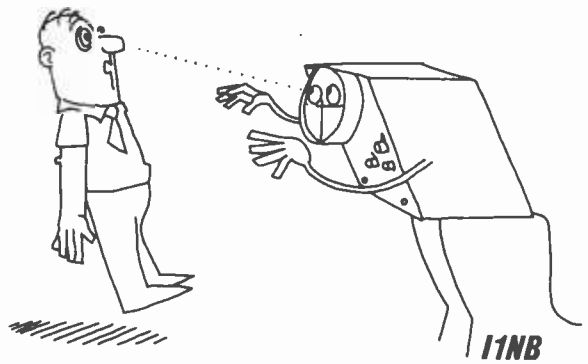
vided with holes drilled down the middle and the lugs of the transformer can be fitted into these and bent over. The loudspeaker impedance for a circuit of this type is most uncritical and any type between 3Ω and 80Ω will work, though greater output can be expected from those with lower impedances. ■

BACK NUMBERS

We regret that the back numbers department of P.W. has now closed and consequently we are unable to supply these. Requests for specific back issues can usually be included in our 'CQ' section; there is no charge for this but it is a service between readers and P.W. are unable to meet any of these requests.

THE HYPNOSCOPE

Bruno Nascimben



THE circuit given here is for a little "fun" project and is designed to convert an oscilloscope into a device to induce hypnosis. We do not have room here to discuss the theory of hypnosis though information on this subject can be found in most public libraries.

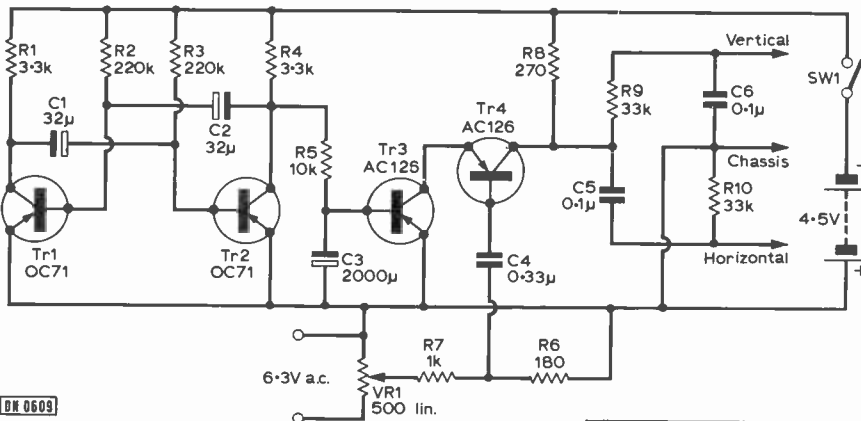
As can be seen from the circuit, it is very simple and inexpensive to build. None of the component values are critical and no circuit changes or modifications are necessary to the oscilloscope.

be derived from a small heater transformer or from the 'scope itself. The mains frequency is modulated by another signal with a frequency of approximately 0.2Hz. This modulated signal is then divided into two signals, one 90° out of phase with the other to be applied to the 'scope plates.

The OC71 transistors generate the 0.2Hz square wave to the integrator RC network (10kΩ-2000μF). The output of this varies the amplitude of the 6.3V a.c. signal in the modulator with the AC126 transistors. Resistors R9 and R10 with capacitors C5 and C6 constitute the phase shift network.

The circuit can be built on a small piece of perforated board or tag board though the layout is not in any way critical.

Adjustment of the 500Ω potentiometer, VR1, will affect the size of the circular pattern while the 'scope's own vertical and horizontal controls will set the shape of the circle.



BN 0609

Fig. 1: The circuit of the Hypnoscope

What happens is this: on the screen of the cathode ray tube we get a circular pattern (if the 'scopes controls have been adjusted correctly) and this circle grows larger and then smaller until it becomes a small spot which in turn becomes a large circle again. This gives the effect of being in a tunnel and the effect is bewitching. If stared at in darkness the effect is hypnotic.

If a skilled operator adds verbal suggestion to the effect, several people can be hypnotised at the same time. There is also room for experimenting with auto-hypnosis.

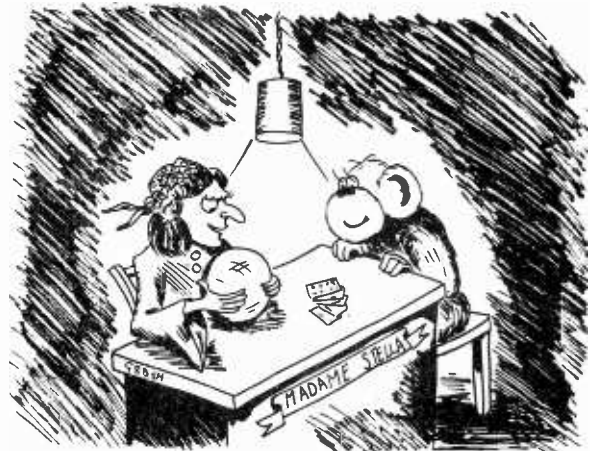
HOW IT WORKS

As can be seen from the circuit given in Fig. 1, four a.f. PNP transistors are used; the actual types are not too important and those shown in the circuit were used simply because they were handy. It is also possible to use NPN types simply by reversing the battery polarity and that of the electrolytics.

Essentially the circuit is a modulator and a very low frequency signal generator. Besides the battery supply we also need a 6.3V a.c. supply: this can

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Transistors																		
2N2218	20 2N4299	15 AD149	50 BC169C	15 GJ7M	25 NK7223	25 OA2200	55 OC35	50 OC81D	20 Z8170	10								
2N2219	20 AAZ12	30 AD161	37 BPS98	28 GJ7M	37 NK7251	24 OA2201	50 OC44	17 OC82	25 Z8271	18								
2N2369A	20 AC126	20 AP115	25 BFY60	22 K8100A	20 NK7713	25 OA2207	47 OC45	12 OC82D	20 ZTX107	15								
1N914	07 2N697	15 2N706	25 AP117	25 BFX51	20 MJ2920	87 OA71	10 OC84	60 OC84	25 ZTX108	12								
18119	25 2N706	10 2N4904	20 AC128	20 ASY205	25 BY100	15 MJ2955	50 OA71	10 OA2222	45 OC58	60 OC170	25 ZTX300	12						
18202	23 2N1132	25 2N2926	10 ACY20	20 BC107	10 BZY88	15	£1.37	OA81	08	OA2224	45 OC59	65 OC171	30 ZTX304	25				
2G302	22 2N1305	25 2N3055	75 ACY39	50 CR8108	10 CR8108	10	CR8108	15	MJE3055	87	OA85	12	OC200	40 ZTX500	16			
2G371	22 2N2147	75 2N3702	10 AD140	50 BC109	10 DDD03	16	NK7212	27	OA91	07	OA2242	23	OC72	20	OCPT1	97	ZTX503	17
2N404	20 2N2160	60 2N3819	35		GT102	30	NK7214	15	OA211	30	OA2246	23	OC81	20	OCPT2	50	ZTX531	25

TRANSISTOR POSTAGE 1p EACH, OVER 10 POST FREE
Express Postage & Insurance 5p one valve plus 1p each additional valve. ORDERS over £5 Post free. 6,000 types in stock send for lists, 5p.

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Tel. 01-769-0199/1649. Open to callers Mon-Sat 9 a.m.—5 p.m. Closed Saturday 1.00—2.30 p.m.

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STEREO HEADPHONE JUNCTION BOX

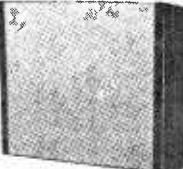


Simple unit connects direct to amplifier and speakers to give attenuated headphone output, has 2 position switch to give headphones only—speakers only.
Only £1.50 each P & P 12½

CARTRIDGES-Stereo

Sonotone 9TA H/C Diamond £2.40. Ronette S105 Medium Output, £1.40. S106 High Output £1.40. Acos GP93/1 Sapphire, £1.90. GP94 1 Sapphire, £2. TA700 equivalent to B.S.R. SX1M, £1.75. Japanese equivalent to B.S.R. TC8s, £1.75. P. & P. 7np on each.

DUDLEY



11" x 9½" x 5" deep, tapering to 3½" deep covered in Black Resine and Mottled fawn Vynair £2.10 P & P 25p.


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E.M.I. 13½ x 8in, 3 ohm £2.50, 15 ohm. P. & P. 30np. E.M.I. 13½ x 8in, fitted two 2½in. tweeters, 15 ohm £4.50. P. & P. 30np. E.M.I. 13½ x 8in. (15 ohm) Hi-Fi quality £6.25. P. & P. 30np. Bakers 12in. 25 watt 8 and 15 ohms £7. P. & P. 30np. Eagle Crossover 86np. P. & P. 5np.

VYNAIR

Widths from 50 to 54 in., 75np yd. off roll. P. & P. 10np. ¼ yard 40np. P. & P. 10np. Send 5np stamps for samples.

IMP



Wedge shaped extension speaker 7½ x 6½ x 4in. (max.). Covered in walnut wood grain cloth with mottled Vynair front. Keyhole slot at back. Fitted with 3 ohm speaker unit. Only £1.25. P. & P. 36np each

CARTRIDGES-Mono

GP.91 Stereo Compatible £1.25. Acos GP67/2 will replace Collaro and Garrard Mono cartridges, 95np. T.T.C. Crystal High Gain, 75np. B.S.R. TC8H Jap. equivalent £1.25. P. & P. 7np.

SPEAKER MATCHING TRANSFORMERS

3, 7, 15 ohms, 10 watt, 70np. P. & P. 17np.

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5½" x 11" x 4½" covered in White, Green or Black rexine or Teak cloth with Silver coloured metal front
£2.90 P & P 25p.

CLARENCE



11" wide x 8½" x 4½" deep with volume control covered in Black rexine and Mottled Vynair.
£2.25 P & P 25p.

NOCTURNE 73 STEREO SYSTEM

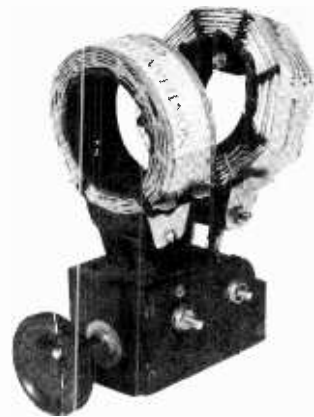


6w. per channel speech and music rating complete with Garrard 2025/TC with Acos stereo cartridge £54.75 P & P £1.

GOING BACK...



COLIN RICHES
ARTHUR DOW



FURTHER to our piece of Vintage equipment shown in the September issue, F. W. Hargraves of Sidcup, Kent, writes to tell us that it is a piece of test equipment used to provide a signal for adjusting cat'swhiskers and periodically checking the general state of crystal receiver equipment during silent periods. It was also used to receive c.w. if the coherer or decoherer failed. This was achieved by running the buzzer continuously, the incoming c.w. signal cross-modulating the buzzer's "tonic train" giving a readable signal.

It was fitted inside the silent cabinet in the aerial circuit immediately following the lightning arrester, coupled via a small transformer whose secondary was wound "on the bight" in order to present as small an X_L to the incoming signal as possible.

Mr. Hargreaves also says that the degree of skill required to read Poldhu or Leafield using marking and spacing (FSK to the non-Vintage) with the Eiffel Tower swinging it in the background cannot be imagined in these days of crystal gates and R9 ear-holes!

John Rose of Great Harwood, Lancashire, writes to say that it would be about the 1920's when he was at school and became interested in wireless. Talking about the ST series of receivers, he says that one of them, he cannot recollect which, was withdrawn owing to a mistake which was not spotted until it was on the market and, before it was corrected, the next series was out. Could this be yet another clue in the Mystery of the ST200?

Mr. Rose tells us how he used to enjoy the old City Hall Radio Exhibitions at Manchester but says that "progress and finance" come in all businesses. He also tells of a joke against himself by some of his relations which was when he used to be listening to his crystal set—it was "Stop breathing, I can't hear it!!"

Science Museum Equipment

For readers interested in seeing some vintage gear, the Radio and Line Communications gallery at the Science Museum in South Kensington, London, has now been moved to the top floor and is once more open to the public.

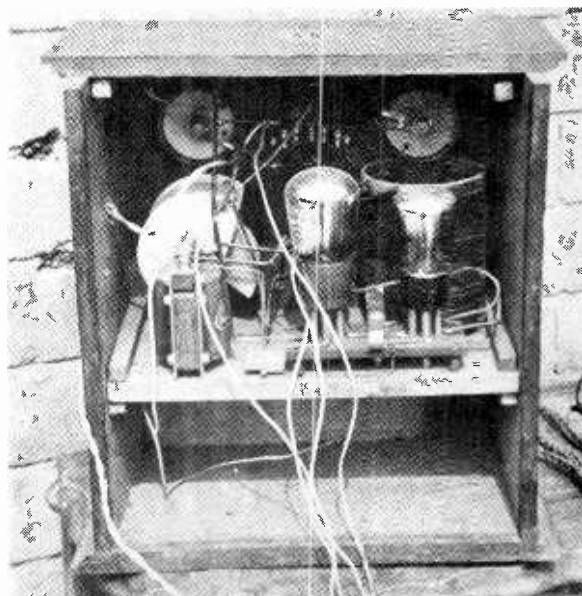
One person highly delighted by this move is Geoff Voller G3JUL whose duty, among others at the museum, is to demonstrate and maintain amateur radio station GB2SM, adjacent to the new gallery.

Another reader, Mr. S. Akehurst, of Earl Shilton, near Leicester, has also been out foraging and came up with the two valve receiver shown in the photograph. He spotted it on top of a neighbour's dustbin! Subsequent enquiries of his neighbour indicate that the set was bought for £30 around 1924-25.

However, the appearance of the set has all the signs of home construction in spite of the legend "Chakophone No. 9 Receiver" on the front panel. Possibly the receiver was bought as a kit of parts and assembled in a home-made cabinet.

The compartment at the bottom probably housed a 90 or 120 volt dry battery together with a separate 9 volt battery for grid bias. Rheostats can be seen for controlling the voltage on the valve filaments, derived from an accumulator. A changeover switch permits operation as a one or two valve receiver.

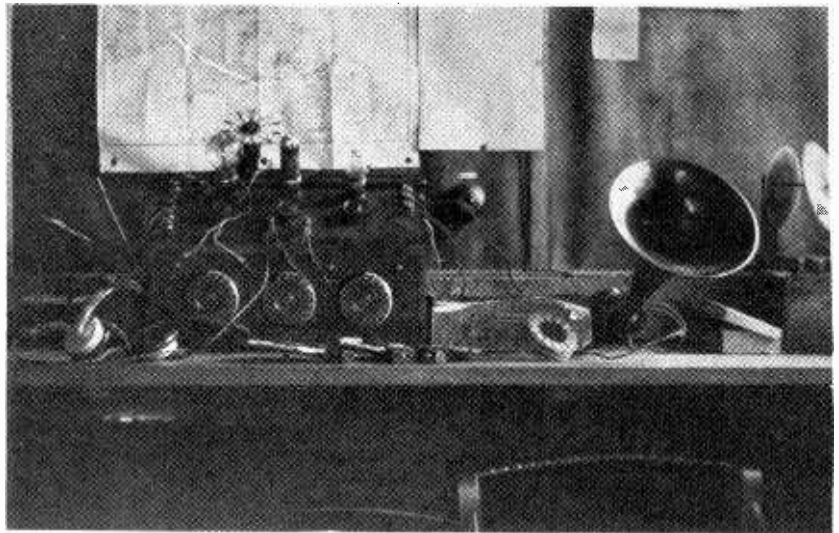
Mr. Akehurst has managed to get the receiver working again and, with a 12ft. aerial, has been able to receive several stations "loud and clear", although he does not mention the waverange covered. The stud switch, which can just be seen above the left-hand valve probably gave coverage of the medium and long wave bands. Mr. Akehurst is also to be congratulated and we hope his effort will be emulated by other readers.



Vintage Picture

Norman Gardiner hails from Southampton and sends us this photograph of a three-valve receiver. He says that he constructed it as the result of the opening of the BBC station at Bournemouth (6BM) which enabled, for the first time, radio programmes to be received in Southampton at loudspeaker strength. Previously the only stations heard were 2LO and Cardiff on headphones.

The loudspeaker shown in the picture is an Amplion. The valves were bright emitters, two of them being French "R" types and the one in the centre of the picture is still in Mr. Gardiner's possession.



Mr. Gardiner's three-valve receiver.

Vintage CO

Information Wanted

...information, sources of books, photographs, etc. especially pictures of the famous vintage personalities and equipment that will help me in my study for my Certificate of Secondary Education. Also anyone in the Canterbury area who owns vintage equipment who I could visit for help. I am quite willing to pay a reasonable amount for postage and pictures.—Michael Rychlik, 48 Whitstable Road, Canterbury, Kent.

...any relevant details on an Eddystone BZ003 433 all-wave four receiver, Patent No. 350,188—Paul Borrey, "Radio Supplies", High Street, Stokesley, North Yorkshire.

...any information at all on receiver ADM Patt. No. M361, Serial No. MC 5967. It is an old TRF with following valve line-up: VR18, PEN220, 215SB, Z22.—C. T. Halliday, 43 Hudson Road, Maghull, Liverpool, L31 5PA.

...the approximate year of manufacture and the prospects for getting a crystal for The Brownie Wireless Company's Standard Crystal Receiver which bears the legend, "Sole manufacturers—the Brownie Co. of Great Britain Ltd.—Patent 214 005" and has BBC Incorporated in the trade mark.—D. K. MacCrossan, 69 Sarto Road, NAAS, Co. Kildare, Ireland.

Equipment Wanted

...an old valve type Marconi N145 output. This is for an old couple who's set has broken.—E. Passingham, 27 Lower Farlington Road, Farlington, Portsmouth, Hampshire.

Equipment for Disposal

...six old valves—PM1ML, PM1HF, PM2, the other three are unmarked but they are an output pentode, r.f. pentode and double diode a.f. triode with top cap. If anyone's interested, I'll be only too pleased to send them along.—Mick Kelsall, Woodhouse Farm, St. Georges, Telford, Salop.

Literature Required

...any old radio magazines, English and foreign, also a 2m receiver in good working order (nothing over £3)—Graham Wilson, 29 Tomatin Road, Hilton, Inverness, Scotland.

Mystery Signals

Mr. N. H. Hodgson from Hayes, Middlesex, writes, "Recently re-reading earlier copies of P.W. I came across letters by Mr. E. Furlong and Mr. A. Trowbridge on the above subject and on Mr. Marconi's work in this field, and it reminded me of something I saw when I was in the R.A.F. as an 'erk' at Aboukir Aircraft Depot, Egypt, in 1923 or 1924.

The wooden hut used as the camp church had adjoining it a smaller hut, which served as a sort of vestry or changing room for the Padre. I had never seen it open until one day I found myself, along with other 'erks,' doing some duty or other inside the hut, and 'lo and behold' there inside was a large 6ft. square frame aerial with lots of wire round it, slowly rotating with no one attending it. It stood on a large table across which was a chart, slowly moving across the table, and a pen held vertically in some gadget jerked back and forth making a record on the chart in near vertical lines about an inch or more long.

On asking what it was, we were told by someone or other that it was a device for registering thunderstorms, and I at least thought no more about it to this day. On reading Mr. Trowbridge's letter I remem-

bered what I had seen and wondered if it had anything to do with Mr. Marconi's investigations, as I suppose it would be about the same time that he was interested in these phenomena?

As in those days radio was a closed book to me I thought nothing of it, but I have since wondered if the device was in use at other R.A.F. stations and some reader might know what its purpose was.

It could of course have been a "monitoring system for Russian signals," but it would be interesting if it had anything to do with Marconi's efforts."

Well, if anyone's any ideas on this we will be pleased to mention them in a future "Going Back" article.

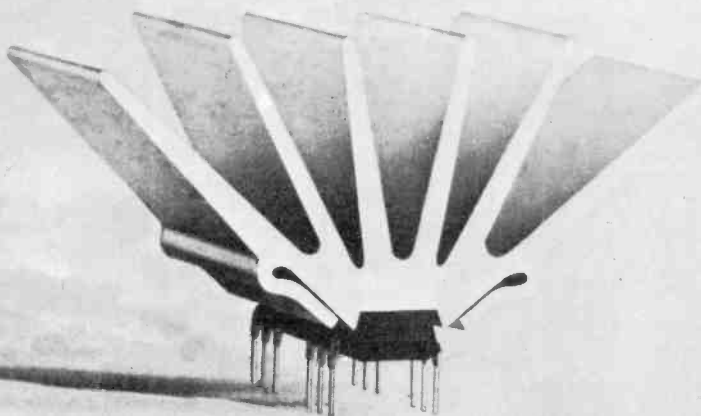
Hugh Wagner writes from Kuala Lumpur: "Readers might be interested in a very small, beautifully built portable 4-valve superhet receiver by R.C.A. I picked it up in a garage in which a monkey was being kept as a pet. The animal had made a dreadful mess of the set, and the owner of both set and monkey . . . a member of the German Embassy staff . . . was glad to give the receiver to me.

Not being very hopeful of getting it going again, I took my time over it . . . and, after two years, have brought it up to something like its pristine beauty. It still has its original genuine leather carry-bag. What amazed me was the i.f. transformers; they were not any larger than many made and sold today as midget i.f.t.'s, and still more incredible, they were enclosed in pots. By the way, the set was bought new in America by the above-mentioned person, as a present for his wife in 1930. Taking into consideration design, lay-out, numbers to be manufactured, costing and then jigging, this means the receiver prototype was probably built at least 18 months earlier.

The sensitivity of this receiver in no way falls below that of the present-day straight superhet (no r.f. stage) transistor receiver. Fortunately, there was room for a small power supply to be placed within the set. H.T. batteries are very expensive here in Malaysia, due to local taxation, which taxes "so much per volt!"

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.

SINCLAIR GENERAL GUARANTEE

Should you not be completely satisfied with your purchase when you receive it from us, return the goods without delay and your money will be refunded in full, including cost of return postage, at once and without question. Full service facilities are available to all Sinclair customers.

Output power 6 watts RMS continuous (12 watts peak).

Frequency Response 5 Hz to 100KHz \pm 1 dB.

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.

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.



Price, inc. FREE printed circuit board for mounting.

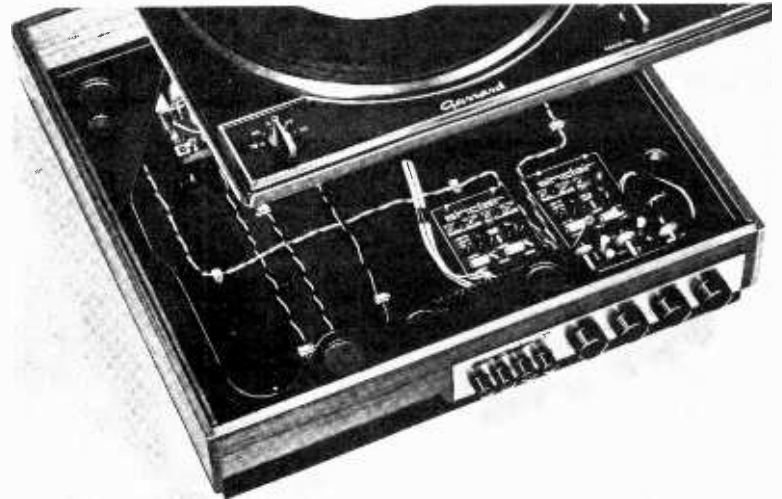
£2.98 Post free

Sinclair Radionics Ltd, London Rd, St. Ives Huntingdonshire PE17 4HJ
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Sinclair Project 60

The World's leading range of high fidelity modules



New!

Project 605

The easy way to buy and build Project 60



Project 605 is one pack containing: one PZ5, two Z30's, one Stereo 60 and one Masterlink. This new module contains all the input sockets and output components needed together with all necessary leads cut to length and fitted with neat little clips to plug straight on to the modules. Thus all soldering and hunting for the odd part is eliminated. You will be able to add further Project 60 modules as they become available adapted to the Project 605 method of connecting.

Complete Project 605 pack with comprehensive manual, post free **£29.95**

All you need for a superb 30 watt high fidelity stereo amplifier.

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Project 60 offers more advantage to the constructor and user of high fidelity equipment than any other system in the world.

Performance characteristics are so good they hold their own with any other available system irrespective of price or size.

Project 60 modules are more versatile – using them you can have anything from a simple record player or car radio amplifier to a sophisticated and powerful stereo tuner-amplifier. Either power amplifier can be used in a wide variety of applications as well as high fidelity. The Stereo 60 pre-amplifier control unit may also be used with any other power amplifier system, as can the AFU filter unit. The stereo FM tuner operates on the unique phase lock loop principle to provide the best ever standards of sensitivity and audio quality. Project 60 modules are very easily connected together by following the 48 page manual supplied free with all Project 60 equipment. The modules are great space savers too and are sold individually boxed in distinctive white and black cartons. With all these wonderful advantages, there remains the most attractive of all – price. When you choose Project 60 you know you are going to get the best high fidelity in the world, yet thanks to Sinclair's vast manufacturing resources (the largest in Europe) prices are fantastically low and everything you buy is covered by the famous Sinclair guarantee of reliability and satisfaction.

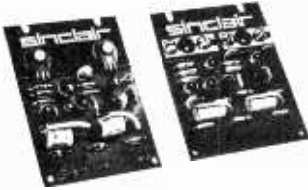
Typical Project 60 applications

System	The Units to use	together with	Cost of Units
Simple battery record player	Z.30	Crystal P.U., 12V battery volume control	£4.48
Mains powered record player	Z.30, PZ.5	Crystal or ceramic P.U. volume control etc.	£9.45
20 + 20 W. stereo amplifier for most needs	2 x Z.30s, Stereo 60, PZ.5	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	£23.90
20 + 20 W. 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
40 + 40 W. R.M.S. de-luxe stereo amplifier	2 x Z.50s, Stereo 60 PZ.8, mains trnsfrmr	As above	£34.88
Indoor P.A.	Z.50, PZ.8, mains transformer	Mic., guitar, speakers, etc., controls	£19.43

F.M. Stereo Tuner (£25) & A.F.U. Filter Unit (£5.98) may be added as required.

from a simple amplifier to a complete stereo tuner amplifier with Project 60 modules

Z.30 & Z.50 power amplifiers



The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and may be used with other units in the Project 60 range equally well.

SPECIFICATIONS (Z.50 units are interchangeable with Z.30s in all applications).

Power Outputs

Z.30 15 watts R.M.S. into 8 ohms using 35 volts; 20 watts R.M.S. into 3 ohms using 30 volts.

Z.50 40 watts R.M.S. into 3 ohms using 40 volts; 30 watts R.M.S. into 8 ohms using 50 volts.

Frequency response: 30 to 300,000 Hz \pm 1 dB.

Distortion: 0.02% into 8 ohms.

Signal to noise ratio: better than 70 dB unweighted.

Input sensitivity: 250 mV into 100 Kohms.

For speakers from 3 to 15 ohms impedance.

Size: 14 x 80 x 57 mm.

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 special for use with the Project 60 system of your choice. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.

PZ.5 30 volts un stabilised **£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**



Project 60 Stereo F.M. Tuner



First in the world to use the phase lock loop principle

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. 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. Good reception is possible in difficult areas, 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:** 1.5 dB. **Sensitivity:** 2 μ V for 30 dB quieting; 7 μ V for lock-in over full deviation. **Squelch level:** 20 μ V. **A.F.C. range:** \pm 200 KHz. **Signal to noise ratio:** > 65 dB. **Audio frequency response:** 10 Hz - 15 KHz (\pm 1 dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2 μ V. **Cross talk:** 40 dB. **Output voltage:** 2 x 150 mV R.M.S. **Operating voltage:** 25-30 VDC. **Indicators:** Power on/tuning/stereo. **Size:** 93 x 40 x 207 mm. **£25**

Built and tested. Post free.

Stereo 60 Pre-amp/control unit



Designed for 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 3 mV. Mag. p.u. 3 mV; correct to R.I.A.A curve \pm 1 dB; 20 to 25,000 Hz. Ceramic p.u. - up to 3 mV; A.U. - up to 3 mV. **Output:** 250 mV. **Signal to noise ratio:** better than 70 dB. **Channel matching:** within 1 dB. **Tone controls:** TREBLE + 15 to -15 dB at 10 KHz; BASS + 15 to -15 dB at 100 Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207 mm. **£9.98**
Built tested and guaranteed.

A.F.U. High & Low Pass 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 (12 dB/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 filter stages - rumble (high pass) and scratch (low pass). Supply voltage - 15 to 35V. Current - 3 mA. H.F. cut-off (-3 dB) variable from 28 KHz to 5 KHz. L.F. cut-off (-3 dB) variable from 25 Hz to 100 Hz. Distortion at 1 KHz (35V supply) (0.02% at rated output). **Size:** 66 x 40 x 90 mm. **£5.98**
Built tested and guaranteed.

The Sinclair 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.

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PW 1

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.

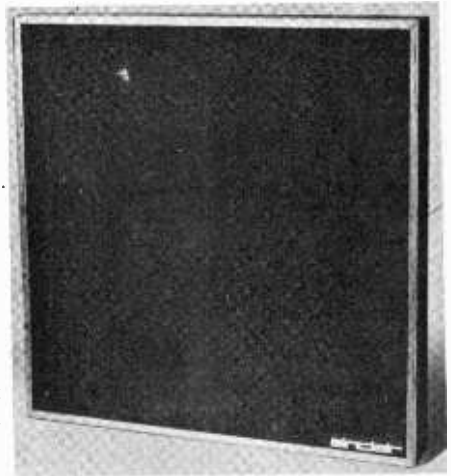
Input Impedance: 8 ohms.

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: 9½ in. square on face x 4½ in. deep with neat pedestal base. Black all over cellular foam front with natural solid teak surround.

Price £8.98.



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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Please send _____

Name _____

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for which I enclose cash/cheque/money order

PW172

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PADGETTS RADIO STORE OLD TOWN HALL, LIVERSEDEGE, YORKS

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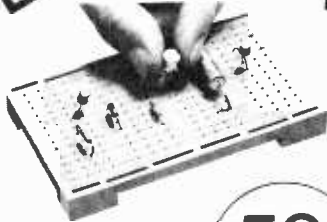
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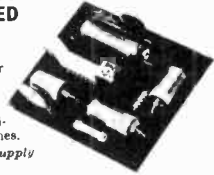
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BRAND NEW LINEAR I.C.'s—FULL SPEC.

Type No.	Case	Leads	Description	1-24	25-99	100 up
BP 201C—81201C	TO-5	8	G.P. Amp	65p	55p	45p
BP 701C—81701C	TO-5	8	OP Amp	65p	50p	45p
BP 702C—81702C	TO-5	8	OP Amp Direct OP	65p	50p	45p
BP 702—72702	D.I.L.	14	G.P. OP Amp Wide Band	58p	45p	40p
BP 709—72709	D.I.L.	14	High OP Amp	55p	45p	40p
BP 709P—7A709PC	TO-5	8	High Gain OP Amp	55p	45p	40p
BP 710—72710	D.I.L.	14	Differential comparator	58p	45p	40p
BP 711—7A711C	TO-5	10	Dual comparator	58p	50p	45p
BP 741—72741	D.I.L.	14	High Gain OP Amp (Protected)	75p	60p	50p
7A 703C—7A703CC	TO-5	6	R.F.—I.F. Amp	48p	35p	27p
TAA 263—	TO-72	4	A.P. Amp	70p	60p	55p
TAA 283—	TO-74	10	G.P. Amp	90p	75p	70p
TAA 350	TO5	8	Wide band limiting amplifier	170p	158p	150p

ANOTHER BI-PAK FIRST!

THE NEW S.G.S. EA 1000 AUDIO AMPLIFIER MODULE *GUARANTEED NOT LESS THAN 3 WATTS RMS



Especially designed by S.G.S. incorporating their proven Linear I.C. Audio Amp. TA1921 providing unlimited applications for the enthusiast in the construction of radios, record players, Audio and Stereo units. Also ideal for Intercom systems, monitoring applications and phone answering machines.

OTHER USES: portable applications where supply rails as low as 9V are of prime importance.

- Sensitivity 40 mV for 1 watt. VOLTAGE GAIN 40dB but can be varied up to 23dB for some applications.
- Signal to Noise Ratio 86dB.
- Frequency response better than 50 Hz to 25 KHz for —3dB.
- Overall Size 2" x 3" x 1".
- Typical Total Harmonic distortion at 1 watt less than 1%.
- Supply voltage (V_a) = 24V 150hm lead. *Module Tested and Guaranteed.

Quantity	1-9	10-25
Price each	£2.63	£2.28

Larger quantities quoted on request.

Full book-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

NOTE THESE PRICES!

I.C.'s		DTL 930 SERIES		LOGIC	
Type No.	Function	1-24	25-99	100 up	Price
BP930	Expandable dual 4-input NAND	25p	20p	15p	
BP932	Expandable dual 4-input NAND buffer	25p	23p	20p	
BP933	Dual 4-input expander	25p	23p	20p	
BP935	Expandable Hex Inverter	25p	23p	20p	
BP936	Hex Inverter	25p	23p	20p	
BP944	Dual 4-input NAND expandable buffer without pull-up	25p	23p	20p	
BP945	Master-slave JK or R8	35p	32p	29p	
RP946	Quad. 2 input NAND	23p	20p	18p	
BP948	Master-slave JK or RS	35p	32p	29p	
BP951	Monostable	90p	85p	80p	
BP962	Triple 3 input NAND	23p	20p	15p	
BP968	Dual Master-slave JK with separate clock	80p	75p	70p	
BP969	Dual Master-slave JK with separate clock	80p	75p	70p	
BP967	Dual Master-slave JK with Common Clock	80p	75p	70p	
BP969	Dual Master-slave JK Common Clock	80p	75p	70p	

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

DTL & TTL INTEGRATED CIRCUITS

Manufacturers' "Fall outs"—out of spec. devices including functional units and part numbers but classed as out of spec. from the manufacturers' very rigid specifications. Ideal for learning about I.C.'s and experimental work.

Pak No.	UIC930 = 12 x μ A 930	50p	UIC948 = 8 x μ A 948	50p
UIC932 = 12 x μ A 932	50p	UIC951 = 5 x μ A 951	50p	
UIC933 = 12 x μ A 933	50p	UIC961 = 12 x μ A 961	50p	
UIC935 = 12 x μ A 935	50p	UIC963 = 5 x μ A 963	50p	
UIC936 = 12 x μ A 936	50p	UIC964 = 5 x μ A 964	50p	
UIC944 = 12 x μ A 944	50p	UIC967 = 5 x μ A 967	50p	
UIC945 = 8 x μ A 945	50p	UIC969 = 5 x μ A 969	50p	
UIC946 = 12 x μ A 946	50p	UIC x 925 Assorted 930 Series 215-50		

Packs cannot be split but 25 Assorted Pieces (our mix) is available as Pack UICX9 Data Booklet available for the BP930 Series. PRICE 13p

UIC00 = 12 x 7400N	50p	UIC46 = 5 x 7446N	50p	UIC81 = 5 x 7481N	50p
UIC01 = 12 x 7401N	50p	UIC47 = 5 x 7447N	50p	UIC82 = 5 x 7482N	50p
UIC02 = 12 x 7402N	50p	UIC48 = 5 x 7448N	50p	UIC83 = 5 x 7483N	50p
UIC03 = 12 x 7303N	50p	UIC50 = 12 x 7450N	50p	UIC86 = 5 x 7486N	50p
UIC04 = 12 x 7404N	50p	UIC51 = 12 x 7451N	50p	UIC90 = 5 x 7490N	50p
UIC05 = 12 x 7405N	50p	UIC53 = 12 x 7453N	50p	UIC91 = 5 x 7491N	50p
UIC10 = 12 x 7410N	50p	UIC54 = 12 x 7454N	50p	UIC92 = 5 x 7492N	50p
UIC13 = 8 x 7413N	50p	UIC60 = 12 x 7460N	50p	UIC93 = 5 x 7493N	50p
UIC20 = 12 x 7420N	50p	UIC70 = 8 x 7470N	50p	UIC94 = 5 x 7494N	50p
UIC40 = 12 x 7440N	50p	UIC72 = 8 x 7472N	50p	UIC95 = 5 x 7495N	50p
UIC41 = 5 x 7441AN	50p	UIC73 = 8 x 7473N	50p	UIC98 = 5 x 7498N	50p
UIC42 = 5 x 7442N	50p	UIC74 = 8 x 7474N	50p	UIC121 = 5 x 74121N	50p
UIC43 = 5 x 7443N	50p	UIC75 = 8 x 7475N	50p	UICX1 = 25 x Assort'd	74's £1-50
UIC44 = 5 x 7444N	50p	UIC76 = 8 x 7476N	50p		
UIC45 = 5 x 7445N	50p	UIC80 = 5 x 7480N	50p		

All prices quoted in new pence Giro No. 388-7006
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BI-PAK

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Postage and packing add 7p. Overseas add extra for airmail.
Minimum order 50p. Cash with order please.

Guaranteed Satisfaction or Money Back

WICKS FOR BARGAINS

E.A. STEREO AMPLIFIER:

5 watts per channel; In attractive afrosmosia veneered sleeve. Controls: On-off volume; Bass; Treble; Balance; Selector: Headphone Jack, Ceramic or Magnetic P.U. Radio and Tape Inputs; Tape output and speaker output. Fully guaranteed 12 months parts, 6 months free service. Size 14½"W x 9½"D x 45"H approx. £16-50 inc. post.

3 WAY SPEAKER SYSTEM:

8" twin cone Bass speaker and 3" tweeter, fitted in extremely elegant teak veneered cabinet. Size: 18½"H x 11½"W x 10"D. 8 ohms handle 10 watts. £7-50 inc. Carr.

GARRARD OFFERS

Garrard SP25 Mk III (Rec. Price (£15-85) **Our Price £11-25.** Carr. & Ins. 50p.

Garrard SP25 Mk III ready wired in beautiful teak plinth with tinted perspex cover. (Fitted with 5-pin DIN plug or phono plugs—state choice) (Rec. Price £23-19). **Our Price £16.** Carr. & Ins. 75p.

Or with choice of fitted cartridges, **SP25 Mk III/Sonotone 9TAHC** (Rec. Price £27-29) **Our Price £18.** Carr. & Ins. 75p.

SP25 Mk III/Shure M3DM (Rec. Price £31-02) **Our Price £20.** Carr. & Ins. 75p.

SP25 Mk III/Goldring G800 (Rec. Price £36-19) **Our Price £21.** Carr. & Ins. 75p.

SP25 Mk III/Shure M55E (Rec. Price £36-16) **Our Price £21.** Carr. & Ins. 75p. **Note!** Garrard **SL65B** (Automatic Changer version of **SP25 Mk III**) alternatively supplied—please add £3 to above prices.

Garrard AP76 (Rec. Price £27-85) **Our Price £18-85.** Carr. & Ins. 50p.

Garrard AP76 ready wired in beautiful teak plinth with perspex cover (fitted with 5 pin DIN or Phono plugs). Please state choice. (Rec. Price £39-85). **Our Price £24-94** Carr. & Ins. 75p.

OR WITH CHOICE OF FITTED CARTRIDGES.

Garrard AP76/Shure M3D (Rec. Price £47-26) **Our Price £28-94.** Carr. & Ins. 75p. **Garrard AP76/Shure M55E** (Rec. Price £52-82). **Our Price £31-35.** Carr. & Ins. 75p.

Garrard AP76/Goldring G800 (Rec. Price £52-82) **Our Price £31-35.** Carr. & Ins. 75p.

Garrard 2025TC fitted with stereo/mono cartridge. £8-99. Carr. Paid.

TEAK PLINTH & PERSPEX COVER Ready cut to take 2025TC, SP25 III, SL65B available at £4-99. Carr. & Ins. 35p.

CARTRIDGES (All with diamond stylus)

Sonotone 9TAHC dia. Rec. Price £4-10. **Our Price £1-99**
Shure M3DM (Rec. Price £7-41) **Our Price £4-87.**
Shure M55E (Rec. Price £12-97) **Our Price £9-00.**
Goldring 800 (Rec. Price £13-00) **Our Price £7-50.**
Goldring 800 H (Rec. Price £10-69) **Our Price £6-99.**
 P & P 18p any type

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- **Mail order only.**
- **All enquiries SAE please.**

Special Offer! Grundig GDM312 Dynamic Microphones. List £7.35 **OUR PRICE £3.** P & P 30p

Hi-Fi Stereo Headphones (Value £5-00) Only £2-25 inc. post.

Speaker Cloth Best quality. Width 36". Under half price at 55p per yd. Black with gold fleck, will blend with any room setting. End of stock line, yds and yds must go.

Plugs, Sockets and Leads.

Phono plugs; 3p each
 30p per dozen.
 2 pin Din spkr. plugs 16p each.
 3 pin Din plugs. 15p each
 5 pin Din plugs. 15p each.
 5 pin Din sockets (chassis) 7p each.
 Stereo Jack Sockets c/cct. 13p each.
 Phono sockets (chassis) 2 way 3p; 3 way 4p; 4 way 3p.
 6ft. stereo lead 5 pin Din to open end. 45p
 6ft. stereo lead 2 phono to open end. 37p
 12ft. spkr. lead 2 pin Din to open end. 40p.
 Please add P & P5p.

100 Mixed Resistors ½ watt 10% all best quality (no ex government) 40p.

Pots 100K x 100K lns & Logs. stereo. 35p inc. post.
 100K DP switch stereo, log. 45p inc. post.
 50K single Balance. 15p inc. post.

4 B.A. brass nuts 50 for 25p inc. post.

Speaker cabinets Attractively veneered in afrosmosia, black front. Size approx. 7½"W x 9½"D x 4½"H. Ready cut to take 8" x 5" speaker. £1-99. P. & P. 12p.

MW/LW TRANSISTOR RADIO



Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-565m + 1070-1870m. 9 volt 6 transistor superhet using 3 AF117 in EF and IF stages powered by a two stage AF amplifier using 3 x AC128. Output approx. 500MW. Also works off car-aerial. Full instruction book 12p free with parts. Red only, ply case, rexine covered. Requires PP7 battery, price £24p extra. 3in high-quality speaker. Price £6 plus 40p P. & P.

STEREO AMPLIFIER Type SHV—2 x 3 watts

Fully built. Separate vol., base and treble controls each channel: 12 x 4½ x 6in high. EZ80 and 2 x ECL86 valves. O.P. trans. for 3-ohm speakers. Double wound mains transformer. Suitable for crystal magn. cartridge, tuner, etc. with mono-stereo switch. 200-250V a.c. mains. £7-25, 50p P. & P.



A.M./F.M. (V.H.F.) tuning gang / 3 x 2 x 1½in plus spindle 1½in (4in dia.) 400 + 180 + 90 + 20p; geared motor drive 6:1; no back lash; cast frame; Brand new; German; 3 x 4b.a. fixings. 35p post pd. less 10% for 6.

MAINS TRANSFORMERS (240-250V input)

Postage in brackets
 6-3V at 2½A, 40p (15p).
 250V at 50mA and 6-3V at 1½A, 50p (20p).
 22V at 1A, 6-3V at 2A and 250V at 50mA, 75p (25p).
 90V at 20mA and 1-4V at 250mA, 60p (16p).
 Deduct 10 per cent from total bill for more than one transformer.



Miniature A.M. transistor tuning gang. 250 + 250p; 2 x 4b.a. fixings, size 1½ x 1½ x 1in; gearing 3:1 to 1½in dia. moulded bush. Plastic dust cover; Plessey. 25p post pd., less 10% for 6.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants

(2 mins. from Station and Buses). FULL GUARANTEE. Aldershot 22240
 CLOSED WEDNESDAY. S.A.E. for enquiries please.

AERIAL BOOSTERS

We make four types of Aerial Boosters. L45 625 U.H.F., L12 V.H.F. TV, L11 V.H.F. Radio, L10 M/W & S/W. Price L45, L12 & L11 £2-95, L10 £2-45.

VALVE BARGAINS

Any 5—45p, 10—70p:
 ECC82, ECL80, EF80, EF85, EF183, EF184, EBF80, EB91, EY86, PCC84, POC89, PC97, PCF80, PCF86, PCL82, PCL83, PCL84, PCL85, PL36, PY33, PY82, PY800, PY801, 80L16, 80C15, 6-30L2.

TRANSISTOR BARGAINS

We offer the following brand new, marked transistors for sale. Any 5—40p, 10—75p: BC113, BC115, BC171, BC173, BC185, BC188. All the following at 15p each: BF115, BF173, BF184, AF116, BF200, BA102, BA129.

PRINTED CIRCUIT BOARD 2-8 ins by 4 ins boards complete with etching compound and instructions—40p.

MAINS DROPPERS

Three section 33-33-33 Ohms 8p.

POST & PACKING under £1-5p Over £1-10p. S.A.E. for leaflets on all items. Money back guarantee if not completely satisfied.

VELCO ELECTRONICS

62A Bridge Street, Ramsbottom, Bury, Lancs.

ELEKON CLEARANCE OFFERS

Pye Transistorised Car Radio Panels. Includes 2 x Double Tuned IF's 5MKT Transistors etc. etc. Your bargain for 50p, post 10p U.K.
 Telescopic Car Aerials. 5-section lockable, 2 keys and bracket. List price £2-10. Our price £1-25, post 10p U.K.
 Assorted Coil Formers. Includes Aladdin types etc. etc. Amazingly cheap. 100 for £1-50, post free U.K.
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 Assorted Valveholders. Includes a lot of old types that you never expected to see again. So many for so little. 100 for £1-50, post free U.K.
 Assorted Radio Knobs. Various shapes and sizes. Knock-out price 100 for £1-50, post free U.K.
 Fibreglass Board, Double-sided Copper Laminated, 12" x 12" x ¼". Ideal for screening or various electronic projects. 25p, post 8p, post on 4 20p. Our Location: Mr. Goode Station opposite Heals of Tottenham Court Road.

ELEKON ENTERPRISES

12A TOTTENHAM STREET, LONDON, W1P 9PQ
 Telephone 01-580 7391



2 OCTAVE MINI ORGAN

As featured in P.W. December issue. All parts except wood £5-15 plus 30p P. & P.

MULTI-SPEED MOTOR

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 & 15,600 r.p.m. Shaft is $\frac{1}{8}$ in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. x 5 in. long. Price 88p plus 23p postage and insurance.



20 AMP ELECTRICAL PROGRAMMER

Learn in your sleep: Have Radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an Electrical Programmer. Made by the famous Smiths Instrument Company. This is essentially a 230/240 volt mains operated Clock and a 20 amp Switch, the switch-off time of which can be delayed up to 12 hours (continuously variable not stepped). Similarly the switch-on time can be delayed. This is a beautiful unit, size $5\frac{1}{2}$ x $3\frac{1}{2}$ x 2 1/2 in. deep. Metal encased, glass fronted with chrome surround. Offered at £2-40 plus 23p postage and insurance.



RESETTABLE FUSE

How long does it take you to renew a fuse? Time yourself when next one blows. Then reckon your time at £1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only £1 each or £11 per dozen, specify 5, 10 or 15 amp—simply fit in place of switch.



BLANKET SWITCH

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



2 1/2 kW FAN HEATER

Three position switching to suit changes in the weather. Switch up for full heater (2 1/2 kW), switch down for half heat (1 1/4 kW), switch central blades cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit £2-85. Post and ins. 38p.



COMPUTER TAPES

2,400' of the Best Magnetic Tape money can buy—users claim good result with Video and sound. 1" wide £1 plus 33p post and insurance, with cassette. 1" wide £1 plus 30p post and insurance with cassette. 1" wide 75p plus 25p post and insurance with cassette. Spare spools and cassettes—1" 75p. 1/2" 75p each plus 20p post and insurance.



SPARTAN Portable RADIO

Long and medium wave, 7 transistor, size 6in. x 4in. x 1 1/2 in. with larger than usual speaker giving very good tone. Built-in ferrite aerial and telescopic aerial for distant stations. A real bargain complete with leather case, carry sling, earplug and case £3-75 plus 25p post and ins.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 5 1/2" casing with 5 1/2" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets, £2 plus 36p post and ins.



MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 50p. Postage 15p for first one then 5p for each one ordered.



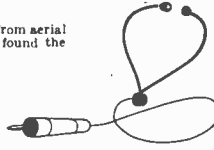
CAPACITOR DISCHARGE CAR IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the Wireless World about a year ago. We can supply kit of parts for improved and even more efficient version, (P.W. June), price £4-95. When ordering please state whether for positive or negative systems. Plus 30p post.

ELECTRONIC IGNITION

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV amplifier, anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. £2—twin stethoscope instead of earpiece 75p extra—post and ins. 20p.



P. E. GEMINI

Dual purpose twin 30 watt stereo amplifier for exceptional performance. Complete kit of parts less case £45 or reprint of data & parts list 55p.



STANDARD WAFER SWITCHES

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

No. of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10 way	12 way
1 pole	40p	40p	40p	40p	40p	40p	40p	40p	40p
2 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
3 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
4 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
5 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
6 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
7 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
8 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
9 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
10 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
11 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p
12 poles	40p	40p	40p	40p	40p	40p	40p	40p	40p

15 WATT 12" HI-FI SPEAKER

Is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi and public address. Handling 15W R.M.S.—Cone moulded fibre—Freq. response 30 10,000 c.p.s.—specify 3 or 15 ohms. Chassis diam. 12in.—12in. over mounting lugs. Overall height 5 1/2 in. A £10 speaker offered this month for £3-75 plus 30p post and ins.



TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. £3-50. 2kW. Model as above except 2 kilowatts £2-50. Don't miss this. Control Switch 35p. P. & P. 40p.



HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from makers probably over £10 each. Special snip price £5-75 plus 25p post and insurance. Don't miss this terrific bargain.



INTEGRATED CIRCUIT BARGAIN

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



DIGITAL COUNTER TIMER

Very stable & reliable crystal controlled circuit. Capable of work in excess of 15 MHz. Construction simplified by use of 15 integrated circuits. Complete kit with case £27-50 or construction data & price list 30p.

70 THINGS YOU CAN MAKE

Send SAE today for list of 70 constructor projects—instruments, alarms, counters, locks, radios etc. etc.

THERMOSTATS

Type "A" 15 amp. for controlling room heaters, greenhouses, airing cupboard. Has spindle for pointer knob. Quickly adjustable from 30-80°F. 40p. Calibrated dial 20p extra. Suitable box for wall mounting. 25p.

Type "B" 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjustable this from 50-550°F. Internal screw alters the setting to this could be adjustable over 30° to 1000°F. Suitable for controlling furnace, oven, kiln, immersion heater or to make flame-stat or fire alarm. 45p plus 12p post and insurance

Type "C" Contact Thermostat. Simply strap it to water tank, motor casing, pipe or other device. Calibrated dial 90° to 190°F. Price 50p.

Type "D" We call this the Ice-stat as it cuts in and out at around freezing point. 2/3 amps. Has many uses one of which would be to keep the loft pipes from freezing, if a length of our blanket wire (18 yd. 50p) is wound round the pipes. 40p.

Type "E" This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperature. 60p.

Type "F" Glass encased for controlling the temp. of liquid—particularly those in glass tanks, vats or slinks—thermostat is held (half submerged) by rubber sucker or wire clip—ideal for fish tanks—developers and chemical baths of all types. Adjustable over range 50° to 160°F. Price 80p

TREASURE TRACER

Complete Kit (except wooden battens) to make the metal detector as the circuit in Practical Wireless August issue. £2-95 plus 20p post and insurance.



DRILL CONTROLLER NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1-50 plus 13p post and insurance. Made up model also available. £2-25 plus 13p post & p.



STEREO DECODER AF/RF MINI PROBE SOUND OPERATED FLASH

as described in this issue. Send for parts lists.

HIGH ACCURACY THERMOSTAT

Uses differential comparator I.C. with thermister as probe. Designer claims temperature control to within 1/7th of a degree. Complete kit with power pack £5-50.

AUTO-ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in or fully retractable. Suitable for 12v positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. £6 plus 25p post and ins.



TOGGLE SWITCH

3 amp. 250v. with fixing ring 71p each, 75p doz

CAR ELECTRIC PLUG

Fits in place of cigarette lighter. Useful method for making a quick connection into the car electrical system. 38p each or 10 for £3-42.

ROCKER SWITCH

13 amp self-fixing into an oblong hole, size approximately 1" x 1 1/2" 6p each, 10 for 54p.



MAINS RELAY BARGAIN

Special this month are some single, double and treble pole changeover relays. Contacts rated at 15 amp. Operating coil wound for 240V A.C. Good British Make. Ex-unused equipment. Size approx. 1 1/2" x 1". Open construction Single pole 25p each 10 for £2-25 Treble pole 40p each 10 for £3-06



BALANCED ARMATURE UNIT

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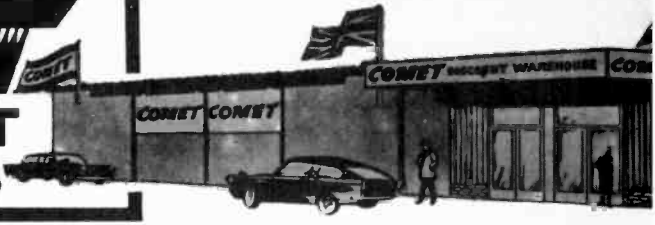
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ALBA UA 700	34.50	24.95	
ALPHA 212 By Highgate	36.75	24.95	
AMSTRAD Stereo 8000 Mk 2	27.95	17.95	
AMSTRAD J.C. 2000	42.95	27.95	
ARMSTRONG 521	59.00	43.95	
DULCI 207	26.00	16.95	
DULCI 207M	32.00	19.95	
FERROGRAPH F307 Mk. II (cased)	64.00	45.95	
FERROGRAPH F307 (Metalcase)	60.00	42.95	
GOODMANS Maxamp	54.00	37.95	
LEAK Delta 30 (cased)	65.00	51.95	
LEAK Delta 70 (cased)	79.50	63.95	
METRO SOUND ST20E	39.50	27.95	
PHILIPS RH 591	79.00	54.95	
PHILIPS RH 590	52.00	36.95	
PHILIPS RH 580	29.00	19.95	
PIONEER SA500	53.00	38.95	
PIONEER SA700	97.97	66.95	
PIONEER SA900	133.83	93.95	
PIONEER Reverberation	45.50	31.95	
REVERBERATION 202W	46.35	33.95	
RANK Rotel 310	45.00	32.95	
RANK Rotel 610	59.00	49.95	
ROGERS Ravensbourne	59.50	42.95	
ROGERS Ravensbourne (cased)	64.00	47.95	
ROGERS Ravensbrook Mk. II	47.50	36.95	
ROGERS Ravensbrook (cased) Mk. II	52.50	39.95	
SINCLAIR 2000	35.00	23.75	
SINCLAIR Project 60/2 x Z30/P25	23.90	15.95	
SINCLAIR PROJECT 60/2 x Z50/			
PZ/Trans	34.86	23.25	
SINCLAIR PROJECT 605	29.95	21.95	
SINCLAIR AFU	5.95	4.45	
SINCLAIR Neoteric	61.95	43.95	
SINCLAIR 3000	45.00	31.50	
TELETON SAQ 206	32.50	18.25	
TELETON 100w. Stereo Discotheque			
8 electronically mixed inputs	185.00	139.00	
WHARFEDALE Linton Amplifier	60.00	47.95	
All the above take both ceramic and magnetic cartridges.			

	Rec. Price	Retail Price	Comet Price
TUNERS			
*ARMSTRONG 523 AM/FM	54.22	42.95	
*ARMSTRONG 524 FM	42.17	33.95	
ARMSTRONG M8 Decoder	9.50	7.70	
*DULCI FMT.7 FM	25.10	19.95	
DULCI FMT.7S Stereo	33.79	27.25	
GOODMANS Stereomax	80.07	47.95	
LEAK Delta FM	75.00	58.95	
LEAK Delta AM/FM	89.50	69.95	
*PHILIPS RH 693	45.30	36.50	
PHILIPS RH 691	85.80	69.95	
PIONEER TX500 AM/FM	66.09	57.95	
PIONEER TX900 AM/FM	147.15	118.00	
RANK ROTEL 320	49.99	39.95	
ROGERS Ravensbourne chassis	59.63	46.95	
ROGERS Ravensbourne In teak case	64.45	48.95	
ROGERS Ravensbrook chassis	43.37	34.95	
ROGERS Ravensbrook (cased)	49.39	38.95	
SINCLAIR 2000	45.00	34.95	
SINCLAIR project 60 tuner (stereo)	25.00	19.95	
TELETON GT 101	43.93	30.95	

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

TUNER/AMPLIFIERS

AKAI AA 8500	221.85	175.00
AKAI 6600	137.34	108.00
AKAI 6300	128.85	99.95
AKAI 6200	91.56	79.95
ARENA 2400	90.30	69.95
ARENA 2600	111.30	69.95
ARENA 2700	88.63	73.95
ARENA T9000	303.45	285.00
ARMSTRONG M8 Decoder	9.50	7.70
ARMSTRONG 525	92.77	71.95
ARMSTRONG 526	105.72	84.95
GOODMANS Module 80, 35w. RMS	91.59	68.95
GOODMANS Model 110 FM/MW/LW/SW 100W RMS	135.00	108.00
LEAK Delta 75	165.00	139.95
MIDLAND 19/542	49.56	37.50
PHILIPS 882 with stereo cassette recorder	98.50	76.95
PHILIPS RH 7920 without decoder	136.20	79.95
PIONEER SX770 AM/FM	120.00	109.95
PIONEER SX990 AM/FM	167.83	129.95
PIONEER 440	104.18	82.95
ROGERS Ravensbrook Chassis	99.39	81.95
ROGERS Ravensbrook (cased)	108.43	89.95
TANDBERG 1171 comp. with decoder	110.00	91.95
TANDBERG TR200 without decoder	99.00	82.95
*TELETON F2000	51.50	28.95
TELETON 7AT 20	119.75	69.95
TELETON 10AT1 150w. RMS	180.00	94.00
TELETON TFS50	79.65	52.95
TELETON TFS50 LA MW/LW/FM	86.64	60.95
TELETON CR5	125.26	71.95
WHARFEDALE 100-1	139.00	89.95

All the above Tuners and Tuner/Amplifiers take both ceramic and magnetic cartridges except Teleton



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F2000 which takes ceramic only. All include MPX Stereo Decoder with the exception of Armstrong where decoder is extra as listed.

	Rec. Price	Retail Price	Comet Price
CARTRIDGES			
GOLDRING 800	12.55	6.75	
GOLDRING 800E	18.16	10.50	
GOLDRING 800 Super E	25.10	15.95	
*GOLDRING CS90 Stereo	5.02	4.10	
*GOLDRING CS91E	7.53	6.00	
GOLDRING G850	6.27	3.85	
EMPIRE 10002E/X	60.34	51.25	
EMPIRE 9997E/X	43.00	34.95	
EMPIRE 9997E/X	25.09	21.00	
EMPIRE 9995E/X	20.31	16.95	
EMPIRE 999E/X	15.89	12.50	
EMPIRE 999/X	12.55	10.25	
EMPIRE 909E/X	12.37	9.95	
EMPIRE 909/X	9.26	7.75	
EMPIRE 90EE/X	9.56	7.95	
ORBIT Magnetic NM 22	Special Price	2.95	
ORTOFON SL15E	28.62	22.95	
ORTOFON 2 X 15K Transformer	7.00	4.95	
ORTOFON M15E	29.08	23.50	
SHURE M3DM	7.16	4.50	
SHURE M31E	11.63	8.70	
SHURE M32E	10.73	8.05	
SHURE M32-3	9.84	7.80	
SHURE M44-5	10.73	7.19	
SHURE M44-7	9.84	7.15	
SHURE M-44C	9.84	7.15	
SHURE M44E	11.63	7.50	
SHURE M55E	12.52	8.85	
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SHURE M75-6	16.10	12.45	
SHURE M75EJ	18.78	14.95	
SHURE M75E	20.57	12.95	
SHURE V15-11	39.35	27.95	
SHURE V15-11-7	37.56	27.95	

Starred cartridges above are ceramic. All others are magnetic.

	Rec. Price	Retail Price	Comet Price
PICKUP ARMS			
GOLDRING Lenco 75	13.98	9.50	
GOLDRING Lenco L89	10.04	6.50	
SME 3009 with S2 Shell	33.26	24.95	
SME 3012 with S2 Shell	35.42	26.45	

The following Turntables are complete with base, plinth, perspex cover and cartridge. Fully wired and ready for use. All at special prices.

	Rec. Price	Retail Price	Comet Price
TURNABLES			
GARRARD SP25 Mk 111 with Goldring G.800			
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GARRARD SP25 Mk 111 with Shure M.44/7			
Special Price £22.95			
GARRARD SP25 Mk 111 with Shure M.55E			
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GARRARD AP76 with Goldring G800			
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GARRARD AP76 with Shure M55E			
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GARRARD AP76 with Shure M75E			
Special Price £36.95			
GARRARD 2025 with Sonotone BT4HC			
Special Price £14.50			
GOLDRING 705/P with G850 26.00			
£16.95			
GOLDRING GL15 with G800			
Special Price £39.95			

GARRARD SP25 Mk III	15.85	10.50
GARRARD SL65 B	20.48	13.45
GARRARD SL95 B	49.23	32.95
GARRARD 401	39.26	27.45
GARRARD SL72 B	31.83	23.95
GARRARD Zero 100A	56.25	42.95
GARRARD Zero 100S	51.75	41.95
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	Rec. Price	Retail Price	Comet Price
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McDONALD 610	19.28	14.50	
McDONALD HT 70	21.22	17.50	
McDONALD HT70 Inc. plinth & cov.	30.68	24.95	
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THORENS TD125AB	115.57	94.50	
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THORENS TD150AB Mk. II	48.05	40.25	
THORENS TX11 Cover	4.26	3.75	
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LEAK 300	39.30	23.95	
LEAK 600	49.50	35.95	
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LOWTHER Ideal Baffle	37.50	32.00	
METRO SOUND HFS103 (pair)	30.05	19.95	
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AKAI 1800SD	153-00	117-00
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BUSH Discassette DC70	21-19	16-95
BUSH TP60 Cassette tape recorder	28-38	23-95
BUSH TP70 Cassette, battery/mains tape recorder	28-91	23-50
FERGUSON 3245 Twin track	36-70	27-95
FERGUSON 3246 4-track	42-55	32-95
FERGUSON 3247 4-track	47-95	37-95
FERGUSON 3248 4-track	53-75	41-95
FERGUSON 3252 4-track	100-52	80-95
FERGUSON 3258 4-track	72-40	55-95
FERROGRAPH 702 2-track tape deck	220-22	185-00
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FERROGRAPH 722	256-52	209-00
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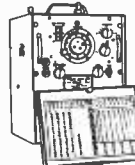
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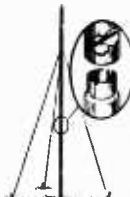


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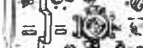
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30F5	0.85	807	0.50	EAF42	0.55	EM71	0.80
30FL1	0.75	813	3.75	EBC33	0.50	ECL80	0.45
30FL12	1.20	866A	0.75	EBC41	0.55	ECL81	0.50
30FL14	0.85	5642	0.70	EBC81	3.00	ECL82	0.35
30LL1	0.40	6090	1.60	EBP80	0.40	ECL83	0.70
30L15	0.85	6146	1.60	EBF83	0.40	ECL84	0.55
30L17	0.85	5360	1.20	EBF89	3.00	ECL85	0.55
30P12	0.30	6939	2.25	EC55	0.50	ECL86	0.40
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30PL14	0.80	7895	1.25	EC91	0.60	EY84	0.40
35A3	0.55	9002	0.40	EC92	0.35	EY88	0.43
35A3	0.70	9003	0.50	EC93	0.55	EY90	0.25
35B5	0.85	AZ1	0.55	EC8010	2.25	EZ41	0.50
35C5	0.50	AZ31	0.55	EC44	0.85	EZ80	0.27
35L5	0.75	CB1L	0.90	ECC81	0.35	EZ81	0.29
35L6GT	0.50	CB1L1	1.00	ECC82	0.30	EY501	0.80
35W4	0.35	CV31	0.35	ECC83	0.35	EY51	0.33
35Z3	0.70	DAF98	0.45	ECC84	0.30	EY92	0.35
35Z4G	0.35	DP96	0.45	ECC85	0.40	EY95	0.35
35Z5GT	0.60	DK40	0.60	ECC88	0.40	EY97	0.65
50B5	0.50	50C5	0.50	50D6G1	0.20	50L6GT	0.55
50A5	0.40	90AG	2.50	90AV	2.50	90C1	0.85
90AG	2.50	90AV	2.50	90C1	0.85	90CV	2.40
90AV	2.50	90C1	0.85	90CV	2.40	807	0.50
807	0.50	813	3.75	813	3.75	866A	0.75
813	3.75	866A	0.75	5642	0.70	6090	1.60
866A	0.75	5642	0.70	6090	1.60	6146	1.60
5642	0.70	6090	1.60	6146	1.60	EBF89	3.00
6090	1.60	6146	1.60	EBF89	3.00	EC55	0.50
6146	1.60	EBF89	3.00	EC55	0.50	EC86	0.80
EBF89	3.00	EC55	0.50	EC86	0.80	EC88	0.80
EC55	0.50	EC86	0.80	EC88	0.80	EC90	0.38
EC86	0.80	EC88	0.80	EC90	0.38	EC91	0.60
EC88	0.80	EC90	0.38	EC91	0.60	EC92	0.35
EC90	0.38	EC91	0.60	EC92	0.35	EC93	0.55
EC91	0.60	EC92	0.35	EC93	0.55	EC8010	2.25
EC92	0.35	EC93	0.55	EC8010	2.25	EC44	0.85
EC93	0.55	EC8010	2.25	EC44	0.85	ECC81	0.35
EC8010	2.25	EC44	0.85	ECC81	0.35	ECC82	0.30
EC44	0.85	ECC81	0.35	ECC82	0.30	ECC83	0.35
ECC81	0.35	ECC82	0.30	ECC83	0.35	ECC84	0.30
ECC82	0.30	ECC83	0.35	ECC84	0.30	ECC85	0.40
ECC83	0.35	ECC84	0.30	ECC85	0.40	EY81	0.40
ECC84	0.30	ECC85	0.40	EY81	0.40	EY83	0.55
ECC85	0.40	EY81	0.40	EY83	0.55	EY84	0.40
EY81	0.40	EY83	0.55	EY84	0.40	EY88	0.43
EY83	0.55	EY84	0.40	EY88	0.43	EY90	0.25
EY84	0.40	EY88	0.43	EY90	0.25	EZ41	0.50
EY88	0.43	EY90	0.25	EZ41	0.50	EZ80	0.27
EY90	0.25	EZ41	0.50	EZ80	0.27	EZ81	0.29
EZ41	0.50	EZ80	0.27	EZ81	0.29	EY501	0.80
EZ80	0.27	EZ81	0.29	EY501	0.80	EY51	0.33
EZ81	0.29	EY501	0.80	EY51	0.33	EY92	0.35
EY501	0.80	EY51	0.33	EY92	0.35	EY95	0.35
EY51	0.33	EY92	0.35	EY95	0.35	EY97	0.65
EY92	0.35	EY95	0.35	EY97	0.65		
EY95	0.35	EY97	0.65				
EY97	0.65						

TRANSISTORS

2N696	0.17	AC127	0.20	BD123	0.80
2N697	0.17	AC128	0.15	BD131	0.85
2N698	0.30	AC132	0.35	BD132	0.85
2N705	0.70	AC153	0.20	BD133	0.80
2N706	0.54	AC154	0.20	BD134	0.85
2N708	0.15	AC157	0.20	BP115	0.20
2N753	0.25	AC169	0.10	BF167	0.18
2N929	0.22	AC176	0.25	BF173	0.20
2N930	0.25	AC187	0.30	BF179	0.30
2N947	0.30	AC198	0.30	BF180	0.35
2N1131	0.25	AC177	0.25	BF181	0.25
2N1132	0.25	AC178	0.25	BF184	0.25
2N1184	1.25	AC199	0.25	BF185	0.20
2N1301	0.40	AC200	0.20	BF194	0.15
2N1302	0.75	AC201	0.20	BF195	0.15
2N1304	0.25	AC222	0.15	BF196	0.20
2N1305	0.25	AD140	0.50	BF197	0.20
2N1303	0.25	AD149	0.50	BF200	0.30
2N1307	0.30	AD161	0.35	BPW87	0.25
2N1308	0.25	AD162	0.35	BPW88	0.25
2N1309	0.30	AD211	1.25	BPW89	0.20
2N1813	0.22	AD212	1.25	BPW91	0.20
2N1711	0.25	AF114	0.20	BPX88	0.25
2N1766	0.75	AF115	0.20	BFY17	0.20
2N2147	0.75	AF116	0.20	BFY19	0.60
2N2160	0.65	AF117	0.20	BFY50	0.25
2N2217	0.30	AF118	0.45	BFY51	0.20
2N2218	0.30	AF125	0.25	BFY52	0.25
2N2919	0.35	AF127	0.20	BSY26	0.20
2N3369A	0.20	AF180	0.35	BSY27	0.20
2N2477	0.65	AF181	0.35	BSY28	0.20
2N2646	0.60	AF186	0.40	BSY65	0.20
2N2905	0.35	AF239	0.40	BSY95A	0.15
2N2923	0.15	AF211	0.45	OC16	0.50
2N2924	0.15	AF226	0.25	OC22	0.50
2N2926	0.125	AF227	0.30	OC23	0.60
2N3053	0.25	AF228	0.25	OC24	0.60
2N3054	0.60	AF229	0.30	OC25	0.35
2N3055	0.75	AF254	0.25	OC26	0.25
2N3133	0.30	AF216	0.70	OC28	0.60
2N3134	0.30	AF218	0.70	OC29	0.60
2N3391	0.20	AF219	0.75	OC30	0.75
2N3392	0.15	AF218	0.75	OC31	0.75
2N3393	0.15	AF220	0.25	OC36	0.60
2N3394	0.15	AF221	0.40	OC42	0.20
2N3395	0.20	BC107	0.125	OC44	0.20
2N3402	0.15	BC108	0.125	OC45	0.15
2N3403	0.15	BC109	0.125	OC70	0.10
2N3404	0.15	BC112	0.125	OC71	0.12
2N3414	0.20	BC118	0.30	OC72	0.25
2N3415	0.15	BC134	0.30	OC73	0.30
2N3416	0.25	BC147	0.175	OC75	0.20
2N3417	0.25	BC148	0.18	OC76	0.20
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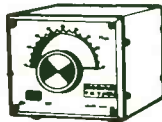
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